Cadenza 流金頌
賽馬會長者計劃新里程
A Jockey Club Initiative for Seniors

Trends of Disease Burden Consequent to Diabetes in Older Persons in Hong Kong:

Implications of Population Ageing

Authors: Sarah M. McGhee
Wai Ling Cheung
Jean Woo
Pui Hing Chau
Jing Chen
Kam Che Chan
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by

Prof. Sarah M. McGhee
Professor, Department of Community Medicine,
School of Public Health, The University of Hong Kong

Ms. Wai Ling Cheung
Research Assistant, Department of Community Medicine,
School of Public Health, The University of Hong Kong

Prof. Jean Woo
Director, CADENZA Project, Head, Division of Geriatrics,
Department of Medicine and Therapeutics, The Chinese University of Hong Kong

Dr. Pui Hing Chau
Research Assistant Professor, CADENZA Project,
Faculty of Social Sciences, The University of Hong Kong

Ms. Jing Chen
PhD Candidate, Department of Community Medicine,
School of Public Health, The University of Hong Kong

Ms. Kam Che Chan
Research Assistant, CADENZA Project,
Department of Medicine and Therapeutics, The Chinese University of Hong Kong

and

Mr. Sai Hei Cheung
Research Assistant, CADENZA Project,
Faculty of Social Sciences, The University of Hong Kong

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Ms. Kam Che Chan
Mr. Sai Hei Cheung

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CADENZA: A Jockey Club Initiative for Seniors

CADENZA: A Jockey Club Initiative for Seniors is a $380 million project initiated and funded by The Hong Kong Jockey Club Charities Trust in light of a rapidly ageing population. Faculty of Social Sciences, The University of Hong Kong and Faculty of Medicine, The Chinese University of Hong Kong are the project partners. It aims at creating an elder-friendly community which fosters positive community attitude towards older people and continuously improves the quality of care and quality of life for Hong Kong's elderly.

CADENZA is an acronym for "**C**elebrate their **A**ccomplishments: **D**iscover their **E**ffervescence and **N**ever-ending **Z**est as they **A**ge." In classical music, a 'Cadenza' is an extended virtuosic section, usually near the end of a movement in a concerto. The word is used figuratively to describe the apex of one's life and the celebration of a lifetime's accomplishments.

CADENZA is made up of 6 major components:

1. ***Community Projects*** are innovative and sustainable service models to cope with the changing needs of seniors.
2. ***Research Training Workshop*** is to build and nurture academic leadership in the field of gerontology.
3. ***Research*** is to advance gerontological knowledge and to evaluate the outcomes of different CADENZA projects.
4. ***Public Awareness*** seeks to promote positive ageing and highlight important issues pertaining to the elderly population, covering 6 major themes: (i) health promotion and maintenance, (ii) health and social services in Hong Kong, (iii) living environment, (iv) financial and legal issues, (v) quality of life and quality of dying, and (vi) age disparities.
5. ***Symposium*** is to provide a platform where overseas and local experts can exchange new insights in the understanding of ageing issues.
6. ***Training*** includes on-line courses, workshops and public seminars to train different levels of professional front-line workers, care-givers and the general public.

The findings covered by this report are part of the series "Challenges of population ageing on disease trends and burden" carried out by CADENZA in collaboration with the Department of Community Medicine, School of Public Health, The University of Hong Kong. This series utilises existing data to estimate the impact of various chronic diseases on the ageing population as well as society as a whole. The first of the series focuses on diabetes mellitus. This report is made available to the public with the compliments of The Hong Kong Jockey Club Charities Trust.

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Contents

Executive Summary 7

1 Introduction 15

1.1 Overview 16
1.2 Types of Diabetes 16
1.3 Diagnostic Classification 17
1.4 International Classification of Diseases (ICD) 18
1.5 Data Quoted in this Report 18

2 Global Trends and Burden 19

2.1 Prevalence 20
2.1.1 Global 20
2.1.2 United States 20
2.1.3 United Kingdom 21
2.1.4 Australia 22
2.1.5 China 22
2.1.6 Singapore 23
2.1.7 Japan 24

2.2 Incidence 25
2.2.1 Global 25
2.2.2 United States 25
2.2.3 United Kingdom 26
2.2.4 Australia 27
2.2.5 China 27
2.2.6 Singapore 27
2.2.7 Japan 28

2.3 Mortality 28
2.3.1 Global 28
2.3.2 United States 29
2.3.3 United Kingdom 29
2.3.4 Australia 30
2.3.5 China 30
2.3.6 Singapore 31
2.3.7 Japan 31

3 Trends and Burden of Diabetes in Hong Kong 33

3.1 Introduction 34

3.2 Prevalence 34

3.2.1 Self-reported diabetes 34
3.2.2 Blood glucose measurement results and self-reported diabetes 37
3.2.3 Estimated number of people with known diabetes and future projection 38
3.2.4 Comparison between Hong Kong and other places 40
3.2.5 Pre-diabetes 42

3.3 Incidence 44

3.4 Disease Burden 45

3.4.1 Mortality 45
3.4.2 Morbidity 50
3.4.2.1 Hospital admission at public hospitals 50
3.4.2.2 Out-patient visits related to diabetes 50
3.4.2.3 Complications of diabetes 51
3.4.3 Disability 52
3.4.4 Cognitive impairment 53
3.4.4.1 Cognitive function 53
3.4.4.2 Dementia 55
3.4.5 Quality of life 56

3.5 Economic Burden 58

3.5.1 Hospital costs 58
3.5.2 General out-patient clinics (GOPC) visits 59
3.5.3 Accident and Emergency Department (A&E) visits 60
3.5.4 Specialist out-patient clinics (SOPC) visits 62
3.5.5 Current and future economic burden in public sectors 63

3.6 Behaviour in Managing Diabetes 64

4 Discussion and Conclusion 67

5 References 71

Executive Summary

Executive Summary

The prevalence of diabetes is increasing world-wide in both developed and developing countries. One of the risk factors for diabetes is being older. In Hong Kong, the prevalence of diabetes among the older population (aged 65 and above) was six times that among the younger population (aged 18 to 64) in 2003-2004. Even if there is no increasing trend in the age-specific prevalence of diabetes, the number of older people who have diabetes can be expected to increase owing to the larger number of older people who are most at risk of developing the disease. As a result, Hong Kong will experience increasingly larger numbers of older people with diabetes in the future. An examination of the trend in prevalence, incidence, mortality and morbidity would enable estimates of the consequences of the ageing population in Hong Kong. This report estimates the current and future burden of the disease for older people.

One of the risk factors for diabetes is being older.

Prevalence

According to self-reported past doctor diagnosis, there is no clear evidence of either an increasing or decreasing trend in the prevalence of diabetes among older people in Hong Kong between 1995 and 2004. The latest findings showed that the prevalence of self-reported diabetes in the community-dwelling population aged 65 and above was 13.5% in 2003-2004. However, this estimate was likely under-reported. According to self-reported data, plus the oral glucose tolerance test (OGTT), about 21.4% of people aged 65 to 84 had diabetes in 2004-2005, of which 28.6% (45.0% men, 13.3% women) were unaware that they had diabetes. The prevalence of diabetes among the population aged 65 and above in Hong Kong was comparable to that in the United States, the United Kingdom and Australia.

The prevalence of diabetes in Hong Kong is not decreasing.

About 1 in 5 people aged 65 to 84 in Hong Kong had diabetes in 2004-2005, of which 28.6% were unaware that they had diabetes.

People aged 65 and above made up 50% of the diagnosed adult cases of diabetes in 2006. Based on the prevalence of self-reported diabetes, the number of cases for people aged over 65 was estimated to increase between 2000 and 2004 from 0.09 million to 0.11 million mainly due to the increase in the number of older people. This number would be expected to increase to 0.30 million by 2036, more than double the number of cases, and to 0.42 million including undiagnosed cases.

The number of older people who have diabetes in Hong Kong is projected to increase from 0.11 million in 2004 to 0.30 million in 2036.

People with the condition of pre-diabetes (defined as having impaired glucose tolerance (IGT) or impaired fasting glucose (IFG)) are at substantially higher risk of developing diabetes than those with normal glucose tolerance. Older people have a higher prevalence of pre-diabetes than younger people. A survey identified 17.9% of those aged 65 to 84 as having pre-diabetes in 2004-2005. Action must be taken to prevent these pre-diabetes cases from becoming diabetes cases.

Incidence

There is not much information on the local trend in incidence of diabetes. Based on self-reported doctor-diagnosed diabetes, a cohort study in 1991-1992 found 37.3 per 1,000 subjects aged 70 and older reported diabetes over 3 years, i.e. an annual incidence of 12.4 per 1,000 per year. This estimate was higher than other countries.

From a 1991-1992 cohort, the incidence rate of diabetes in Hong Kong was about 12.4 per 1,000 population.

Mortality

Diabetes is the ninth most common cause of mortality among the population aged over 65 in Hong Kong, accounting for 1.4% of deaths among the older population in 2007. In 2007, mortality rates from diabetes were 43.2 per 100,000 for males and 56.5 for females aged 65 and above. However, these do not include all potential complications. The age-standardised mortality rates were quite stable between 1981 and 1998, increasing sharply in the late 1990's but generally decreasing from 2001 to 2007. This is different from the United States which has had an increasing trend since 1981.

As many people would have been recorded as dying from another cause which was itself a complication of diabetes, the indirect cost of diabetes would be better measured by deaths attributable to diabetes. The relative risk (from overseas) of all-cause mortality among people with diabetes compared to those without was 1.38 for males and 1.40 for females aged 60 to 69, and 1.13 for males and 1.19 for females aged 70 and above. This translates into around 673 deaths attributable to diabetes in older people in Hong Kong in 2006 (that is, a rate of 79.0 per 100,000 population).

The mortality rate attributable to diabetes in Hong Kong was about 79.0 per 100,000 population in 2006.

Morbidity

In 2006, among the diabetes related hospital discharges for all ages, 56% were for people aged 65 and above. In general, older people had a longer length of stay than younger people. For out-patient visits, older people with diabetes had an 81% higher likelihood of having doctor consultations than those without.

More than half of older people with diabetes in Hong Kong have complications.

Complications related to diabetes are common. Between 2002 and 2006, more than half of the public hospital admissions for diabetes involved complications. Older people had a higher proportion (58%) of complications than younger adults (46%). Survey data revealed that in 2004-2005, over half of those aged 65 to 84 with known diabetes had elevated fasting blood glucose implying that there was poor control of diabetes which could lead to further complications. These complications, in particular vision problems and amputation, affect activities of daily living (ADL).

In 2004-2005, over half of those aged 65 to 84 with known diabetes in Hong Kong had elevated fasting blood glucose implying that there was poor control of diabetes.

Disability

Older people with diabetes were 1.8 to 4.1 times (depending on different tasks) more likely than those without diabetes to report some difficulty with ADL. More older people with diabetes reported difficulty in at least one of the three functional domains (26.0% compared with 14.8% of those without). Those aged over 70 with diabetes had a 50% to 70% greater chance of mild to severe functional limitation than those without diabetes.

Cognitive impairment

There is evidence from overseas that older people with diabetes are more likely to have impaired cognitive function than those without diabetes. In Hong Kong, some evidence has supported such an association among community-dwelling older people. However, the evidence supporting a relationship between diabetes and dementia is inconclusive.

Older people with diabetes are more prone to functional and cognitive impairment, in addition to the well-known complications.

Quality of life

Older people with diabetes generally had poorer quality of life than those without, regardless of the measurement tool. Based on self-rated health, more older people with diabetes reported their health to be poorer than other people of the same age. In addition, the probability of having depressive symptoms was higher among older people with diabetes compared to those without.

Older people with diabetes generally have poorer quality of life and are more likely to have depressive symptoms than those without.

Economic burden

As well as costs due to increased risk of other diseases and complications, there are also health care costs associated with diabetes. Direct costs include medical costs such as hospitalisation, doctor consultations and medicines. Indirect costs include costs of dealing with disability, costs from loss of work and costs of premature mortality.

The attributable direct cost of diabetes in Hong Kong was estimated at about HK$1.4 billion in 2006 for those aged 65 and above.

Because of an increased number of older people, the economic burden in the public sector due to diabetes in those aged 65 and above will increase to HK$3.5 billion in 2036 (at 2006 prices).

The attributable direct cost of diabetes in Hong Kong was estimated at about HK$1.4 billion in 2006 for those aged 65 and above. This is a conservative estimate which does not include private sector care. The cost of hospital care contributed to most of the costs amounting to HK$1.2 billion in 2006, which was near 80% of the total diabetes attributable hospital cost for the adult population. The economic burden in the public sector due to diabetes in the population aged 65 and above will increase to HK$3.5 billion in 2036 (at 2006 prices) which is more than double the current cost.

Although the dollar value was not estimated, there will be economic implications for dealing with functional and cognitive impairment resulting from poorly controlled diabetes in older people. The resulting disability cost would be higher in the older population than in the younger one.

Conclusion

Diabetes exerts high costs on the health care system and the population, especially older people.

1. Diabetes exerts high costs on the health care system and the population, especially older people who are at the highest risk of developing the disease. All of these costs will predictably increase in the future as the population ages. The increasing number of older people will increase the number of cases and the age profile of people with diabetes will also increase leading to a higher degree of dependency and more co-morbidities. According to the data examined, a large number of existing older people with diabetes are not being diagnosed and, among those diagnosed, a large number do not have adequate control of their blood sugar levels.

   Every opportunity should be taken by health care providers to find cases of diabetes among older people, to ensure that all diagnosed cases are well controlled and monitored for the development of complications.

We should ensure that all diabetes cases are identified, well controlled and monitored for the development of complications.

2. Apart from underscoring the importance of the prevention of diabetes and its complications, the findings have specific implications for caring for older people with diabetes, and for adopting an elder-oriented approach:

   - Comprehensive geriatric assessment covering physical, functional, psychological, nutritional and social domains needs to be carried out to guide the management plan, in view of the increased predisposition to functional and cognitive impairment, dementia, depression and poor quality of life of older people with diabetes, in addition to the current diabetes complications screening.

   - There is a need to consider care in the context of a social unit, recognizing that a proportion of the older population is less able to achieve lifestyle modification; less able to manage complex drug regimes (and therefore more prone to adverse drug effects); less able to cope with multiple service providers at multiple sites; and less able to handle gadgets and information technology. Care would ideally be provided in a user friendly and convenient community setting integrating medical and social activities for management and maintenance.

- The need for eye care and monitoring for retinopathy is particularly important since vision affects independence and quality of life.
- 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.

It is recommended to adopt an elder-oriented approach in care of older people with diabetes as a cornerstone in health and social services in addition to prevention, screening and optimizing disease control.

Chapter 1

Introduction

Chapter 1
Introduction

1.1 Overview

Diabetes mellitus (Diabetes) is a chronic metabolic disease where the pancreas does not produce enough insulin or the body cannot effectively use the insulin to lower blood glucose (World Health Organization (WHO), 2008b). One of the risk factors for diabetes is being older. Other risk factors for diabetes include being overweight or obesity, physical inactivity, certain drugs or diseases that affect the functioning of the pancreas and family history (Department of Health of Hong Kong Special Administrative Region, 2006). The risk factors of diabetes have additive effects, such that the presence of more risk factors is associated with increased odds of having diabetes (Ko *et al*., 2000).

Common symptoms of diabetes include frequent urination, abnormal thirst, fatigue, weight loss, blurred vision and poor wound healing. Diabetes can often be asymptomatic and people affected may remain unaware of the condition until complications develop (Department of Health of Hong Kong Special Administrative Region, 2006). Diabetes can also lead to various adverse consequences, including retinopathy, neuropathy, limb amputation, kidney failure, heart disease and stroke (WHO, 2008b). These complications, in particular retinopathy and amputation, affect activities of daily living (ADL).

Diabetes is a chronic medical condition that can be controlled but not cured. Combined with the increasing risk associated with advancing age, the prevalence of diabetes in the population increases with age. With the global ageing trend, the prevalence of diabetes is increasing world-wide in both developed and developing countries.

1.2 Types of Diabetes

According to the WHO, there are three common types of diabetes: Type 1, Type 2 and gestational diabetes (WHO, 2008b).

- Type 1 diabetes: usually develops in childhood and adolescence. Patients require lifelong insulin injections for survival.
- Type 2 diabetes: usually develops in adulthood and is related to obesity, lack of physical activity and unhealthy diet. This is the commonest type of diabetes (representing 90% of diabetic cases world-wide). Treatment may involve lifestyle changes and weight loss, and oral medications or insulin injections.
- Gestational diabetes: usually develops in pregnant women who have never had diabetes before but who have high blood sugar (glucose) levels during pregnancy.

1.3 Diagnostic Classification

According to the WHO and International Diabetes Federation (IDF) (2006), the WHO Diagnostic Classification criteria defines diabetes, impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) as follows:

- Diabetes is defined as a fasting plasma glucose level ≥ 7.0mmol/L or 2-hour plasma glucose ≥ 11.1mmol/L.
- Impaired glucose tolerance (IGT) is defined as fasting plasma glucose level < 7.0mmol/L and 2-hour plasma glucose of 7.8 to 11.1mmol/L.
- Impaired fasting glucose (IFG) is defined as a fasting plasma glucose level of 6.1 to 6.9mmol/L and (if measured) 2-hour plasma glucose <7.8mmol/L.

Two-hour plasma glucose measurement is based on oral glucose tolerance test (OGTT) with 75g oral glucose load. IGT and IFG are often termed "pre-diabetes", which imply a higher risk of developing diabetes.

1.4 International Classification of Diseases (ICD)

The International Statistical Classification of Disease and Related Health Problems (ICD) is published by the WHO for the international standard diagnostic classification of disease. The ICD is commonly used to classify diseases and other health problems on records including death certificates and hospital discharge records. The ICD codes for diabetes are:

- ICD 9th version (ICD-9): 250
- ICD 10th version (ICD-10): E10-E14

1.5 Data Quoted in this Report

This report treats all types of diabetes together because most data sources used do not distinguish between types of diabetes in adults. In most of the survey data included in this report, the definition of diabetes is a self-reported past diagnosis of diabetes by a doctor. In most cases, this was not verified from clinical records. Nevertheless, some of the surveys did use the diagnostic classification based on glucose tests and it has been stated explicitly whenever clinical data is quoted.

For mortality and health care utilisation statistics, the ICD is widely used for classifying diabetes. In Hong Kong, the classification of disease and causes of death was based on ICD-9 for the years 1979 to 2000, and then ICD-10 from 2001 onwards. Hence, the figures from 2001 onwards may not be comparable with figures for previous years and caution should be exercised when interpreting the trend of disease across 2000 and 2001 in Hong Kong.

As the statistics quoted in this report were compiled from different sources, the conceptualization and compilation methods could vary considerably across studies. The comparisons presented in this report, therefore, can only be interpreted in a broad sense. It is recommended that readers consult the cited references for the meta-data of the studies.

Chapter 2

Global Trends and Burden

Chapter 2
Global Trends and Burden

2.1 Prevalence

2.1.1 Global

Using the WHO diagnostic criteria for diabetes, it is estimated that the world-wide prevalence and number of cases of diabetes in all age-groups is increasing. Even assuming that age-specific prevalence remains constant, the number of people with diabetes will approximately double between 2000 and 2030 (Wild *et al*., 2004) (Table 2.1).

Table 2.1 World-wide prevalence of diabetes for the year 2000 and projection for 2030

	2000	2030	% change
Prevalence	2.8%	4.4%	57% increase
Number of people with diabetes	171 million	366 million	114% increase

Wild *et al*. (2004) pointed out that the expanding older population has contributed most to this increasing prevalence. Since the prevalence of diabetes is slightly higher in men than in women under the age of 60, but the reverse is observed for older ages, the expanding older female population leads to a greater number of women with diabetes, despite the prevalence being higher in men.

While people with diabetes in developing countries were mainly middle-aged, those in developed countries were mainly aged 65 and above.

2.1.2 United States

In the United States, the prevalence of self-reported past doctor diagnosis of diabetes increased in all age groups between 1980 and 2006 (Centers for Disease Control and Prevention, Department of Health and Human Services of the United States, 2008). It was projected that the number of

people with diabetes in the United States would increase from 17.7 million in 2000 to 30.3 million in 2030 (Wild *et al*., 2004).

Between 1980 and 2006, people aged 65 to 74 had the highest prevalence of self-reported past diagnosis of diabetes followed by people aged 75 or older, people aged 45 to 64, and people under 45. In 1980, the prevalence of self-reported past doctor diagnosis of diabetes among people aged 65 to 74 was 9.1% and among people aged 75 and above it was 8.9%; whilst the respective figures increased to 18.4% and 16.6% in 2006 (Centers for Disease Control and Prevention, Department of Health and Human Services of the United States, 2008) (Table 2.2). It was estimated that between 1999 and 2002, among those aged 65 and above, 26.9% of persons with diabetes were unaware of their condition (Cowie *et al*., 2006).

Table 2.2 Prevalence of self-reported diabetes, by age group, United States, 1980-2006

Age groups	1980	1990	2000	2006
65-74	9.1%	9.9%	15.4%	18.4%
75+	8.9%	8.6%	13.0%	16.6%
Whole population (age-adjusted*)	2.8%	2.9%	4.5%	5.6%

** The age-adjusted prevalence used the estimated 2000 U.S. population as the standard.*

2.1.3 United Kingdom

In the United Kingdom, the prevalence of self-reported past diagnosis of diabetes by a doctor among the population aged 16 and above nearly doubled from 2.4% in 1994 to 4.5% in 2006. The prevalence of diabetes increased with age in general. From 1994 to 2006, the prevalence increased in all age groups. In 1994, the prevalence of diabetes among those aged 65 to 74 years was 5.3% and that among those aged 75 years and above was 6.0%; whilst in 2006, the respective figures increased to 12.8% and 11.8% (The NHS Information Centre of the United Kingdom, 2008) (Table 2.3).

Table 2.3 Prevalence of self-reported past diagnosis of diabetes by a doctor, by age group, United Kingdom, 1994-2006

Age groups	1994	1998	2003	2006
65-74	5.3%	6.8%	9.9%	12.8%
75+	6.0%	7.4%	9.2%	11.8%
Whole population (16+)	2.4%	2.8%	4.1%	4.5%

2.1.4 Australia

In Australia, the age-adjusted prevalence of self-reported past doctor diagnosis of diabetes rose from 2.4% in 1995 to 3.0% in 2001 and 3.5% in 2004-2005 (Australian Bureau of Statistics, 2006). Between 1995 and 2005, the prevalence increased among those aged 55 and above, whilst that among the younger age groups remained more or less the same. In 1995, the prevalence of diabetes among those aged 65 to 74 years was 8.4% and that among those aged 75 and above was 8.9%; whilst in 2004-2005, the respective figures increased to 13.9% and 13.3% (Table 2.4).

Table 2.4 Prevalence of self-reported doctor diagnosis of diabetes, by age group, Australia, 1995-2005

Age groups	1995	2001	2004-2005
65-74	8.4%	11.4%	13.9%
75+	8.9%	10.0%	13.3%
Whole population (age-adjusted*)	2.4%	3.0%	3.5%

** The age-adjusted prevalence used the estimated resident Australian population as of 30 June, 2001 as the standard.*

Based on self-report of past doctor diagnosis and OGTT using the WHO diagnostic criteria, it was estimated that the overall prevalence of diabetes among people aged 75 and above was 23.0% in 1999-2000, over half of whom were undiagnosed (Dunstan *et al*., 2002). In addition, another 30.0% of people aged 75 and above had IGT or IFG, which might suggest a further increase in the prevalence of diagnosed diabetes in future.

2.1.5 China

In China, the prevalence of diabetes appears to have increased among the population aged 35 to 64. In 1994, using the 1985 WHO criteria, the prevalence of diabetes among the population aged 35 to 44 years, 45 to 54 years and 55 to 64 years was 1.7%, 4.1% and 7.7% respectively (Pan *et al*., 1997). Using the American Diabetes Association (ADA) criteria, the prevalence of self-reported and undiagnosed diabetes among the population aged 35 to 44, 45 to 54 and 55 to 64 increased to 3.2%, 5.6% and 8.6% respectively in 2000-2001 (Gu *et al*., 2003) (Table 2.5).

Table 2.5 Prevalence of diabetes (self-reported and undiagnosed), by age group, China, 1994-2001

Age groups	1994	2000-2001
35-44	1.7%	3.2%
45-54	4.1%	5.6%
55-64	7.7%	8.6%

According to official statistics, the prevalence of self-reported diabetes increased rapidly from 0.2% in 1993, to 0.3% in 1998 and to 0.6% in 2003 (Ministry of Health of the People's Republic of China, 2004). It was projected that the number of people with diabetes in China would more than double from 20.8 million in 2000 to 42.3 million in 2030 (Wild *et al.*, 2004).

The percentage of undiagnosed diabetes was over 70% in 1994-1995 and 2000-2001 (Gu *et al.*, 2003; Pan *et al.*, 1997). In 2000-2001, the proportion of undiagnosed cases among those aged 65 to 74 with diabetes was as high as 73.8%. This high percentage implies that a majority of diabetes cases were not aware of their status.

The prevalence of pre-diabetes was also high in China. In 1994, the prevalence of IGT was 5.9% for people aged 45 to 54 and 8.0% for those aged 55 to 64 (Pan *et al.*, 1997). In 2000-2001, the prevalence of IFG was 7.2% and 8.6% for the two age groups respectively (Gu *et al.*, 2003). The prevalence of IFG reached 10.4% among those aged 65 to 74. The high prevalence might suggest an increasing trend in prevalence of diabetes in future.

2.1.6 Singapore

In Singapore, based on the WHO diagnostic criteria for diabetes, the prevalence of diabetes for the population aged 18 to 69 remained stable between 1998 and 2004, being 9.0% in 1998 and 8.2% in 2004 (Ministry of Health of Singapore, 1999, 2005). The prevalence of diabetes dropped slightly in the age groups 50 to 59 and 60 to 69 (Table 2.6). The proportion of undiagnosed cases among people aged 18 to 69 also decreased from 62.1% in 1998 to 49.4% in 2004 (Ministry of Health of Singapore, 2005).

Table 2.6 Prevalence of diabetes, by age group, Singapore, 1998 and 2004

Age groups	1998	2004
50-59	21.8%	16.7%
60-69	32.4%	28.7%
18-69	9.0%	8.2%

Between 1998 and 2004, the prevalence of IGT decreased among all the age groups. Among those aged 50 to 59, the prevalence of IGT decreased from 24.1% in 1998 to 18.6% in 2004; among those aged 60 to 69, it remained at about 22% in both years (Ministry of Health of Singapore, 1999, 2005).

Among all races, Chinese had the lowest rates of diabetes (8.0% in 1998, 7.1% in 2004) and IGT (14.3% in 1998, 11.7% in 2004). However, the proportion of undiagnosed cases in the Chinese population was among the highest (63.9% in 1998, 50.4% in 2004) (Ministry of Health of Singapore, 1999, 2005).

2.1.7 Japan

In Japan, the prevalence of self-reported diabetes was around 15.0% among the population aged 60 and above in 2000 (Ministry of Health, Labour and Welfare of Japan, 2001). It was projected that the number of people with diabetes in Japan would increase moderately from 6.8 million in 2000 to 8.9 million in 2030 (Wild *et al*., 2004).

Adopting different criteria, national studies have used the self-reported previous doctor diagnosis of diabetes and the level of stable glycated hemoglobin (HbA1c) to estimate the prevalence of possible and probable diabetes. People with HbA1c being 6.1% and above, or under diabetes treatment were regarded as probable diabetes cases, while those without diabetes treatment and with a HbA1c between 5.6% and 6.1% were defined as possible diabetes cases (Ministry of Health, Labour and Welfare of Japan, 2004, 2008b).

The prevalence of probable diabetes for the population aged 20 and above has increased slightly over the past decade (8.2% in 1997 as compared to 10.5% in 2007). The prevalence of probable diabetes for the population aged 70 and above slightly increased from 13.8% in 1997 to 16.2% in 2007 (Ministry of Health, Labour and Welfare of Japan, 2004, 2008b) (Table 2.7).

Table 2.7 Prevalence of probable diabetes, by age group, Japan, 1997-2007

Age groups	1997	2002	2007
60-69	13.7%	14.4%	17.7%
70+	13.8%	15.7%	16.2%
Whole population (20+)	8.2%	9.0%	10.5%

The prevalence of possible diabetes for the population aged 20 and above increased dramatically from 7.9% in 1997 to 21.1% in 2007. Between 1997 and 2007, the prevalence of possible diabetes for the population aged 60 to 69 increased from 9.5% to 25.1% and for those aged 70 and above from 12.0% to 29.4% (Ministry of Health, Labour and Welfare of Japan, 2004, 2008b) (Table 2.8).

Table 2.8 Prevalence of possible diabetes, by age group, Japan, 1997-2007

Age groups	1997	2002	2007
60-69	9.5%	14.8%	25.1%
70+	12.0%	16.5%	29.4%
Whole population (20+)	7.9%	10.6%	21.1%

2.2 Incidence

2.2.1 Global

Statistics on the incidence of diabetes are sparse when compared with the prevalence statistics. The world-wide number of cases increased from 11.1 million in 2000 to 11.6 million in 2002 (WHO, 2002a, 2002b, 2004). Meanwhile, the incidence rate was more or less the same, with 1.9 per 1,000 population in 2002 (WHO, 2004) (Table 2.9).

Table 2.9 World-wide incidence of diabetes, 2000-2002

	2000	2001	2002
Number of cases	11.1 million	11.3 million	11.6 million
Incidence rate (per 1,000)	1.8	1.9	1.9

2.2.2 United States

In the United States, the incidence of self-reported diagnosed diabetes in all age groups was increasing from 1980 to 2006 (Centers for Disease Control and Prevention, Department of Health and Human Services of the United States, 2009b). Among those aged 65 to 79, the incidence rate nearly doubled from 6.9 per 1,000 population in 1980 to 12.8 per 1,000 population in 2006, with more rapid increase since the 1990s (Table 2.10).

Table 2.10 Incidence of diagnosed diabetes (per 1,000), by age group, United States, 1980-2006

Age groups	1980	1990	2000	2006
45-64	5.2	6.0	10.1	12.1
65-79	6.9	6.0	11.6	12.8

For both men and women, age-adjusted annual incidence was about twice as high in 2006 compared with 1980, with most of the increase occurring in the latter half of the time period. In 2006, the age-adjusted incidence among women (7.6 per 1,000) was similar to that of men (7.9 per 1,000). While the incidence followed similar trends for men and women in the age group 18 to 44, different trends were observed between men and women in different age groups (Centers for Disease Control and Prevention, Department of Health and Human Services of the United States, 2009a, 2009c).

2.2.3 United Kingdom

In the United Kingdom, the age-adjusted incidence of diabetes, based on blood glucose measurement, nearly doubled between 1994 and 2003, from 1.8 to 3.3 per 1,000 person-years. The population aged 60 and above had the greatest increase. Among those aged 65 to 69, the incidence rate doubled from 5.2 per 1,000 population in 1994 to 10.7 per 1,000 population in 2003 (QResearch, 2007) (Table 2.11).

Table 2.11 Incidence of diagnosed diabetes (per 1,000), by age group, United Kingdom, 1994 and 2003

Age groups	1994	2003
65-69	5.2	10.7
Whole population (age-adjusted*)	1.8	3.3

** The age-adjusted incidence used the UK Census 2001 population as the standard.*

2.2.4 Australia

In Australia, based on self-report and WHO criteria, the annual incidence of diabetes among those aged 49 and above was about 9.3 per 1,000 in 2002-2004 (Cugati *et al*., 2007). Also based on self-report and WHO criteria, but in a younger population (aged 25 to 88), the annual incidence of diabetes was about 7.7 per 1,000 (unadjusted for age) in 2004-2005 (Magliano *et al*., 2008).

2.2.5 China

In China, based on ADA standards, the annual incidence of diabetes of a Shanghai sample aged 20 to 94 was 16.5 per 1,000 person-years in 1998-2001 (Jia *et al*., 2007). Based on WHO diagnostic criteria, a Daqing study showed the annual incidence of diabetes among people aged 25 to 74 was 1.3 per 1,000 person-years in 1986-1990 (Hu *et al*., 1993).

There was an increasing trend for clinically diagnosed Type 2 diabetes. Between 1999 and 2005, the incidence rates of Type 2 diabetes, based on a registry in Harbin, increased by 12% per year (Liu *et al*., 2007). The rate in metropolitan areas doubled from 0.5 per 1,000 person-years in 1999 to 1.1 per 1,000 person-years in 2005. The incidence rate increased with age until 70 years. The incidence rate among males aged 55 and above was higher than their female counterparts, but the reverse was true for those aged below 55. The surrounding county areas had lower incidence rates than the metropolitan areas (Table 2.12).

Table 2.12 Incidence of diabetes (per 1,000), by area, in Harbin, China, 1999-2005

Areas	1999	2001	2003	2005
Metropolitan	0.5	0.6	0.8	1.1
Surrounding Counties	0.1	0.2	0.3	0.2

2.2.6 Singapore

Information on incidence of diabetes in Singapore is not readily available.

2.2.7 Japan

In Japan, based on self-report and WHO criteria, the annual incidence of diabetes among those aged 30 to 59 was about 6.9 per 1,000 for men and 3.8 per 1,000 for women in 2001 (Nagaya *et al*., 2005). Based on ADA criteria, the annual incidence of diabetes among those aged 19 to 86 was about 1.2 per 1,000 in 2002-2006 (Inoue *et al*., 2008).

2.3 Mortality

2.3.1 Global

It was estimated that 1.1 million people died from diabetes in 2004 (WHO, 2008a). The proportion of deaths due to diabetes world-wide increased from 1.6% in 2000 to 1.9% in 2004 (WHO, 2002a, 2008a). It was projected that the number of deaths due to diabetes would nearly double from 1.1 million in 2004 to 2.2 million in 2030 (WHO, 2008a, 2008c) (Table 2.13).

Table 2.13 World-wide number of deaths from diabetes for year 2004 and projection for 2030

	2004	2030	% change
Number of deaths due to diabetes	1.1 million	2.2 million	95% increase
Proportion of deaths due to diabetes among all deaths	1.9%	3.3%	74% increase

However, these figures underestimate the true burden because the underlying cause of death is often recorded as another condition such as heart disease or kidney failure. If deaths for which diabetes was contributory was taken into account, it was estimated that there were 2.9 million deaths attributable to diabetes annually (WHO, 2008b).

It was estimated that the overall risk of dying among people with diabetes was at least double the risk of their counterparts without diabetes (WHO, 2008b). About 29% of all deaths among the population aged 65 and above who had diabetes were attributable to diabetes in 2000 (Roglic *et al*., 2005).

A recent study showed that the relative risk of increased mortality was 1.4 for men and women aged 60 to 69 and the corresponding figures were 1.1 and 1.2 for men and women aged 70 and above (Barnett *et al*., 2006).

2.3.2 United States

In the United States, the age-standardised death rates for diabetes remained stable between 1999 and 2003 and decreased slightly from 2004 to 2005 (National Center for Health Statistics of the United States, 2008). The death rates increased sharply with age and the age-specific death rates followed similar trends. In 2005, the death rate for diabetes among those aged 65 to 74 was 86.8 per 100,000 (Table 2.14).

Table 2.14 Death rates for diabetes (per 100,000), by age group, United States, 1999-2005

Age groups	1999	2001	2003	2005
65-74	91.8	91.4	90.8	86.8
75-84	178.0	181.4	181.1	177.2
85+	317.2	321.8	317.5	312.1
Whole population (age-adjusted*)	25.0	25.3	25.3	24.6

** The age-adjusted death rates used the US population as of 1 April, 2000 as the standard.*

2.3.3 United Kingdom

In the United Kingdom, the age-standardised death rates for diabetes slightly decreased from 9.4 (males) and 6.5 (females) per 100,000 population in 1999 to 7.9 (males) and 5.7 (females) per 100,000 in 2005 (Office for National Statistics of the United Kingdom, 2008). The death rates increased with age for both genders, and the males had higher death rates than the females at all ages (Table 2.15). In 2005, the death rate for diabetes among those aged 65 to 74 was 27.9 and 19.0 per 100,000 for the males and females respectively.

Table 2.15 Death rates for diabetes (per 100,000), by age group and sex, United Kingdom, 1999-2005

Age groups	1999		2002		2005	
	Male	Female	Male	Female	Male	Female
65-74	38.2	25.2	35.5	24.1	27.9	19.0
75-84	85.5	62.1	87.5	64.3	79.2	59.4
85+	182.0	147.9	210.6	168.8	184.4	164.3
Whole population (age-adjusted*)	9.4	6.5	9.1	6.5	7.9	5.7

** The age-adjusted death rates used the European Standard Population as the standard.*

2.3.4 Australia

In Australia, the age-standardised death rates for diabetes remained stable between 1997 and 2005 (Australian Bureau of Statistics, 2008). The death rates increased sharply with age. The age-specific death rates among those aged 85 and above showed an increasing trend. In 2005, the death rate for diabetes among those aged 65 to 74 was 46.5 per 100,000 (Table 2.16).

Table 2.16 Death rates for diabetes (per 100,000), by age group, Australia, 1997-2005

Age groups	1997	1999	2001	2003	2005
65-74	57.7	53.9	51.5	56.8	46.5
75-84	140.9	134.2	129.1	129.2	141.6
85+	263.8	282.6	286.6	335.4	336.5
Whole population (age-adjusted*)	17.7	16.2	15.9	16.5	16.3

**The age-adjusted death rates used the Australian population as of 30 June, 2001 as the standard.*

2.3.5 China

In China, the death rates for diabetes in urban areas increased by two-thirds from 11.4 per 100,000 in 2003 to 19.0 per 100,000 in 2007; while the corresponding figures for the rural areas increased less rapidly from 6.4 to 8.2 per 100,000 (Ministry of Health of the People's Republic of China, 2004, 2008). The age-specific death rates for diabetes also increased for those aged 75 and above (Table 2.17). Males generally have higher death rates for diabetes than females, except for the younger old people.

Table 2.17 Death rates for diabetes (per 100,000), by age group, China (urban areas), 2003-2007

Age groups	2003	2006	2007
60-64	29.1	25.5	26.0
65-69	61.9	58.4	51.6
70-74	118.8	110.2	106.9
75-79	162.7	187.4	198.2
80-84	169.7	265.2	268.5
85+	171.2	356.6	361.6
Whole population	11.4	15.5	19.0

2.3.6 Singapore

In Singapore, the death rates for diabetes nearly doubled in the past decade, from 7.4 per 100,000 population in 1997 to 13.3 per 100,000 population in 2007 (Singapore Department of Statistics, 2008) (Table 2.18). Nevertheless, this increase included the effect due to ageing.

Table 2.18 Death rates for diabetes (per 100,000), Singapore, 1997-2007

	1997	2002	2005	2007
Whole population	7.4	10.2	12.0	13.3

2.3.7 Japan

In Japan, the death rates for diabetes slightly decreased from 11.4 per 100,000 population in 1995 to 10.8 per 100,000 in 2006 (Ministry of Health, Labour and Welfare of Japan, 2008a). The death rates increased with age. In 2006, the death rate for diabetes among those aged 65 to 69 was 18.0 per 100,000 while that among those aged 80 to 84 was 62.6 per 100,000 (Table 2.19). The males had higher death rates than the females at all ages. Adjusting for age, the death rates for diabetes followed the same trend, that is slightly decreased from 10.1 (males) and 6.6 (females) per 100,000 population in 1995 to 7.2 (males) and 3.7 (females) per 100,000 in 2006.

Table 2.19 Death rates for diabetes (per 100,000), by age group, Japan, 1995-2006

Age groups	1995	2000	2004	2006
60-64	17.8	13.4	11.2	11.7
65-69	26.3	19.9	18.8	18.0
70-74	39.6	30.8	27.5	27.9
75-79	68.4	45.9	40.7	41.6
80-84	114.4	74.6	63.1	62.6
Whole population	11.4	9.8	10.0	10.8

Chapter 3

Trends and Burden of Diabetes in Hong Kong

Chapter 3
Trends and Burden of Diabetes in Hong Kong

3.1 Introduction

Hong Kong has a rapidly ageing population. The population aged 65 and above nearly doubled during the past two decades, from 455,800 in 1988 to 879,600 in 2008 (Census and Statistics Department of Hong Kong Special Administrative Region, 2009). It is projected that in 2036, there will be 2,261,000 people aged 65 and above in Hong Kong (Census and Statistics Department of Hong Kong Special Administrative Region, 2007b).

Even if there is no increasing trend in the age-specific prevalence of diabetes, the number of older people who have diabetes can be expected to increase over the years owing to the larger number of older people, who are most at risk of developing diabetes. As a result, Hong Kong will experience increasingly larger numbers of older people with diabetes in the future.

3.2 Prevalence

There are several estimates of the prevalence of diabetes in older people in Hong Kong. These can be grouped into two sets (1) self-reported past doctor diagnosis and (2) blood glucose measurements plus self-reported past doctor diagnosis.

3.2.1 Self-reported diabetes

Data were collected from several household surveys, which asked whether the respondent had been told by a doctor that they had diabetes, had been diagnosed with diabetes in the past or was receiving medical care for diabetes (Table 3.1 and Figure 3.1). According to self-reported estimates, there is no clear evidence of either an increasing or decreasing trend in the prevalence of diabetes among older people in Hong Kong from 1995 to 2004. Among the community-dwelling population aged 60 and above, the prevalence of self-reported past doctor diagnosis of diabetes was 15.0% in 2000 and 15.9% in 2004 (Census and Statistics Department of Hong Kong Special Administrative Region, 2001, 2005).

Based on the Population Health Survey 2003/2004, the prevalence of diabetes among the population aged 65 and above was 13.5%, whilst that for the population aged 18 to 64 was 2.2% in 2003-2004. The prevalence of diabetes among the older population was six times that among the younger population

(Department of Health of Hong Kong Special Administrative Region and Department of Community Medicine, The University of Hong Kong, 2005).

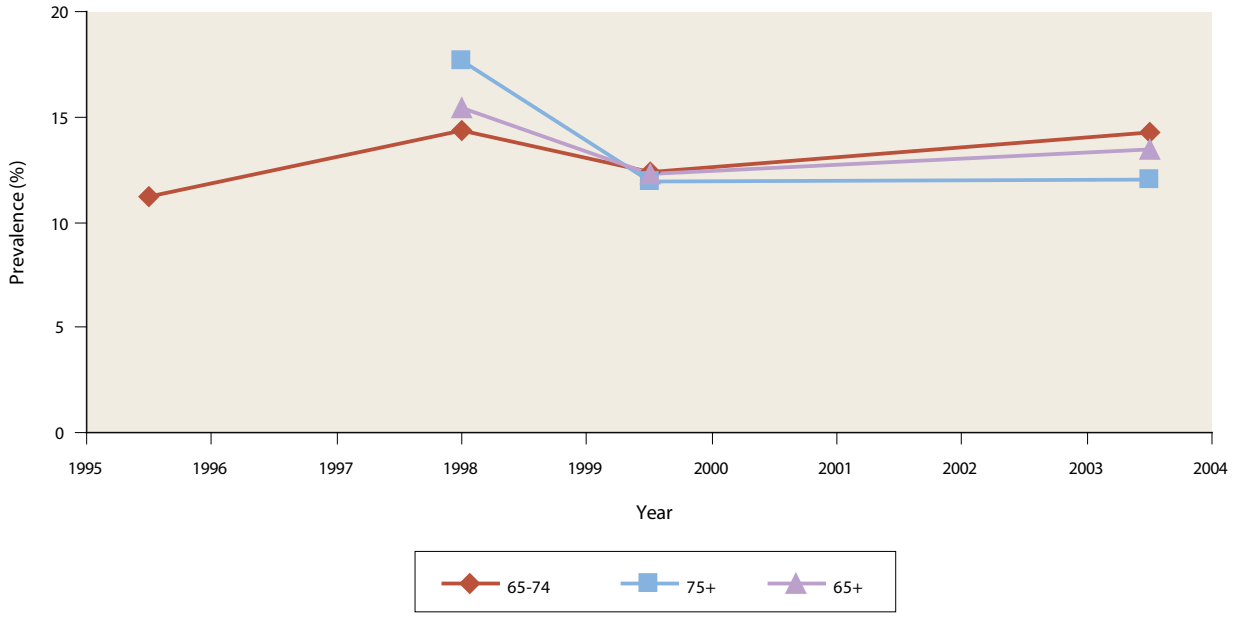
Table 3.1 Prevalence of diabetes in older people from self-reported data, Hong Kong, 1995-2004

Age groups	1995-1996 [1]	1998 [2]	1998-2001 [3]	2003-2004 [4]
		Total		
65-74	11.2%	14.3%	12.4%	14.3%
75+	--	17.7%	11.9%	12.0%
65+	--	15.5%	12.3%	13.5%
		Male		
65-74	9.3%	12.7%	12.1%	13.1%
75+	--	18.1%	11.7%	11.1%
65+	--	14.4%	12.0%	12.5%
		Female		
65-74	13.6%	15.8%	12.5%	15.6%
75+	--	17.4%	12.1%	12.6%
65+	--	16.4%	12.4%	14.4%

Data sources:

1. *Hong Kong Cardiovascular Risk Factor Prevalence Study 1995-1996. Question used "Have you ever been diagnosed by a doctor (western-trained) that you have diabetes?"*
2. *Harvard Household Survey 1998. Question used "Have you ever been told by a doctor that you have diabetes?"*
3. *Elderly cohort from Elderly Health Centre, Department of Health of Hong Kong, 1998-2001. Question used "Active Disease – both receiving regular health care or not"*
4. *Population Health Survey, 2003/2004. Question used "Have you ever been told by a doctor or health professional that you have diabetes?"*

Figure 3.1 Prevalence of self-reported diabetes, Hong Kong, 1995-2004



A few more estimates of the prevalence of diabetes based on self-report of previous doctor diagnoses are shown in Table 3.2. These estimates are not directly comparable with the previous estimates due to specific sample selection criteria.

Table 3.2 Further estimates of prevalence of self-reported diabetes in older people

Year	Age	Sample Characteristics	Prevalence	Source
1988	55+	Older people not living in institution	8.5%	Chi and Lee (1989)
1991-1992	70+	Older people receiving allowance from the government	10.3%	Ho *et al*. (1994)
1997	65+	Older people living in Central and Western District	13.5%	Chu *et al*. (1998)
1998-1999	65+	Ambulatory older people	12.4%	Chu *et al*. (2005)
2000	60+	Older people living in community	15.0%	Census and Statistics Department of Hong Kong Special Administrative Region (2001)
2001-2003	65+	Older people attending a mobile clinic in Sham Shui Po for screening	11.7%	McGhee *et al*. (2007)
2001-2003	65+	Ambulatory older people who attended a health check	14.5%	Lee *et al*. (2006)
2004	60+	Older people living in community	15.9%	Census and Statistics Department of Hong Kong Special Administrative Region (2005)
2004	60+	Older people living in institutions	20.8%	Census and Statistics Department of Hong Kong Special Administrative Region (2005)

Most of the studies carried out have been on older people in the community and may underestimate the prevalence among all older people which covers those in institutions where the prevalence is higher. It was estimated that the prevalence of self-reported diabetes among the institutional population aged 60 and above was 20.8% in 2004 (Census and Statistics Department of Hong Kong Special Administrative Region, 2005).

3.2.2 Blood glucose measurement results and self-reported diabetes

The prevalence based on self-reported data was likely to be underestimated. A few studies estimated the prevalence of diabetes by combining self-reported past doctor diagnosed diabetes and measurements of blood glucose with a definition of diabetes based on WHO criteria. Results of these studies are shown in Table 3.3. According to self-reported data plus OGTT, about 21.4% of the subjects aged 65 to 84 had diabetes in 2004-2005 (Department of Health of Hong Kong Special Administrative Region, 2007). Again, there is no clear evidence of either an increasing or decreasing trend in the prevalence.

Table 3.3 Prevalence of diabetes among older people based on self-reported diagnosis plus blood glucose measurement, Hong Kong, 1995-2005

Age groups	1995-1996 [1]	2001-2002 [2]	2004-2005 [3]
		Total	
65-74	25.4%	--	--
75+	--	--	--
65+	--	--	21.4% #
		Male	
65-74	21.7%	32.9%	--
75+	--	33.3%	--
65+	--	32.9%	19.8% #
		Female	
65-74	29.3%	36.2%	--
75+	--	44.4%	--
65+	--	38.5%	23.3% #

 # Refer to the age group 65-84 years.

Data sources:

1. *Hong Kong Cardiovascular Risk Factor Prevalence Study 1995-1996. Diabetes defined by self-report (on medication) or OGTT.*
2. *Prevalence of diabetes mellitus in the Hong Kong Cardiovascular Risk Factor Prevalence Study cohort. Medical history obtained and 2-hour OGTT.*
3. *Heart Health Survey 2004/2005. Diabetes status was based on self-report or OGTT.*

The extent of under-reporting of self-reported data can be reflected by the gap between self-reported data and that combined with measurement data. Table 3.4 shows an estimate of under-reporting of diabetes using self-reported data.

Table 3.4 Under-reporting of diabetes based on self-reported data, Hong Kong

	Self-reported only	Self-reported & blood glucose measurement	Percentage of diabetes cases under-reported
Aged 65-74		**1995-1996** [1]	
Male	9.3%	21.7%	57.1%
Female	13.6%	29.3%	53.6%
Total	11.2%	25.4%	55.9%
Aged 65-84		**2004-2005** [2]	
Male	10.9%	19.8%	45.0%
Female	20.2%	23.3%	13.3%
Total	15.3%	21.4%	28.6%

Data sources:

1. *Hong Kong Cardiovascular Risk Factor Prevalence Study 1995-1996.*
2. *Heart Health Survey 2004/2005.*

From the Hong Kong Cardiovascular Risk Factor Prevalence Study, it was estimated that over half (55.9%) of the people aged 65 to 74 years with diabetes were unaware of their diabetes status. From the Heart Health Survey 2004/2005, among those aged 65 to 84 years with diabetes, 28.6% were unaware that they had diabetes. The proportion of people with diabetes who were unaware of their diabetes status was higher for men at 45.0% compared to 13.3% for women (Department of Health of Hong Kong Special Administrative Region, 2007).

3.2.3 Estimated number of people with known diabetes and future projection

We estimate the total numbers of people in Hong Kong with known diabetes by multiplying the prevalence rates of self-reported previous doctor diagnosis of diabetes with the Hong Kong demographic data. Self-reported prevalence was used because this indicates the number of people who are currently being treated. Of course, these numbers do not include the undiagnosed cases.

Based on the same series of survey, it was estimated that the prevalence of a previous diagnosis of diabetes among those aged 60 and above was 15.0% in 2000 and 15.9% in 2004 (Census and Statistics Department of Hong Kong Special Administrative Region, 2001, 2005). It was estimated that the number of people aged 60 and above with diabetes increased from 0.15 million in 2000 to 0.17 million in 2004 (Table 3.5). This corresponds to an increase of around 12.4%. This increase is partly due to the increased prevalence in 2004 and an increased number of older people in Hong Kong.

Table 3.5 Estimated number of people aged 60 and above with known diabetes in Hong Kong, 2000 and 2004

Aged 60+	2000	2004
Population	986,600	1,049,800
Prevalence with diabetes	15.02% [1]	15.87% [2]
Estimated population with diabetes	148,187	166,603

Data sources:

1. *Thematic Household Survey Report No. 21: Pattern of study in higher education; Socio-demographic profile, health status and long-term care needs of older persons.*
2. *Social Data Collected via the General Household Survey - Special Topics Report No.27: Casual employment; Part-time employment; Socio-demographic, health and economic profiles of elderly people and soon-to-be old people.*

Focusing on the population aged 65 and above, estimations of the number of known cases of diabetes had to be based on different databases, namely the Elderly Health Centre cohort 1998-2001 and the Population Health Survey 2003/2004. It was estimated that 0.09 million people aged 65 and above had diabetes in Hong Kong in 2000 and 0.11 million in 2004. This corresponds to an increase of around 23.3%. This is consistent with the findings above.

Assuming a constant prevalence rate between 2003/2004 and 2006, we estimated the total number of people in Hong Kong with known diabetes in 2006 by the same methodology. It was estimated that 0.23 million people have diabetes in Hong Kong of which 50% are aged 65 and above (Table 3.6).

Table 3.6 Estimated number of people with known diabetes in Hong Kong, 2006*

Age groups	Male	Female	Total
18-44	8,088	15,205	23,293
45-64	46,872	43,031	89,903
65-74	31,149	36,177	67,326
75+	17,334	28,617	45,951
18-64	54,960	58,237	113,197
65+	48,483	64,794	113,277
Total (18+)	103,443	123,031	226,474

** Estimated number of people with known diabetes in 2006*

= Population in mid-2006 by age group and sex × prevalence of diabetes by age group and sex

Using the same methodology (2003/2004 prevalence) and assuming that the age and gender specific prevalence remains the same, the number of people aged 65 and above with known diabetes would be expected to increase from 0.11 million in 2006 to 0.30 million by 2036 (Table 3.7), which is, more than double over 30 years. By 2036, people aged 65 and above would make up about 70% of the diagnosed adult cases of diabetes. Assuming the percentage of undiagnosed diabetes cases was the same as that revealed by the Heart Health Survey (28.6%), the estimated number of people aged 65 and above with diabetes would be 0.42 million in 2036.

Table 3.7 Estimated number of people aged 65 and above with known diabetes in Hong Kong, 2006 and 2036

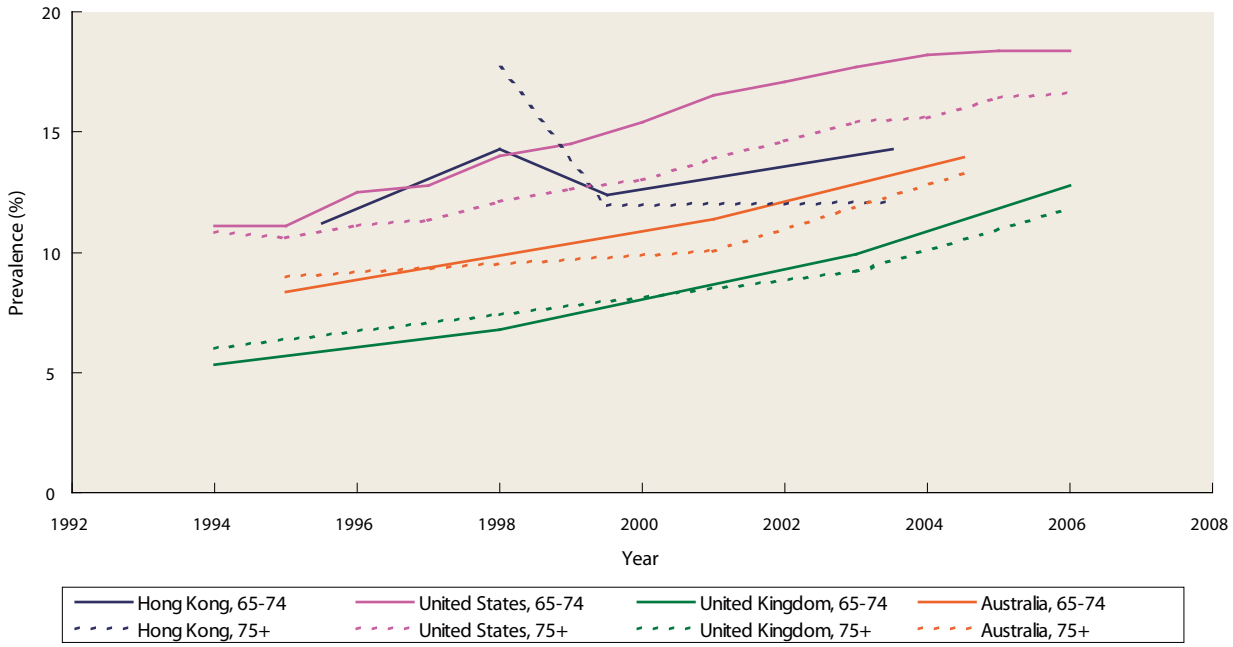
Aged 65+	2006	2036
Estimated number with known diabetes	113,277	297,858
% increase compared with 2006	--	163% increase

The above estimates assume the age-specific prevalence of known diabetes remains unchanged until 2036. The IDF predicted that, by 2025, Hong Kong will be one of the 10 regions in the world with the highest prevalence of diabetes among those aged 20 to 79 (IDF, 2008). If the age-specific prevalence is increasing, the number of people with known diabetes would be larger than our estimates above.

3.2.4 Comparison between Hong Kong and other places

Owing to the differences in conceptualization and compilation methods, international comparisons can only be conducted in a broad sense. From the previous sections, the prevalence of self-reported diabetes among the population aged 65 and above in Hong Kong, the United States, the United Kingdom and Australia are similar. These are compared in a broad sense in Figure 3.2.

Figure 3.2 Prevalence of self-reported diabetes among population aged 65 and above in selected places, 1994-2006



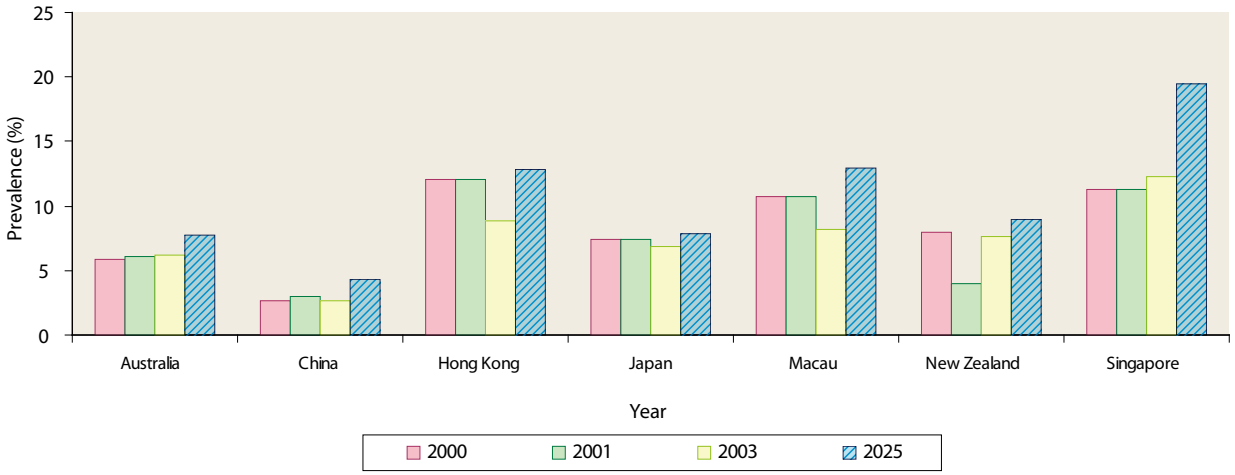
Based on the IDF estimates, Table 3.8 and Figure 3.3 show the trends in prevalence of diabetes, including undiagnosed cases, in Hong Kong and other Western Pacific regions for those aged 20 to 79 from 2000 to 2003 and projections for 2025 (IDF, 2008).

Table 3.8 Prevalence of diabetes (diagnosed and undiagnosed) among population aged 20-79 in Western Pacific Region, 2000 to 2025

Country	2000	2001	2003	2025
Australia	5.9%	6.1%	6.2%	7.7%
China, Hong Kong	12.1%	12.1%	8.8%	12.8%
China, Macau	10.7%	10.7%	8.2%	12.9%
China, People's Republic of	2.7%	3.0%	2.7%	4.3%
Japan	7.4%	7.4%	6.9%	7.9%
Korea, Democratic People's Republic of	-	-	5.2%	6.3%
Korea, Republic of	6.1%	6.1%	6.4%	8.3%
New Zealand	8.0%	4.0%	7.6%	9.0%
Singapore, Republic of	11.3%	11.3%	12.3%	19.5%
Taiwan	9.1%	9.1%	5.6%	6.6%
Thailand	3.7%	2.0%	2.1%	2.6%
Vietnam	-	-	1.0%	1.4%

Data source: Diabetes Atlas, International Diabetes Federation (http://www.eatlas.idf.org/About_e_Atlas).

Figure 3.3 Prevalence of diabetes (diagnosed and undiagnosed) among population aged 20-79 in Western Pacific Region, 2000-2003 and projected for 2025



These results show that the prevalence of diabetes among the population aged 20 to 79 in 2003 in Hong Kong was comparable to Australia, Japan, New Zealand and Macau, lower than Singapore, but higher than China. The IDF did not project an obvious increasing trend for the prevalence of diabetes in Hong Kong in 2025, while an increasing trend was projected for Singapore. Nevertheless, the projected prevalence of diabetes in 2025 in Hong Kong would be much higher than in Australia, China and Japan, though it is still much lower than in Singapore.

3.2.5 Pre-diabetes

IGT and IFG refer to levels of blood glucose concentration above the normal range, but below those which are diagnostic for diabetes. Subjects with IGT or IFG are at substantially higher risk of developing diabetes than those with normal glucose tolerance. Hence, they are said to have pre-diabetes.

Using the WHO criteria for IGT, the Cardiovascular Risk Factor Prevalence Study 1995-1996 found that the prevalence of IGT among the population aged 25 to 74 was 15.7% (14.2% for men and 17.1% for women) (Department of Clinical Biochemistry, Queen Mary Hospital of Hong Kong, 1997). The prevalence of IGT increased with age, about 1 in 4 people aged 65 to 74 had IGT (as compared to 1 in 13 for those aged 24 to 34) (Table 3.9).

Table 3.9 Prevalence of pre-diabetes (IGT) in Hong Kong, 1995-1996

Age groups	Male	Female	Total
25-34	6.2%	9.8%	8.0%
35-44	13.5%	14.1%	13.8%
45-54	15.0%	19.4%	17.3%
55-64	17.4%	24.1%	20.4%
65-74	24.8%	26.0%	25.4%
Total (25-74)	14.2%	17.1%	15.7%

Data source: The Hong Kong Cardiovascular Risk Factor Prevalence Study, 1995-1996.

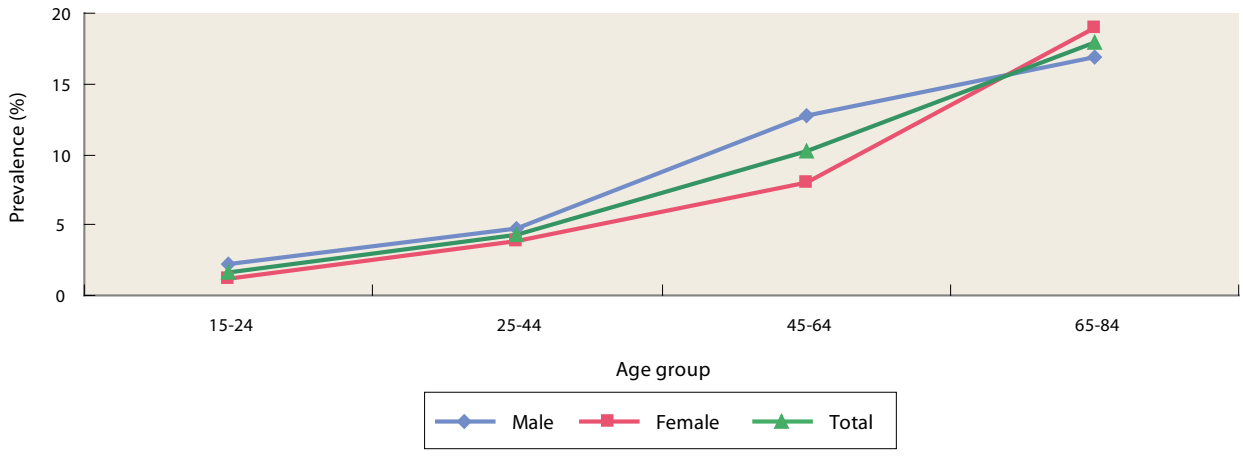
Based on WHO criteria for IGT and IFG, the Heart Health Survey 2004/2005 found that the prevalence of pre-diabetes (IGT or IFG) among the population aged 15 to 84 was 7.5% (8.7% for men and 6.4% for women) (Department of Health of Hong Kong Special Administrative Region, 2007). Again, the prevalence of pre-diabetes increased sharply with age, about 1 in 6 people aged 65 to 84 had pre-diabetes (Table 3.10 and Figure 3.4).

Table 3.10 Prevalence of pre-diabetes (IGT or IFG) in Hong Kong, 2004-2005

Age groups	Male	Female	Total
15-24	2.2%	1.2%	1.7%
25-44	4.8%	3.9%	4.3%
45-64	12.8%	8.0%	10.2%
65-84	16.9%	18.9%	17.9%
Total (15-84)	8.7%	6.4%	7.5%

Data source: Heart Health Survey 2004/2005.

Figure 3.4 Prevalence of pre-diabetes (IGT or IFG) in Hong Kong, by age group, 2004-2005



Using the Heart Health Survey prevalence estimate as the more conservative one, we calculated the number of persons in Hong Kong in 2006 who were likely to have pre-diabetes and thus were at risk of developing diabetes (Table 3.11). Nearly 0.14 million people aged 65 to 84 were estimated to have pre-diabetes in 2006, that is around 30.8% of all those with pre-diabetes.

Table 3.11 Estimated number of people with pre-diabetes in Hong Kong, 2006

Age groups	Male	Female	Total
15-24	9,854	5,528	15,382
25-44	48,720	50,107	98,827
45-64	119,040	74,192	193,232
65-84	61,634	74,976	136,611
Total (15-84)	239,248	204,804	444,052

According to IDF, it was predicted that Hong Kong will be one of the 10 regions in the world with the highest prevalence of pre-diabetes among those aged 20 to 79 by 2025. It was predicted that by that time the prevalence of pre-diabetes will be 14.6% (IDF, 2008). Action has to be taken to prevent these pre-diabetes cases from becoming diabetes cases.

3.3 Incidence

A cohort study of Chinese subjects aged 70 years and above in 1991-1992 found that the incidence rate of self-reported doctor diagnosis of diabetes was 37.3 per 1,000 in a 36-month follow up after recruitment (Woo *et al.*, 2002). This works out to an annual incidence of 12.4 per 1,000. In the Cardiovascular Risk Factor Prevalence Study 1995-1996, respondents who reported being diagnosed with diabetes by a western trained doctor were asked how long ago they were diagnosed and this date was used to identify those diagnosed within the last year. This gave an estimate of incidence of self-reported doctor-diagnosed diabetes in those aged 65 to 74 of 8.9 per 1,000. These estimates, especially the former, seem to be higher than in other countries.

In another local study, Population Health Survey 2003/2004, respondents were asked whether they had been diagnosed with diabetes by a doctor or health professional and, if so, whether it was in the past 12 months. The resulting estimate of incidence among those aged 15 and above was 15.9 per 1,000 (Department of Health of Hong Kong Special Administrative Region and Department of Community Medicine, The University of Hong Kong, 2005). The incidence rate increased with age (Table 3.12). The incidence rate of diabetes among those aged 65 and above (55.6 per 1,000) was nearly six times that among those aged 15 to 64 (9.5 per 1,000).

Table 3.12 Incidence of diabetes diagnosed in the 12 months preceding the survey (per 1,000) in Hong Kong, by age group and sex, 2003-2004

Age groups	Male	Female	Total
18-44	3.1	3.1	3.1
45-64	24.4	18.7	21.3
65-74	50.9	59.6	55.0
75+	29.9	75.0	56.7
15-64	10.7	8.5	9.5
65+	44.7	65.9	55.6
Total (15+)	15.9	16.0	15.9

Data source: Population Health Survey, 2003/2004

The estimate of incidence from the Population Health Survey is higher than that from the Woo *et al.* (2002) study and other countries. This may be due to the different methodology and survey question over-estimating the actual incidence.

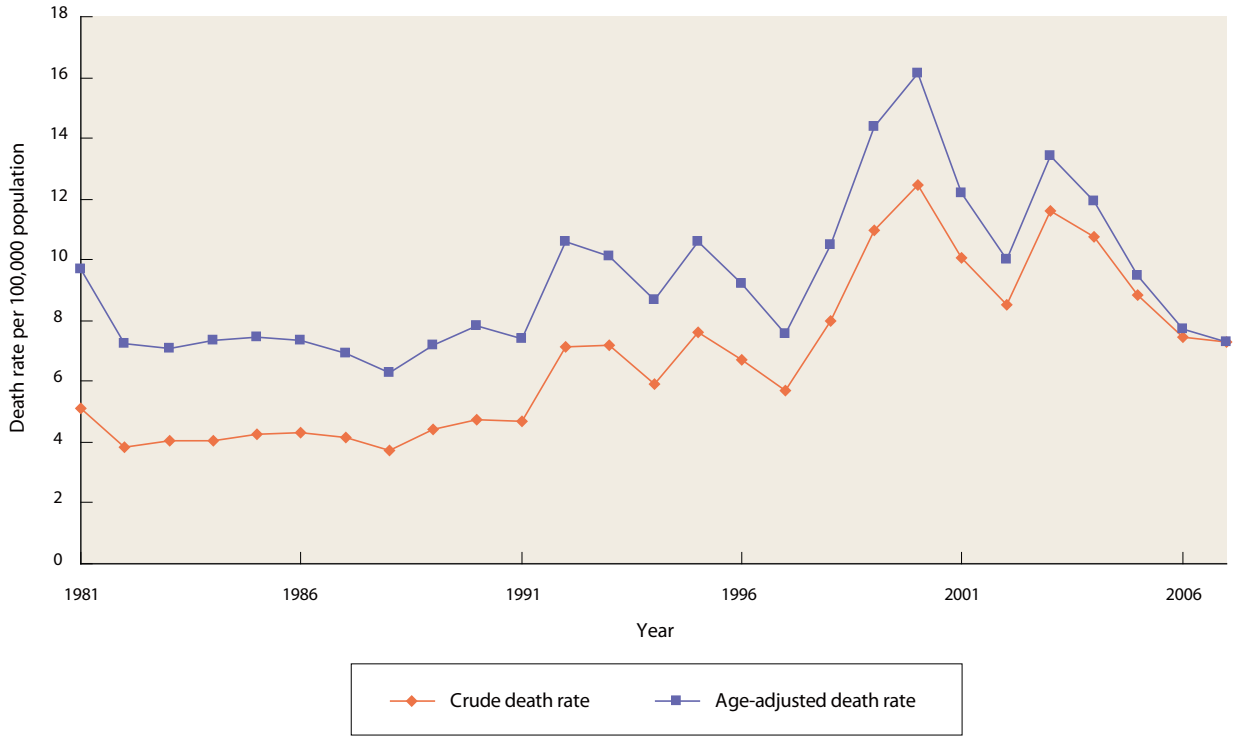
There is not much information on the local incidence of diabetes either currently or in the past. We were unable to identify useful information on the incidence of diabetes in older people in Hong Kong using clinical criteria.

3.4 Disease Burden

3.4.1 Mortality

Diabetes is the ninth most common cause of mortality in Hong Kong (Department of Health of Hong Kong Special Administrative Region, 2008b). In 2007, there were 506 deaths from diabetes, accounting for 1.3% of all deaths (Department of Health of Hong Kong Special Administrative Region, 2008b). The crude death rates from diabetes increased slightly from 5.1 per 100,000 in 1981 to 7.3 per 100,000 in 2007 (Department of Health of Hong Kong Special Administrative Region, 2005, 2008a). The age-standardised death rates for diabetes increased from 9.7 per 100,000 in 1981 to 16.2 per 100,000 in 2000, then decreased to 7.3 per 100,000 in 2007. The age-standardised mortality rates were quite stable between 1981 and 1998, increasing sharply in the late 1990's but generally decreasing from 2001 to 2007 (Figure 3.5). This is different from the United States which has had an increasing trend since 1981.

Figure 3.5 Crude and age-adjusted* death rates for diabetes in Hong Kong, 1981-2007



** The age-adjusted death rates used the Hong Kong population as of mid-2007 as the standard.*

Data source: Vital Statistics, Department of Health (http://www.healthyhk.gov.hk/phisweb/en/enquiry/index.html).

The death rates increased sharply with age (Table 3.13). The trend in standardised mortality from diabetes among people aged 65 and above was similar to that for all ages (Figure 3.6). In 2007, the standardised death rates for diabetes among those aged below 65 was 1.1 per 100,000 and among those aged 65 and above it was 50.4 per 100,000 (Department of Health of Hong Kong Special Administrative Region, 2008b).

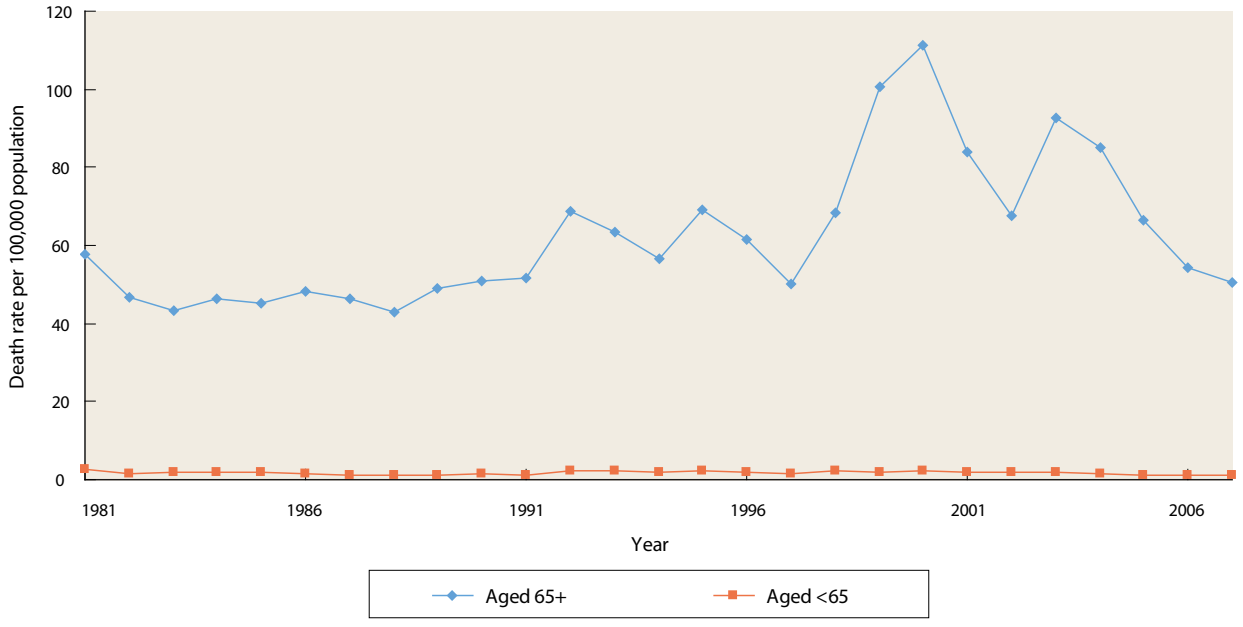
Table 3.13 Death rates for diabetes (per 100,000), by age group, Hong Kong, 1981-2007

Age groups	1981	1990	2000	2001	2007
65-74	34.4	27.1	55.9	53.0	22.6
75-84	94.8	67.0	147.6	102.0	64.1
85+	54.9	105.3	249.1	169.3	141.0
<65 (age-adjusted*)	2.7	1.6	2.5	1.9	1.1
65+ (age-adjusted*)	57.9	51.1	111.1	84.0	50.4
Whole population (age-adjusted*)	9.7	7.8	16.1	12.2	7.3

** The age-adjusted death rates used the Hong Kong population as of mid-2007 as the standard.*

Data source: Vital Statistics, Department of Health (http://www.healthyhk.gov.hk/phisweb/en/enquiry/index.html).

Figure 3.6 Age-adjusted* death rates for diabetes (per 100,000), by age group, Hong Kong, 1981-2007

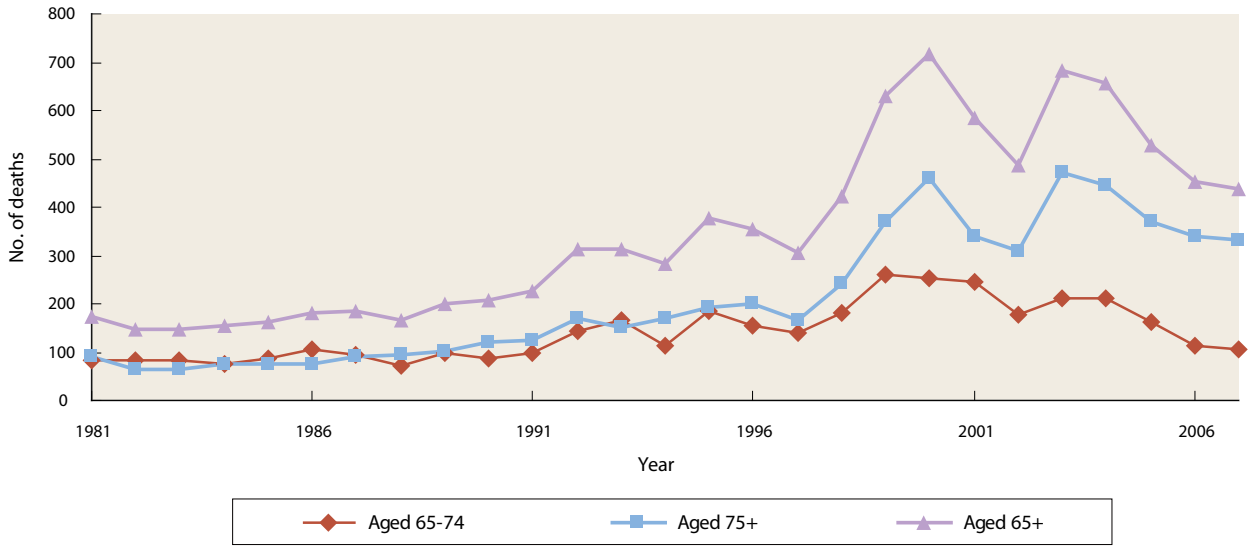


** The age-adjusted death rates used the Hong Kong population as of mid-2007 as the standard.*

Data source: Vital Statistics, Department of Health (http://www.healthyhk.gov.hk/phisweb/en/enquiry/index.html).

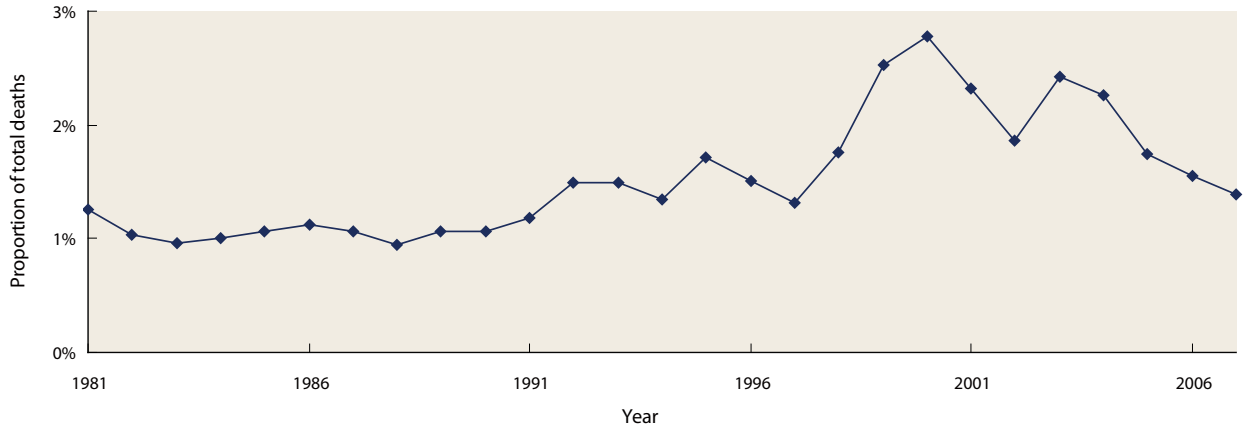
Among those aged 65 and above, the number of deaths from diabetes increased from 174 in 1981 to 716 in 2000, then decreased to 439 in 2007 (Figure 3.7) (Department of Health of Hong Kong Special Administrative Region, 2005, 2008a). The proportion of deaths from diabetes among all deaths of those aged 65 and above followed a similar pattern, being 1.4% in 2007 (Figure 3.8).

Figure 3.7 Number of deaths due to diabetes among the population aged 65 and above, 1981-2007



Data source: Vital Statistics, Department of Health (http://www.healthyhk.gov.hk/phisweb/en/enquiry/index.html).

Figure 3.8 Proportion of deaths with diabetes as principal cause among the population aged 65 and above, 1981-2007



Data source: Vital Statistics, Department of Health (http://www.healthyhk.gov.hk/phisweb/en/enquiry/index.html).

While the death rates from diabetes increased with age, females had higher death rates than males among the older group (Department of Health of Hong Kong Special Administrative Region, 2005, 2008a). In 2007, mortality rates from diabetes were 43.2 per 100,000 for males and 56.5 for females aged 65 and above (Table 3.14).

Table 3.14 Death rates from diabetes (per 100,000) in Hong Kong, by age group and sex, 2007

Age groups	Male	Female	Total
65-74	26.1	19.0	22.6
75-84	57.2	69.5	64.1
85+	114.0	153.3	141.0
<65	1.6	0.6	1.1
65+	43.2	56.5	50.4

Data source: Vital Statistics, Department of Health (http://www.healthyhk.gov.hk/phisweb/en/enquiry/index.html).

As many people would have been recorded as dying from another cause which was itself a complication of diabetes, the indirect cost of diabetes would be better measured by deaths attributable to diabetes. Hence, we used the attributable risk methodology to estimate the deaths attributable to diabetes in order to show the actual burden of diabetes. The attributable fraction (AF) is the proportion of cost (e.g. its mortality, disease burden or dollar cost) that is caused by a risk factor after controlling for confounding factors. Applying this to the population gives the population attributable fraction (PAF) or the proportion of the cost for the population that is caused by the risk factor. The PAF is estimated as:

$$PAF = Prevalence \times (Relative\ Risk - 1) / [(Prevalence \times (Relative\ Risk - 1)) + 1]$$

where prevalence refers to the prevalence of diabetes in the population of interest and relative risk is the risk of someone with diabetes incurring this cost compared with someone without diabetes. This PAF is then applied to the total cost for the population of interest.

The relative risk of all-cause mortality among people with diabetes compared to those without is 1.38 for males and 1.40 for females aged 60 to 69, whereas 1.13 for males and 1.19 for females aged 70 and above (Barnett *et al.*, 2006). In Hong Kong, 673 deaths among older people (302 for male and 371 for women) in 2006 could be attributed to diabetes (that is, a rate of 79.0 per 100,000 population) using the prevalence of diabetes from the Population Health Survey 2003/2004 (Table 3.15).

Table 3.15 Diabetes-attributable deaths among population aged 65 and above, Hong Kong, 2006

Aged 65-69	Male	Female
Relative risk of mortality	1.38	1.40
PAF%	4.93%	6.11%
Deaths in Hong Kong in 2006	1,928	817
Attributed deaths	95	50

Aged 70+	Male	Female
Relative risk of mortality	1.13	1.19
PAF%	1.51%	2.52%
Deaths in Hong Kong in 2006	13,669	12,741
Attributed deaths	207	321

3.4.2 Morbidity

3.4.2.1 Hospital admission at public hospitals

Based on data provided by the Hospital Authority, inpatient utilisation statistics were compiled. In 2006, there were about 13,600 inpatient discharges and deaths in public hospitals with a principal discharge diagnosis of diabetes (ICD9 250). There were around 7,700 episodes for people aged 65 years and above which amounts to 56% of the total episodes for diabetes in public hospitals for all ages.

In general, older people have a longer length of stay (LOS) in hospital than younger people (6.7 days for those aged 65 and above compared with 4.2 days for those aged 45 to 64). Among those aged 65 and above with diabetes, the average LOS in hospital tends to be longer for those with complications (7.5 days) compared to those without (5.6 days).

3.4.2.2 Out-patient visits related to diabetes

The Harvard Household Survey 1998 data (Harvard University and The University of Hong Kong, 1998) were used to estimate the difference in the likelihood of out-patient visits between those with diabetes and those without.

For general out-patient clinics (GOPC), Accident and Emergency Department (A&E) and family doctors, those with diabetes were more likely to visit them for chronic illness, cold/flu/fever or

other health problem than those without (Table 3.16). Among people aged 65 and above, those with diabetes had an 81% higher likelihood of having doctor consultations, in the 14 days prior to interview, than those without.

Table 3.16 Likelihood of doctor consultations in the 14 days prior to interview for those with diabetes relative to those without diabetes

Age groups	Odds Ratio (OR)	p-value	95% Confidence Interval (CI)
16-64 *	2.397	0.000	1.538 - 3.735
65+ *	1.808	0.040	1.027 - 3.184
Total (16+) *	2.237	0.000	1.578 - 3.173

* *Adjusted by age group, sex, other chronic illness, martial status, personal income, insurance coverage, occupation, living alone and health status*

Data source: Harvard Household Survey 1998.

For specialist out-patient clinics (SOPC), people with diabetes also had more doctor consultations for any disease than those without. For example, those aged 16 and above with diabetes had an 81% higher likelihood of visiting an SOPC in the 14 days prior to interview than those without (Odds Ratio (OR)=1.81; 95% CI: 1.04-3.16).

3.4.2.3 Complications of diabetes

Complications of diabetes are common. Based on statistics from the Hospital Authority, between 2002 and 2006, over 50% of inpatients discharged from public hospitals had complications as indicated by the ICD codes for diabetes with complications. Older people had a higher proportion (58% for those aged 65 and above) of complications than younger adults (46% for those under 65).

People with diabetes are at greater risk of having retinopathy, neuropathy, limb amputation, kidney failure, heart disease and stroke. According to the WHO fact sheet, over time, about 2% of people with diabetes become blind and about 10% develop severe visual impairment after 15 years with diabetes. Up to 50% of people with diabetes have damaged nerves, 10-20% die of kidney failure and about 50% die of cardiovascular disease, mainly heart disease and stroke (WHO, 2008b).

An Australian study estimated that one third of people aged 40 and above with Type 2 diabetes would experience a serious complication (Colagiuri *et al.*, 2003). Of 8,536 people with Type 2 diabetes, eye problems were most common, experienced by 26.6%, followed by kidney problems (10.4%), foot or leg ulcers (9.0%), stroke (6.9%) and heart attack (8.9%). Amputation (4.9%) was a less common but important complication affecting activities of daily living.

In Hong Kong, one diabetes centre studied co-morbidities and complications in 1990 (Qualigenics Diabetes Centre, n. d.). Half of the patients with diabetes also had either co-existing high blood pressure or high blood cholesterol level. About 25% and 20% of the diabetes patients had retinopathy and were on renal dialysis respectively. In addition, about 20-30% of stroke, 25% of heart attacks and 50% of amputations were caused by diabetes.

Wang *et al.* (1998) showed that from 1990 to 1996, the prevalence of retinopathy and neuropathy among patients first attending a diabetes clinic was 21.9% and 12.8% respectively. Another study found that people aged 60 and above with diabetes had a higher likelihood of heart disease (23.2% compared with 13.3% of those without diabetes), hypertension (58.9% compared with 31.1%), stroke (8.9% compared with 2.6%) and vision problem (33.3% compared with 19.9%) (Chou and Chi, 2005a).

Diabetic retinopathy is a common and serious condition which can lead to blindness but is to some extent treatable if detected early enough. However, survey data revealed that in 2004-2005, 56.9% of those aged 65 to 84 with known diabetes had elevated fasting blood glucose implying that there was poor control of diabetes which could lead to further complications (Department of Health of Hong Kong Special Administrative Region, 2007).

3.4.3 Disability

In the Global Burden of Disease study (GBD), WHO used disability weights by treatment status for those with diabetes (Murray and Lopez, 1996). Table 3.17 shows that a high disability weight is given to blindness, both treated and untreated. Amputation also had a high disability weight but for the untreated cases only. For the treated cases, diabetic foot had the second highest disability weight.

Table 3.17 Disability weights by treatment status for GBD diabetes models

Conditions	Untreated	Treated
Diabetes Cases	0.01	0.03
Blindness due to retinopathy	0.60	0.49
Neuropathy	0.08	0.06
Diabetic foot	0.14	0.13
Amputation	0.16	0.07

Data source: The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries, and risk factors in 1990 and projected to 2020.

In Australia, it was estimated that diabetes was responsible for 4.9% of the total disability-adjusted life years (DALYs) suffered by the population in 1996. Life lost due to disability (YLD) contributed to over 40% of DALYs due to diabetes. YLD from diabetes were also responsible for 4.6% of YLD from all causes (Mathers *et al.*, 1999). Thus diabetes is considered as a major cause of chronic disability.

In Hong Kong, Chou and Chi (2005a) used standardised questionnaires about 15 tasks and showed diabetes to be associated with disabilities among people aged 60 and above. Older people with diabetes were 1.8 to 4.1 times (depending on different tasks) more likely than those without diabetes to report some difficulty in ADL. More older people with diabetes reported difficulty in at least one of the three functional domains covering self-care tasks, mobility and higher functioning (26.0% compared with 14.8% without diabetes). The most common difficulty was meal preparation (14.2% compared with 5.5% without diabetes), followed by personal shopping (11.8% compared with 5.2% without diabetes) and climbing stairs (9.3% compared with 5.0% without diabetes).

Woo *et al.* (1998) also carried out a functional assessment of ten basic ADL using the Barthel Index (BI) by means of interview and physical assessment of people aged 70 and above at their places of residence. A score of less than 15 on the BI scale indicates severe limitation, 15-19 moderate-to-mild limitation and 20 no limitation. The OR adjusted for age and sex was 1.7 (95% CI: 1.0-3.0) for severe limitation and 1.5 (95% CI: 1.1-2.2) for moderate-to-mild limitation for those with diabetes compared to those without.

3.4.4 Cognitive impairment

Most studies overseas suggest that diabetes is associated with an increased risk of cognitive impairment and dementia. Some details are discussed below.

3.4.4.1 Cognitive function

A recent review showed that Type 2 diabetes was likely to be associated with cognitive impairment (Pasquier *et al.*, 2006). Stewart and Liolitsa (1999) found that, while using different assessment tools, most of the case control studies suggested older people with diabetes performed less well in cognitive functions than those without. A study in Japan demonstrated that people aged 60 and above with Type 2 diabetes were more likely, than those without diabetes, to have cognitive impairment as indicated by significantly lower scores on the Mini-Mental State Examination and Digit Symbol Test (Mogi *et al.*, 2004).

However, Stewart and Liolitsa (1999) concluded that prospective studies have inconsistent findings. In one longitudinal cohort study in the United States, people aged 65 and above with Type 2 diabetes had significantly higher risk of mild cognitive impairment after controlling for all covariates (Luchsinger *et al*., 2007). A study in Finland, meanwhile, found that Type 2 diabetes was not a significant risk factor for cognitive impairment or impaired memory among people aged 69 to 78 (Vanhanen *et al*., 1999).

A meta-analysis found that people with Type 1 diabetes had lowered cognitive performance, as compared to those without diabetes, in various cognitive domains (Brands *et al*., 2005).

Using local data from the Elderly Health Centre for the period from 1998 to 2001, we classified an Abbreviated Mental Test (AMT) score of 0-3 as severe cognitive impairment and 4-7 as moderate impairment. We found slightly more people aged 65 and above with diabetes had severe or moderate cognitive impairment and the relationship was significant using a chi-square test for association (P<0.001) (Table 3.18).

Table 3.18 Cognitive function* of people aged 65 and above in Elderly Health Centre cohort, by diabetes status, 1998-2001

Diabetes status	Cognitive function N(%)			
	Severe impairment	Moderate impairment	Normal	Total
Have regular care for diabetes	68(1.0%)	485(7.0%)	6,368(92.0%)	6,921(100.0%)
Without diabetes	522(0.9%)	3,064(5.2%)	55,002(93.9%)	58,588(100.0%)
Total	590(0.9%)	3,549(5.4%)	61,370(93.7%)	65,509(100.0%)

* *Abbreviated Mental Test (AMT) as assessment tool and the classification of the level of cognitive impairment is based on the scores (0-3 Severe impairment; 4-7 Moderate impairment and 8-10 Normal)*

Data source: Elderly Health Centre cohort 1998-2001.

Table 3.19 shows that there was some difference in the findings depending on whether the older person lived in an institution. The level of cognitive function was significantly associated (p-value<0.001) with the living arrangement of the people with diabetes. More people with diabetes living in institutions tended to have severe or moderate cognitive impairment than those who lived in the community.

Table 3.19 Cognitive function* of people aged 65 and above in Elderly Health Centre cohort with diabetes under regular care, by living status, 1998-2001

Living status	Cognitive function N(%) Severe	Moderate impairment	Normal impairment	Total
Living in institution	20(7.1%)	52(18.4%)	210(74.5%)	282(100.0%)
Living in community	48(0.7%)	433(6.5%)	6,158(92.8%)	6,639(100.0%)
Total	68(1.0%)	485(7.0%)	6,368(92.0%)	6,921(100.0%)

* *Abbreviated Mental Test (AMT) as assessment tool and the classification of the level of cognitive impairment is based on the scores (0-3 Severe impairment; 4-7 Moderate impairment and 8-10 Normal)*

Data source: Elderly Health Centre cohort 1998-2001.

3.4.4.2 Dementia

Evidence to support a relationship between diabetes and dementia is not as clear as that between diabetes and cognitive impairment though a positive association has been reported in some studies (Pasquier *et al.*, 2006). A 6-year follow up study in Sweden found that people aged 75 and above had higher risk for dementia, in particular vascular dementia (Xu *et al.*, 2004). A 9-year study on Catholic nuns, priests and brothers in the United States found that people aged 55 and above with diabetes had 65% higher risk of dementia compared with those without diabetes (Arvanitakis *et al.*, 2004). However, some recent studies did not show a significant increase in risk. For example, a study of the Framingham cohort (over an average 12.7 years of follow-up) found that diabetes was an insignificant risk factor for dementia, yet it was a risk factor among those who originally had relatively low risk for dementia (Akomolafe *et al.*, 2006).

In Hong Kong, we examined the relationship between diabetes and self-reported dementia using the Population Health Survey 2003/2004 data (Table 3.20). Diabetes status was not significantly associated (p-value=0.96) with dementia status among the survey respondents aged 65 and above. As people with dementia were unlikely to be interviewed in the survey, people with dementia may be under-represented in the sample. Hence, the results may not be conclusive.

Table 3.20 Dementia status of people aged 65 and above in Population Health Survey, by diabetes status, 2003-2004

Diabetes status	Signs of dementia present? Yes	No	Total
Have diabetes	1.8%	98.2%	100.0%
Without diabetes	2.0%	98.0%	100.0%

Data source: Population Health Survey 2003/2004.

3.4.5 Quality of life

To estimate quality of life (QOL) for people with diabetes in Hong Kong, a specific instrument, Hong Kong Chinese version of diabetes-specific quality of life (HKC-DQoL-37), has been tested in Hong Kong and considered to be valid and reliable (Shiu *et al.*, 2008). It consists of three subscales with 37 items (14 items on satisfaction, 19 items on diabetes impact and 4 items on concern about diabetes). Shiu *et al.* (2008) showed that the mean HKC-DQoL-37 score was about 2.2 (SD=0.5) and that younger age, complications of diabetes, hospital admission due to hypoglycaemia and insulin therapy worsen QOL of diabetes patients.

A recent study of Type 2 diabetes patients aged 18 to 89 in 2003, using a 57-item Diabetes Stress Questionnaire, found that 33.6% could be classed as being anxious-depressed (Lee *et al.*, 2006). Those who had complications, who did not disclose their diabetes to their family, or who very often or sometimes believed that diabetes rendered them a burden to the family were more likely to be anxious-depressed.

Based on the Geriatric Depression Scale (GDS), a local study of people aged 60 and above in 1996 found that the proportion of people who had depressive symptoms (GDS≥8) was significantly higher among those with diabetes (26.0%) as compared with those without (19.7%) (Chou and Chi, 2005b).

Using the Harvard Household Survey database (Harvard University and The University of Hong Kong, 1998), we found that older people (aged 65 and above) with diabetes were more likely to rate their health as poor compared to those without diabetes (p-value=0.002) (Table 3.21).

Table 3.21 Self-rated health status of people aged 65 and above in Harvard Household Survey, by diabetes status, 1998

Diabetes status	Self-rated health compared with others of the same age N(%)		
	Good#	Poor*	Total
Have Diabetes	21(23.4%)	70(76.7%)	91(100.0%)
Without Diabetes	200(41.1%)	287(59.0%)	487(100.0%)
Total	221(38.3%)	357(61.7%)	578(100.0%)

 # The category "Good" refers to excellent, very good or good self-rated health status.

** The category "Poor" refers to fair or poor self-rated health status.*

Data source: Harvard Household Survey 1998. Question used "In general, how is your health at this time compared to other people around your same age?" Numbers were weighted by age group and sex. The Percentages were based on the weighted numbers before rounding.

Using the baseline health assessment of a cohort of members attending Elderly Health Centres in Hong Kong, we found that those with diabetes reported poorer self-rated health (p-value<0.001) (Table 3.22).

Table 3.22 Self-rated health status of people aged 65 and above in Elderly Health Centre cohort, by diabetes status, 1998-2001

Diabetes status	Self-rated health compared with others of the same age N(%)			
	Better	Normal	Worse	Total
Have regular care for diabetes	1,307 (18.9%)	4,782 (69.0%)	840 (12.1%)	6,929 (100.0%)
No diabetes	14,279 (24.4%)	40,138 (68.5%)	4,213 (7.2%)	58,630 (100.0%)
Total	15,586 (23.8%)	44,920 (68.5%)	5,053 (7.7%)	65,559 (100.0%)

Data source: Elderly Health Centre cohort 1998-2001. Questions used "Is your health condition considered as better, normal or worse when compared to that of similar age group?"

Subjects with diabetes in the Elderly Health Centre cohort were significantly more likely to report that their activities were limited and they accomplished less but these data were not adjusted for confounders. The results suggest that there is a significant different between those with and without diabetes in physical aspects of their quality of life.

Again, using the Elderly Health Centre data, it was shown that 12.2% of people aged 65 and above with diabetes have depressive symptoms (GDS short-form≥8) compared to 9.3% without diabetes (p-value<0.001) (Table 3.23).

Table 3.23 Depression status of people aged 65 and above in Elderly Health Centre cohort, by diabetes status, 1998-2001

Diabetes status	Depression Status N(%)		
	GDS#<8	GDS#≥8	Total
Have regular care for diabetes	6,075(87.8%)	848(12.2%)	6,923(100.0%)
No diabetes	53,121(90.7%)	5,458(9.3%)	58,579(100.0%)
Total	59,196(90.4%)	6,306(9.6%)	65,502(100.0%)

 # GDS short-form scale (Range 0-15) ≥8 indicates depressive symptoms.

Data source: Elderly Health Centre cohort 1998-2001.

3.5 Economic Burden

Diabetes can result in many long term health conditions, especially if it is undetected or poorly controlled. These are reflected in the disease burden. However, some of these conditions result in economic losses. There are not only direct health costs associated with diabetes but also indirect health costs due to increased risk of other disease and complications arising from diabetes. Direct costs include medical costs such as hospitalisation, doctor consultation and other costs such as medicines. Indirect costs include costs of dealing with disability, costs from loss of work and costs of premature mortality.

In Hong Kong, it was estimated that in 2004, the annual cost of a Type 2 diabetes patient was HK$13,457, of which 87.9% was from direct cost (Chan *et al.*, 2007). Medical costs contributed HK$11,638 to the direct cost of a Type 2 diabetes patient per year. As the medical services are heavily subsidised by the government of Hong Kong, the public sector had been paying 90.6% of the direct medical cost, which amounted to 3.9% of the total healthcare expenditure in Hong Kong. If complications e.g. vascular were present, the costs could be up to 30% higher.

In the United States, it was estimated that the total cost of diabetes in 2002 was US$132 billion, with 69.5% in direct medical expenditures (American Diabetes Association, 2003). The annual medical cost of a diabetes patient in the United States was US$13,243. It was also found that more than half (51.8%) of the direct medical costs were incurred by people aged over 65 (American Diabetes Association, 2003). Over 10 years, the total cost of diabetes in the United States has increased by 77.6%, from US$98 billion in 1997 to US$174 in 2007 (American Diabetes Association, 1998, 2008).

Here, using the attributable risk methodology, the direct costs of diabetes, in particular among older people, in Hong Kong were estimated.

3.5.1 Hospital costs

Based on statistics provided by the Hospital Authority, population aged 18 and above used around 6 million (6,033,541) bed days at the public general hospitals for all diseases in 2006. The population aged 65 and above used approximately 60% of these bed days and near 30% of these bed days for older people were used by patients with diabetes.

The attributable cost of inpatient care was estimated using (i) the number of inpatient bed days based on statistics from the Hospital Authority, (ii) the prevalence of diabetes from Population Health Survey 2003/2004, (iii) the relative prevalence of diabetes complications and (iv) a unit cost of an inpatient bed day based on the charge for non-eligible persons in Hong Kong ("S. S. No. 4 to Gazette No. 13/2003", 2003). The results based on attributable risk methodology are shown in Table 3.24.

Table 3.24 Diabetes-attributable cost of inpatient care in Hong Kong, 2006

	Age	
	18-64 years	65+ years
(1) Estimated number of inpatient bed days in 2006	2,431,372	3,602,169
(2) Estimated numbers of inpatient bed days attributable to diabetes*	105,443	368,993
(3) Cost per inpatient bed day (HK$)	3,300	3,300
Estimated attributable cost (HK$)	347,961,075	1,217,677,196

** After taking into account the PAF% of different complications of diabetes and general medical condition.*

The attributable cost of inpatient care for diabetes in people aged 65 and above was around HK$1.2 billion in 2006, which was near 80% of the total attributable inpatient care cost of diabetes for people aged 18 and above.

3.5.2 General out-patient clinics (GOPC) visits

In 2006, there were around 5 million attendances (5,557,700) at the GOPC for all diseases (Census and Statistics Department of Hong Kong Special Administrative Region, 2007a). Using data from the Harvard Household Survey, it was estimated that the population aged 65 and above used approximately 18% of these visits (Table 3.25).

Table 3.25 Estimated numbers of GOPC attendances in Hong Kong, by age group, 2006

Age groups	Proportion of GOPC visits from Harvard Household Survey	Estimated number of GOPC visits
≤15	19.0%	1,055,259
16-64	62.9%	3,494,081
65+	18.1%	1,008,359
Total	100.0%	5,557,700

The attributable cost of GOPC visits was estimated using (i) the estimated number of GOPC visits from the Harvard Household Survey, (ii) the prevalence of diabetes from Population Health Survey 2003/2004, (iii) the relative risk estimates of the likelihood of a person with diabetes visiting a GOPC as compared to a person without diabetes from the Harvard Household Survey and (iv) a unit cost of a GOPC visit based on the charge for non-eligible persons in Hong Kong ("S. S. No. 4 to Gazette No. 13/2003", 2003). The results based on attributable risk methodology are shown in Table 3.26.

Table 3.26 Diabetes-attributable cost of GOPC visits in Hong Kong, 2006

	Age	
	16-64 years	65+ years
(1) Estimated number of GOPC visits in 2006	3,494,081	1,008,359
(2) PAF%= P(RR-1)/[P(RR-1)+1)]	3.15%	9.82%
Prevalence of diabetes	2.33%	13.48%
Relative risk of visiting GOPC given diabetes	2.397	1.808
(3) Estimated numbers of GOPC visits attributable to diabetes (1) * (2)	110,151	99,054
(4) Cost per attendance (HK$)	215	215
Estimated attributable cost (HK$)	23,682,540	21,296,566

The attributable cost of GOPC visits for diabetes in people aged 65 and above was around HK$21.3 million in 2006, which was nearly 50% of the total attributable GOPC cost of diabetes for people aged 16 and above or 1.8% of all GOPC attendances in that year.

3.5.3 Accident and Emergency Department (A&E) visits

In 2006, there were around 2 million attendances (2,028,569) to the A&E for all diseases (Census and Statistics Department of Hong Kong Special Administrative Region, 2007a). Again, using data from the Harvard Household Survey, we estimate the number of A&E visits by age group as shown in Table 3.27.

Table 3.27 Estimated numbers of A&E attendances in Hong Kong, by age group, 2006

Age groups	Proportion of A&E visits from Harvard Household Survey	Estimated number of A&E visits
≤15	41.0%	832,233
16-64	53.8%	1,092,306
65+	5.1%	104,029
Total	100.0%	2,028,569

The diabetes-attributable cost of A&E visits was estimated using (i) the estimated number of A&E visits from the Harvard Household Survey, (ii) the prevalence of diabetes from the Population Health Survey 2003/2004, (iii) the relative risk estimates of the likelihood of a person with diabetes visiting A&E as compared to a person without diabetes from the Harvard Household Survey and (iv) the unit cost based on the charge for an A&E visit to a non-eligible person ("S. S. No. 4 to Gazette No. 13/2003", 2003). The results based on attributable risk methodology are shown in Table 3.28.

Table 3.28 Diabetes-attributable cost of A&E visits in Hong Kong, 2006

	Age	
	16-64 years	65+ years
(1) Estimated no. of visits in 2006	1,092,306	104,029
(2) PAF%= P(RR-1)/[P(RR-1)+1)]	3.15%	9.82%
Prevalence of diabetes	2.33%	13.48%
Relative risk of visiting A&E given diabetes	2.397	1.808
(3) Estimated numbers of A&E visits attributable to diabetes (1) * (2)	34,435	10,219
(4) Cost per attendance (HK$)	570	570
Estimated attributable burden in A&E (HK$)	19,627,999	5,824,856

The diabetes-attributable cost of A&E for people aged 65 and above was around HK$5.8 million in 2006 which was more than 20% of the total diabetes-attributable cost of A&E for people aged 16 and above in that year.

3.5.4 Specialist out-patient clinics (SOPC) visits

Apart from GOPC and A&E, there were around 6 million visits (5,786,268) to SOPC for all diseases in Hong Kong in 2006 (Census and Statistics Department of Hong Kong Special Administrative Region, 2007a). Using the same methodology as above, we estimated the number of SOPC visits by age group (Table 3.29) and attributable cost of SOPC visits (Table 3.30).

Table 3.29 Estimated numbers of SOPC attendances in Hong Kong, by age group, 2006

Age groups	Proportion of SOPC visits from Harvard Household Survey	Estimated number of SOPC visits
≤15	11.7%	675,769
16-64	62.0%	3,590,020
65+	26.3%	1,520,479
Total	100.0%	5,786,268

Table 3.30 Diabetes-attributable cost of SOPC visits in Hong Kong, 2006

	Age	
	16-64 years	65+ years
(1) Estimated number of SOPC visits in 2006	3,590,020	1,520,479
(2) PAF%= P(RR-1)/[P(RR-1)+1)]	1.86%	9.86%
Prevalence of diabetes	2.33%	13.48%
Relative risk of a SOPC visit given diabetes	1.811	1.811
(3) Estimated numbers in SOPC attributable to diabetes (1) * (2)	66,604	149,891
(4) Cost per attendance (HK$)	700	700
Estimated attributable cost of SOPC visits (HK$)	46,622,624	104,923,713

The diabetes-attributable cost of SOPC for people aged 65 and above was HK$0.1 billion in 2006 or around 70% of the total diabetes-attributable cost of SOPC for people aged 16 and above in that year.

3.5.5 Current and future economic burden in public sectors

Table 3.31 shows the summary of the attributable medical costs of diabetes in the public sector for people aged 65 and above in Hong Kong in 2006. This is around HK$1.4 billion which includes the cost of inpatient care in public hospital and the cost of doctor consultations.

Table 3.31 Summary of the attributable medical costs to diabetes among the population aged 65 and above for the public medical sectors in Hong Kong, 2006

Aged 65+	HK$ million
Inpatient Care in Public Hospitals	1,218
General out-patient clinic (GOPC)	21
Accident and Emergency (A&E)	6
Special out-patient Clinic (SOPC)	105
Total attributable medical costs	1,350

From Table 3.6, it was estimated that in 2006, there were about 0.11 million people aged 65 and above in Hong Kong with known diabetes. The attributable medical costs of diabetes per capita among the population aged 65 and above was estimated by dividing the total attributable cost in the public sector for those aged 65 and above by the estimated number of people aged 65 and above in 2006 with known diabetes. Table 3.32 shows that the attributable medical costs of diabetes in the public sector per capita among those aged 65 and above in Hong Kong was about HK$11,915 in 2006. This estimate was consistent with that estimated by Chan *et al.*(2007) even though their estimate was for people of all ages with diabetes.

Table 3.32 Summary of the attributable medical costs to diabetes in the public sector per capita among the population aged 65 and above in Hong Kong, 2006

Per person aged 65+	HK$
Inpatient Care in Public Hospitals	10,750
General out-patient clinic (GOPC)	188
Accident and Emergency (A&E)	51
Special out-patient Clinic (SOPC)	926
Total attributable medical cost per capita	11,915

Based on the above estimation, the future economic burden of diabetes, in terms of the attributable medical costs in the public sector, among the population aged 65 and above was projected to year 2036 (Table 3.33).

Table 3.33 Estimated attributable medical cost to diabetes in the public sector for those aged 65 and above in Hong Kong in 2036

Aged 65+	2036
Total attributable medical cost per capita	HK$ 11,915
Estimated number of known diabetes cases	297,858
Estimated attributable medical cost to diabetes in public sectors	HK$ 3.5 billion
% increase compared with 2006	163% increase

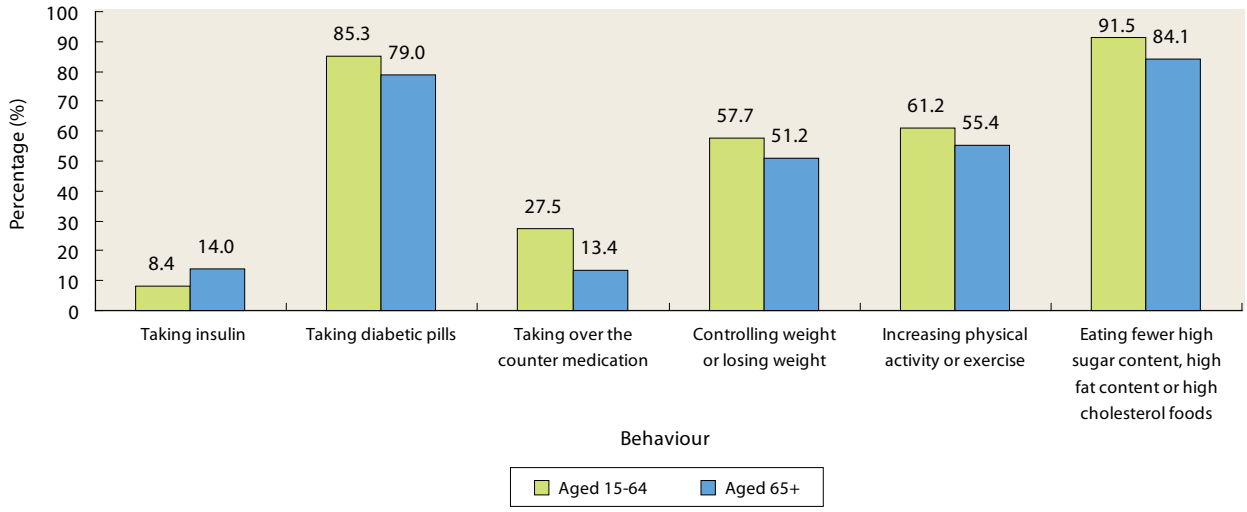
This is a conservative estimate which does not include private sector care. Other direct costs not included in the above are over the counter medication for which we have no solid information, and other prescribed drug costs, although part of this cost is included in the costs of medical consultation discussed above.

Although the dollar value was not estimated, there will be economic implications of dealing with functional and cognitive impairment resulting from poorly controlled diabetes in older people. The resulting indirect cost would be higher in the older population than in the younger one.

3.6 Behaviour in Managing Diabetes

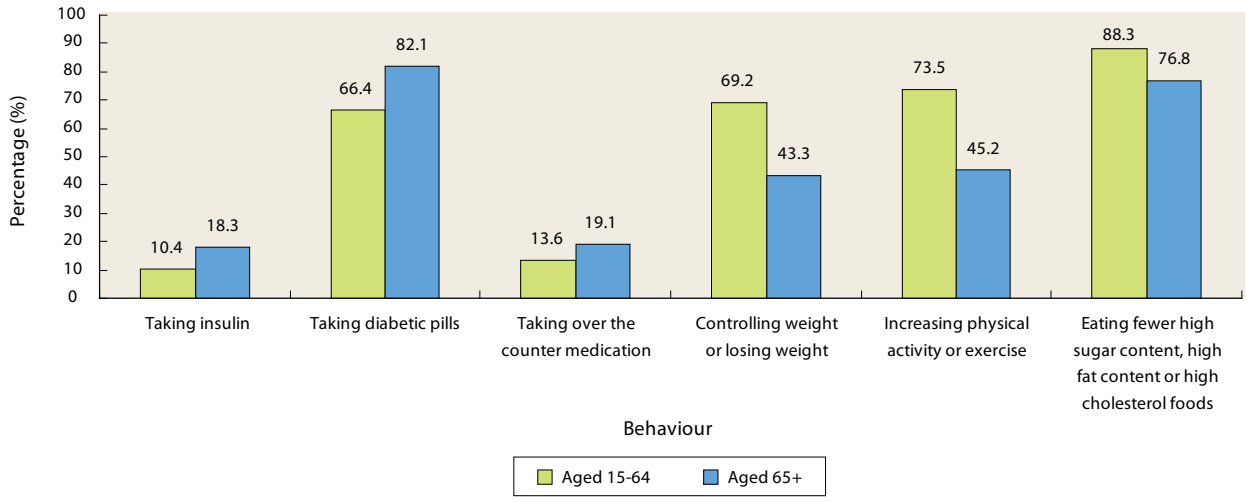
In the Population Health Survey 2003/2004, respondents who had diabetes reported their behaviour in managing their disease. Some common managing behaviour include drug treatments (such as taking insulin, oral diabetes medicine and over-the-counter medication) and modification of lifestyle (such as weight control, increasing physical activity or exercise and having a healthier diet)(Department of Health of Hong Kong Special Administrative Region and Department of Community Medicine, The University of Hong Kong, 2005). Figures 3.9 and 3.10 show the uptake rate of these strategies among people with diabetes in different age groups and sex.

Figure 3.9 Behaviour in managing diabetes among the male population with diabetes in Hong Kong, by age group, 2003-2004



Data source: Population Health Survey, 2003/2004.

Figure 3.10 Behaviour in managing diabetes among the female population with diabetes in Hong Kong, by age group, 2003-2004



Data source: Population Health Survey, 2003/2004.

The above results show that taking oral medications was the most common behaviour in managing diabetes. More older females use drug treatment than in the younger population, but the reverse is true for the male population apart from taking insulin. Older people, meanwhile, both men and women, were less likely than younger people with diabetes to try to modify their lifestyle.

From the Heart Health Study, we know that more than half the people aged 65 to 84 who were known to have diabetes still had elevated fasting blood glucose. This implies that there was poor control of diabetes in older people and this could lead to further serious complications.

Chapter 4

Discussion and Conclusion

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Discussion and Conclusion

Diabetes exerts high costs on the health care system and the population, especially on older people who are at the highest risk of developing disease. Apart from the direct costs of care and the indirect costs of mortality, there will be a very high cost of disability and reduced quality of life which is likely to be higher among the older population than among those who are younger due to functional and cognitive impairment. All of these costs will predictably increase in future as the population ages.

The increasing number of older people will increase the number of cases and the age profile of people with diabetes will also increase leading to a higher degree of dependency and more co-morbidities. According to the data examined, a large number of existing older people with diabetes are not being diagnosed and, even among those diagnosed, a large number do not have adequate control of their blood sugar levels.

Every opportunity should be taken by health care providers to find cases of diabetes among older people, to ensure that all diagnosed cases are well controlled and monitored for the development of complications. Prevention is better than cure. Among all risk factors for diabetes, obesity and lack of physical activity are examples of modifiable factors. Adoption of a healthy lifestyle should start at a young age.

Apart from underscoring the importance of the prevention of diabetes and its complications, the findings have specific implications for caring for older people with diabetes, and for adopting an elder-orientated approach:

- Comprehensive geriatric assessment covering physical, functional, psychological, nutritional and social domains needs to be carried out to guide the management plan, in view of the increased predisposition to functional and cognitive impairment, dementia, depression and poor quality of life of older people with diabetes, in addition to the current diabetes complications screening.
- There is a need to consider care in the context of a social unit, recognizing that a proportion of the older population is less able to achieve lifestyle modification; less able to manage complex drug regimes (and therefore more prone to adverse drug effects); less able to cope with multiple service providers at multiple sites; and less able to handle gadgets and information technology. Care would ideally be provided in a user friendly and convenient community setting integrating medical and social activities for management and maintenance.
- The need for eye care and monitoring for retinopathy is particularly important since vision affects independence and quality of life.
- 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.

Chapter 5

References

Chapter 5
References

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