# Chapter 8
# Integrated Assessment of Addiction Epidemiology in Hong Kong, 1996–2005

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**Abstract**  In Hong Kong, the Central Registry of Drug Abuse (CRDA) is a register that forms the database for the study of drug addiction in the territory. Using a geographic information system-based approach, a pilot study was conducted, which integrated data from the CRDA, census, HIV (human immunodeficiency virus) reports/seroprevalence studies, and methadone clinics service statistics, to support the assessment of the trends of heroin addiction, HIV-related risks, and the interrelationship with sociodemographic attributes in heroin users and the general population. Apart from the visualization of spatial distribution of heroin users, the study had uncovered specific local patterns at district levels. It is noted that despite a general decline in heroin addiction in Hong Kong, some areas showed a rising pattern in selected subpopulations. The increasing use of multidrugs also gave a district-specific pattern. Against the background of a low HIV prevalence in heroin users, the temporospatial pattern of injection provides potentially useful clues to track the spread of HIV risk. The location and coverage of methadone clinics, an important HIV-prevention strategy, were assessed in context of their public health impacts. It is concluded that the extension of the project to a long-term system would be useful for the study of addiction epidemiology, so that lessons learned from Hong Kong can contribute to the global knowledgebase on the development of effective response to substance abuse.

## Introduction

As a special administrative region (SAR) of China, Hong Kong has a long history of social and public health turmoils resulting from substance abuse, beginning with the Opium War that saw the unveiling of British rule in the middle

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of the nineteenth century. Before 1945, the sale and use of opium were in fact legal. In the year of 1964, seizure of heroin in Hong Kong almost topped the world, second only to the much larger countries of United States and Thailand (Lee 2000). Thereafter, the territory's heroin addiction pattern has been shaped by the alteration of the social environment and interventions introduced by the Government, notably the methadone treatment program launched in the mid-1970s. For over thirty years, methadone is offered through a territory-wide program that has enabled over 60% of the heroin users to be treated (UN Regional Task Force on Drug Use and HIV Vulnerability 2002). Methadone maintenance or substitution treatment is now a main strategy for reducing human immunodeficiency virus (HIV) spread through the minimization of risk behaviors (Wong, Lee, Lim, and Low 2003). Remarkably, the HIV epidemic has spread through injection drug users in many countries in the region but left Hong Kong relatively untouched (Chan and Lee 2004). The situation is, understandably, a volatile one, as can be inferred from the intensive international travel and proximity to the Golden Triangle.

As a public health issue, heroin addiction carries a global dimension and a diversity of local implications. In this connection, the tracking of Hong Kong's heroin addiction situation is particularly meaningful, both for evaluating the local intervention programs and serving as a reference for other countries, including Vietnam, Malaysia, and neighboring Chinese cities, as methadone treatment began to be rolled out in the past years. Parallel with the launching of the methadone treatment program some thirty years ago, a Central Registry of Drug Abuse (CRDA) also came into being in the territory. The ongoing collection, collation, and analysis of drug addiction data through this register has opened up the study of addiction epidemiology. CRDA is a rich source of reference, and has become the core data source of addiction epidemiology in Hong Kong. Two open access statistical reports are now published by CRDA every year. However, unlike infectious disease epidemiology that looks at the prevalence and incidence of biological markers, addiction epidemiology is a more complex subject that is founded on the monitoring of behavioral markers, measurement of HIV risk, and trends prediction. Conventional means of constructing statistical analysis from a single data source seems to be inadequate to meet the aspiration of addiction epidemiology.

The advent of geographic information system (GIS) has opened up a new chapter for addiction epidemiology. In Hong Kong, heroin addiction has long been seen as a very local phenomenon. It is not uncommon to find more injection heroin users (IHUs) in one or some streets/areas but not the others. This was possibly the original rationale for the presentation of breakdown statistics according to districts in the CRDA report. The districts can be conveniently compared while being controlled for other common environmental and social characteristics. This chapter reports on a pilot study on the application of GIS in the enhancement of epidemiologic study on heroin addiction in Hong Kong, focusing on the trends during 1996 to 2005.

## Capturing Data for a Pilot Study

The objectives of the pilot study were to: (1) determine the temporospatial trend of heroin addiction; (2) explore demographic and social factors associated with addiction; and (3) assess the risk of HIV and related infections. An integrative approach utilizing data from multiple sources, both on heroin users and the general population, was adopted. With a population of 6.8 million in an area of 1000 km$^2$ (Census and Statistics Department 2006b), the territory of Hong Kong is divided into 18 districts and 282 tertiary planning units (TPUs) (Fig. 8.1). The availability of district and TPU-level data on heroin addiction and the general population is invaluable in supporting the pilot GIS-based epidemiologic study.

In the study, heroin addiction data were obtained from the CRDA, a territory-wide register run on a voluntary basis and managed directly by the government. Over the years, changes have been introduced to improve the operation of the very system. The last major alteration was introduced in 1995, which included the redevelopment of the computer system, expansion of the reporting network from 34 to 67 agencies, and the application of revised questionnaires (Central Registry of Drug Abuse 2006). Sources of reports have included law enforcement departments,
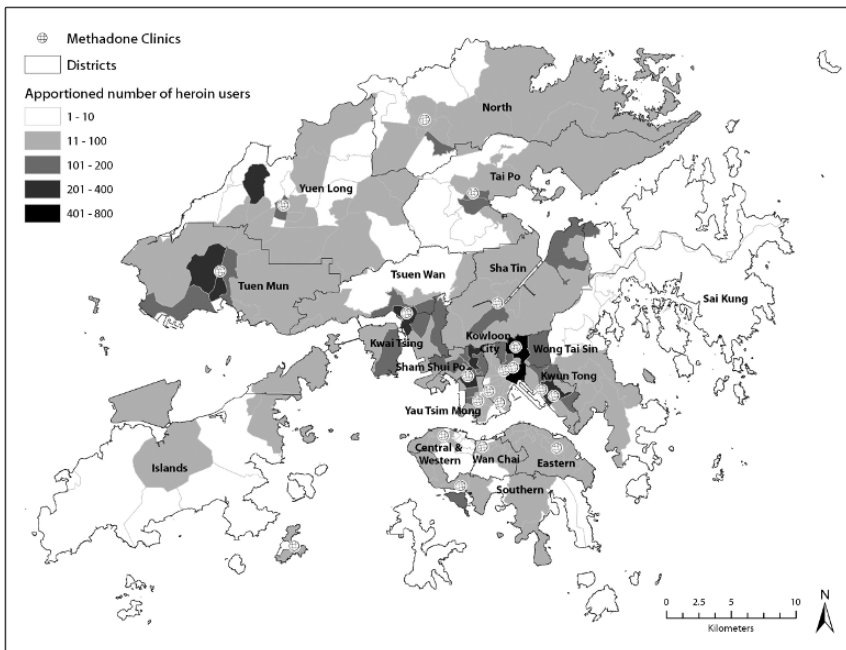


**Fig. 8.1** Map showing the distribution of heroin users according to districts.
Number of heroin users 2005, acquired from the CRDA, is apportioned from districts into tertiary planning units. It is symbolized by graduated colours. The 20 methadone clinics are mapped according to their exact locations

treatment and welfare agencies, tertiary institutions, hospitals, and clinics. For consistency, we decided to focus on data collected between 1996 and 2005, so that the number of confounders can be minimized.

Relevant data were retrieved from the hard copies of the CRDA reports or website (www.nd.gov.hk/drugstatistics.htm), supplemented by aggregate data made available on request through the Narcotics Division of the Hong Kong Government. Each year between 10,000 and 16,000 heroin users were reported. Four major categories of yearly district-level data were collected from the CRDA for developing the pilot study. These were:

1. Prevalence and incidence of heroin users, as derived from the reported and newly reported numbers, and the practice of multiple drug (multidrug) use.
2. Demographics of heroin users comprising their sex and age.
3. Social characteristics of heroin users, namely, education level, housing type, conviction history, employment, and habit of using multidrugs.
4. Risk factors for blood-borne infection, using injection as the main surrogate.

In order to assess the risk of HIV infection, yearly statistics on HIV-infected drug users and seroprevalence studies in Hong Kong (without district breakdown) were extracted from the HIV surveillance reports published by the Department of Health of the Hong Kong Government (http://www.info,gov.hk/aids/english/index.htm). Knowingly, methadone treatment is a protective factor against HIV dissemination in drug users. There are now a total of 20 methadone clinics in the territory of Hong Kong. The effective registration of heroin users of each methadone clinic, defined as the number of individuals who have attended the clinic in the preceding 28 days, was accessed from the Department of Health for reference.

To provide background data for assessment, population statistics were used. Specifically, district-level demographic and socioeconomic data from 1996 to 2005 were extracted from the Statistical Reports published by the Census and Statistics Department of the Hong Kong Government (http://www.censtatd.gov.hk). Two categories of yearly statistical data have been obtained:

1. Population statistics on age and sex.
2. Socioeconomic attributes including median monthly income, dependency ratio, education attainment, and unemployment.

## Building a GIS Framework for Addiction Epidemiology

Using ArcInfo 9.1, a study framework was designed to visualize the pattern of heroin addiction, analyze its correlations with demographic and socioeconomic factors at a district level, and determine the potential risk of HIV and related infections. A 1:5000 digital base map of 1996 and 2001 Tertiary Planning Unit and Street Block (TPU and SB) Boundaries was obtained from the Planning Department of the Hong Kong Government. The project was conducted beginning with conversion

and standardization of data, through mapping and then an assessment of factors and impacts associated with heroin addiction.

The reported number of heroin users was converted into incidence and prevalence using district-level mid-year population as the denominator. Inconsistency of age classification between different data systems was adjusted on the notion that all individuals within an age interval were evenly distributed. Areal interpolation, using population-weighted method, was adopted to transfer data from districts to TPUs, a smaller geographic unit in Hong Kong. Areal interpolation refers to the apportionment of data values from source polygons to target polygons based on selected algorithms (Reibel and Bufalino 2005). In our study, a population-weighted method is adopted that assumes value of data in the target polygons is proportional to the number of population in the source polygons. The interactive selection of symbology for map layers was applied according to their categories or quantities to enhance flexibility in visualizing data. We explored the spatial relationships among variables by arbitrarily overlaying map layers or performing logical operations of data such as Boolean, adjacency, and areal interpolation. Finally, factors associated with heroin addiction and their impacts were visualized with maps, graphs, and tables. The approach has enabled the assessment of heroin addiction to be made in four dimensions: first, demographic characteristics of heroin addiction; second, the impacts of population patterns on heroin addiction; third, trend of socioeconomic factors associated with heroin addiction; fourth, public health impacts of heroin addiction, including HIV risk, abuse of multiple drugs, and crimes.


## An Assessment of Addiction Epidemiology

### *Temporospatial Pattern of Heroin Users*

Over the years, CRDA has provided a useful description of heroin addiction through the published reports. It is known that the number of reported heroin users, both total in a year and new cases, has been on a decline. Visualizing the numbers over districts gives a somewhat different pattern (Fig. 8.2). The overall decline is still observed, but the slope varies across districts. The prevalence (expressed as number per 100,000 population) is highest in two urban districts of Yau Tsim Mong and Sham Shui Po. Interestingly, no obvious decline is seen for female heroin users, but rather a paradoxical rise in prevalence in 5 of the 18 districts, which appears to be more marked after 2003. In male, the fluctuation is less marked. The incidence numbers show a similar pattern.

The district variation and time trends of the numbers of heroin users, both in terms of prevalence and incidence, are probably related to the demographic change of the background population. The Hong Kong population's age has been increased. The mean age of the general population has risen from 34.8 in 1996 (Census and Statistics Department 2002a) to 39 in 2005 (Census and Statistics Department 2005). Correspondingly, the age of heroin users has also been rising. The mean age
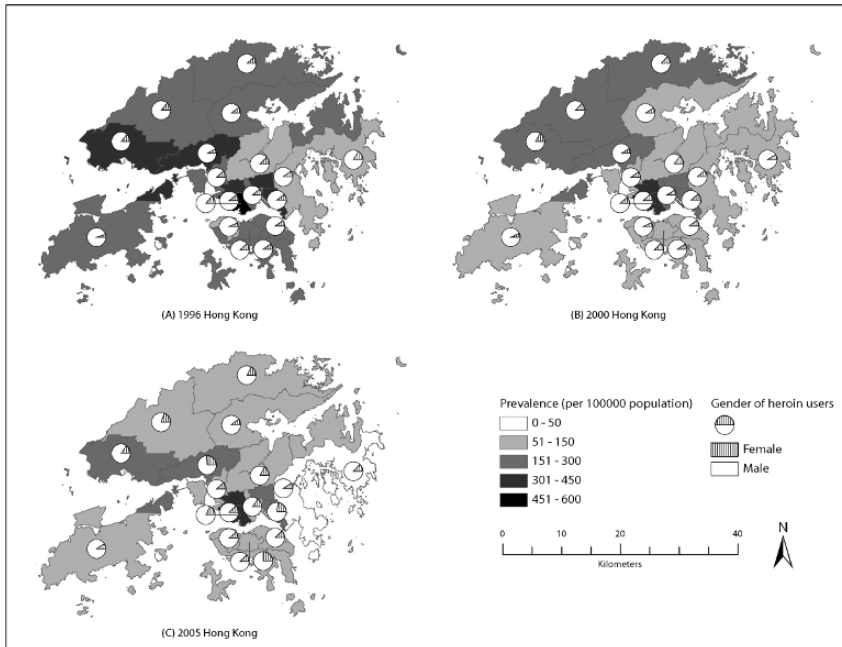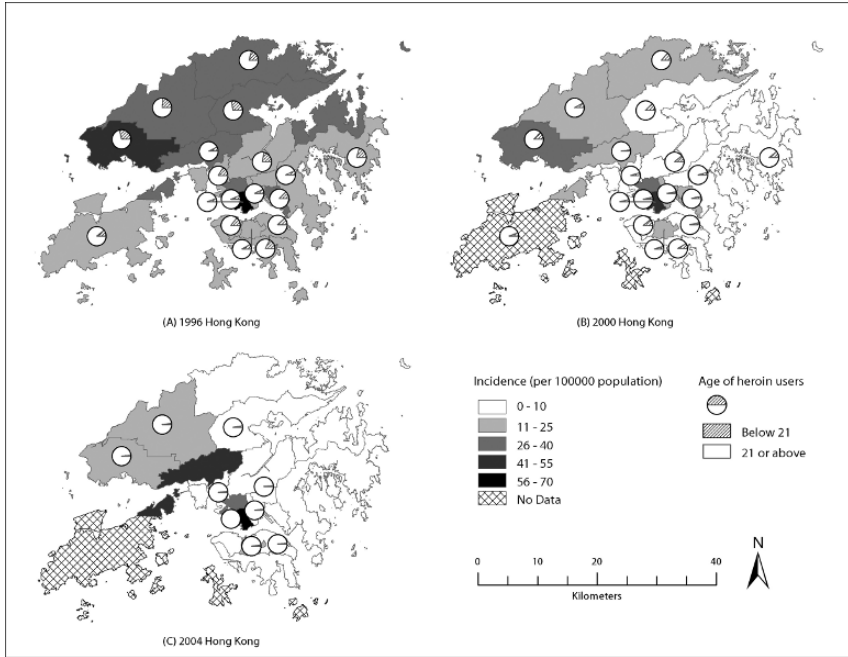
**Fig. 8.2** Distribution and temporal change of the prevalence of male and female heroin users 1996, 2000, and 2005.
Prevalence of heroin users in (A) 1996, (B) 2000, (C) 2005 refers to the total number of heroin users per 100,000 population. Graduated coloring is adopted to visualize differences between districts. Gender of heroin users is shown as pie charts, with striped symbol for female and white symbol for male

of all heroin users was 40 (42 for male and 33 for female respectively) (CRDA 2006). The higher prevalence districts for heroin users correspond with those districts with a higher population of people above the age of 35. On the contrary, the absolute number of reported heroin users below the age of 21 has fallen from 2200 in 1996 to 77 in 2005 (CRDA 2006). The size of the population below the age of 21 has also fallen. Again there is a district variation of the trend, which is important in context of the development of corresponding intervention strategies (Fig. 8.3).

## HIV Risk in IHUs

HIV is efficiently transmitted through needle sharing in IHUs. The risk of HIV spread in IHUs is a cause for concern in many countries, including China and South East Asia. In Hong Kong, the reported number of HIV-infected drug users has remained at a low level throughout the past 10 years, alongside the low seroprevalences determined in surveillance studies (Centre for Health Protection,

**Fig. 8.3** Distribution and temporal change of the incidence of heroin users by age below 21 years versus 21 years or above – 1996, 2000, and 2004.
Incidence of heroin users, referring to newly reported number of heroin users per 100,000 population, is shown in graduated colors. Overlaid on incidence map are the pie charts that show the comparison between heroin users aged below 21 (striped symbol) and those aged 21 or above (white symbol). Absense of pie chart reflects the unavailability of required data

Department of Health 2006). Figure 8.4 shows the distribution of heroin injectors in Hong Kong, in 2005. The absolute number of injectors has been decreasing uniformly, in line with the fall in the number of heroin users. The percentage of those who have injected has varied from 40% to 65% in different districts. As these are prevalence figures reflecting the history of injection for the heroin users, this does not necessarily reflect the current pattern of risk behaviors. Overall, the picture suggests that there is no significant variation of HIV risk across districts.

Methadone treatment is one important strategy of reducing the population risk of HIV spread in IHUs. On a daily basis, about 8000 heroin users attend Hong Kong's methadone clinics. Dividing the effective registration on a selected day of year by the total number of heroin users for that year, we calculate the coverage of methadone treatment as 98.9% in 2005. District-based coverage cannot be directly determined from the available data and spatial location of methadone clinics. However, from the map in Fig. 8.1, it can be seen that the methadone clinics are closer to where the heroin users are geographically located.
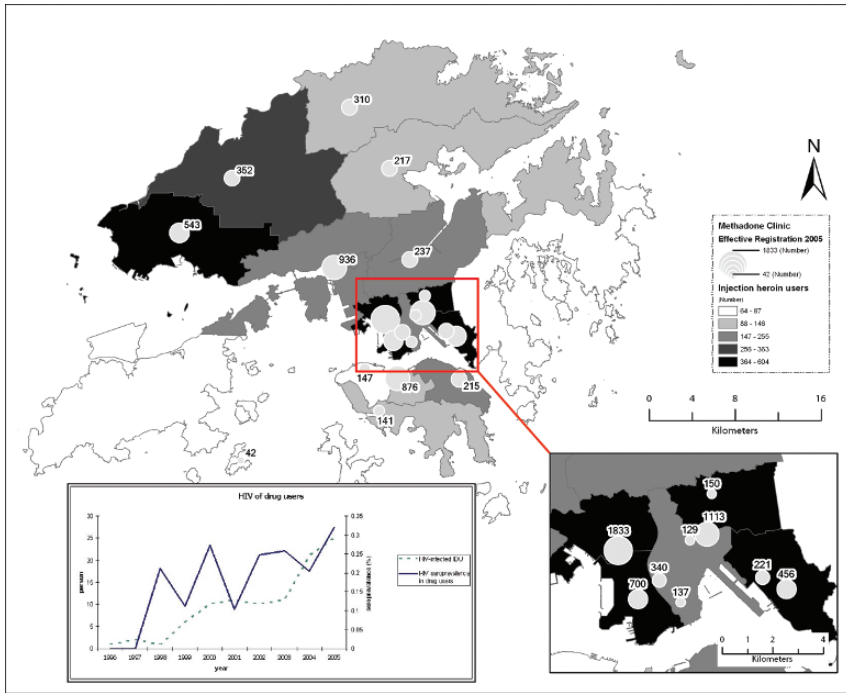
**Fig. 8.4** Distribution of injection heroin users (IHUs), methadone clinics, and the relationship with HIV risk.
A choropleth map showing the total number of IHUs in 2005 by districts symbolized by graduated colors. The size of methadone clinics is proportional to the effective registration of each methadone clinic, the number highlighted in white, as of the end of December 2005. A chart showing HIV reports as well as the seroprevalence of heroin users of the years 1996 to 2005 is attached below the map

## *Relationship of Heroin Addiction with Social Environment*

Heroin addiction is not an isolated social phenomenon. It is associated with one's socioeconomic background and also that of the society. In the year 2005, 63.5% of the reported heroin users were unemployed, 44.6% have received only up to lower secondary education, and 54.9% resided in aided housing (CRDA 2006). The geographic pattern of unemployment is shown in Fig. 8.5. The unemployment rate of the total population has risen from 2.2% in 1997 to 7.9% in 2003, which then fell to 5.6% in 2005 (Census and Statistics Department 2006a). The proportion of heroin users who were unemployed had not followed this trend. The absolute number of unemployed heroin users has remained largely unchanged, which implies a rising proportion between 1997 and 2001. In some districts, the proportion was much higher; for example, Tai Po, Yuen Long, and Sham Shui Po.
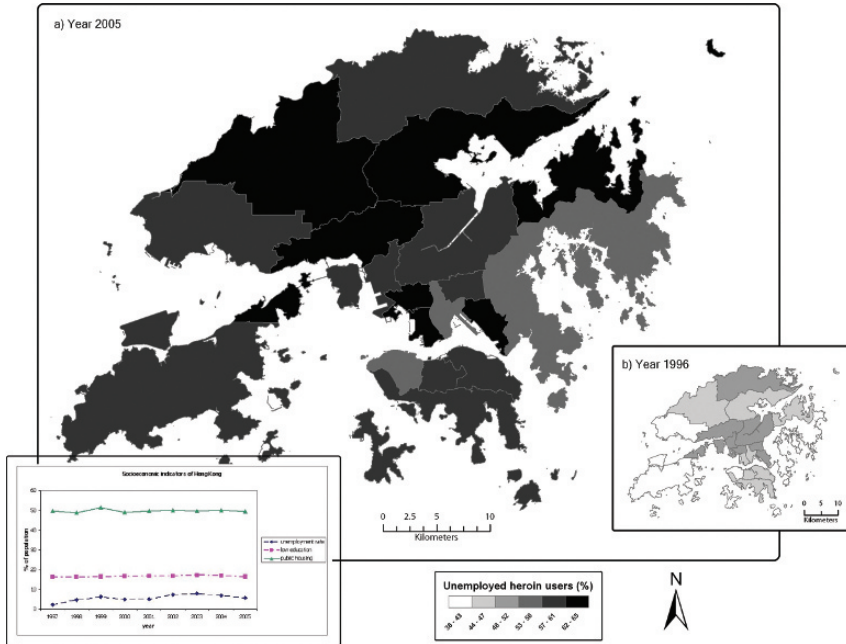
**Fig. 8.5** Unemployed heroin users and socioeconomic indicators of the general population.
The larger map exhibits the percentage of unemployed heroin users of all heroin users in 2005 by
districts, contrasting with a smaller map showing the percentage in year 1996. Both choropleth
maps used the same classification scheme with six equal intervals. The chart below shows the
socioeconomic indicators of Hong Kong from 1997 to 2005

Low education is another presumptive vulnerability factor associated with ad-
diction. The general education level in Hong Kong has risen. Between 2000 and
2005, the percentage of the general population who have only attained low education
(lower secondary only, referring to that for people at and below the age of 15) has
declined by an average of about 5% in all districts. For heroin users in general, the
proportion of those attaining up to lower education level has remained the same at
over 80%, which is much higher than that of the general population (39.7% in 2000
and 25.5% in 2005). The corresponding district-level figures for heroin users are,
however, not available for analysis. Housing could be another means of assessing
the socioeconomic status of heroin users. In Hong Kong, a very high proportion of
the general population are residing in pubic housing (about 50%). Interpretation of
the association with housing type as an attribute for socioeconomic status is difficult.

Criminal offense is one important marker of adverse outcome of heroin addic-
tion. Over the 10-year period between 1996 and 2005, the crime rate in Hong
Kong has stabilized at a relatively low level of between 1000 and 1300 per 100,000
population (Hong Kong Police 2006). The number of heroin users who had been
convicted varied from one district to another. Interestingly, the four highest level
districts (Kwun Tong, Yau Tsim Mong, Shum Shui Po, and Wong Tai Sin) in 1996

all showed a clear decline by 2005. All were densely populated districts with a higher number of heroin users reported. The remaining 14 gave a smaller and stable number over years. The association between heroin addiction and adverse social environment may go either way: heroin addiction leading to social problems on one hand, and adverse social environment predisposing to heroin addiction on the other.

## The New Trend of Multidrug Use

The practice of using more than one drug is defined as multidrug use. In this study, we refer to heroin users who abuse at least one other drug on top of heroin. The latest CRDA report recorded a highest number of people (4037) abusing multidrug in 2005 (Central Registry of Drug Abuse 2006). The mapping of the situation has allowed us to examine the problem from a temporospatial perspective. First of all, not all districts began simultaneously to report the new pattern of multidrug use. We used the report of 20 persons as the threshold for multidrug use, as inconsistent fluctuation at lower level was likely. Eight out of 18 districts had reached this level
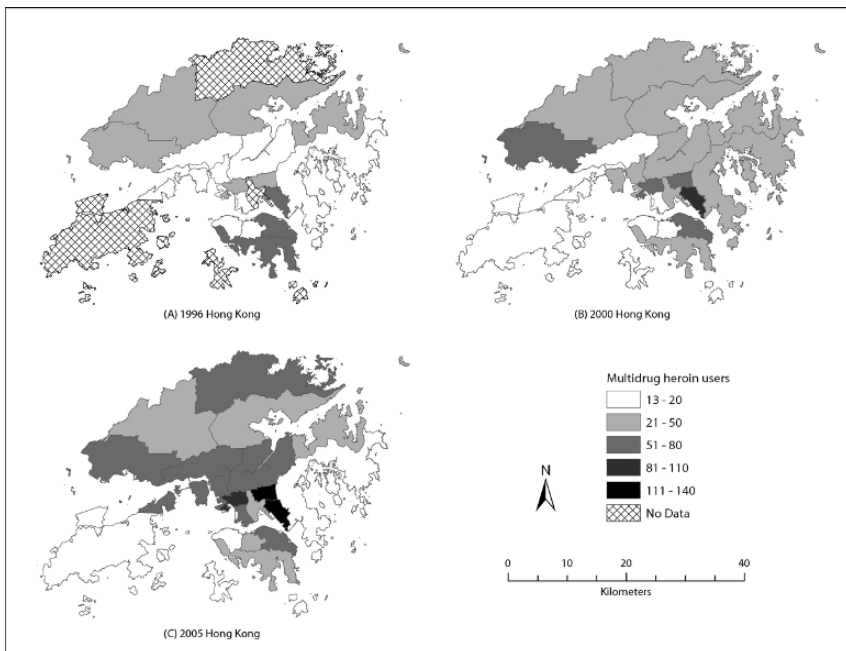


**Fig. 8.6** Distribution and temporal change of the multidrug users 1996, 2000, and 2005.
Number of heroin users consuming multidrugs in (A) 1996, (B) 2000, and (C) 2005 is displayed as graduated colors, with the darker ones representing a higher number of multidrug heroin users. Districts with no data appear in gray

in 1996 in the report of multidrug use in heroin users. The number has continued to grow and by 2005, all except two districts had reported multidrug use beyond the threshold level.

Geographically, there is a general trend of a rising proportion of heroin users abusing multiple drugs. In districts with a relatively early start of multidrug use, a plateau was reached the level of which had varied from one district to another. Kwun Tong, for example, had reached a plateau of about 108 multidrug abusing heroin users since the year 2000 (Fig. 8.6). For districts like Wan Chai, Islands, and Yau Tsim Mong, the percentage has continued to rise. The rising trend of multidrug use paralleled the decline in the overall number of heroin users, and the increase of the number of reports of soft drug abuse (Central Registry of Drug Abuse 2006). Triazolam and midazolam are the commonly used soft drugs in heroin users in Hong Kong. Unlike young people abusing multiple soft drugs, heroin users take triazolam/midazolam as substitute for expensive heroin.

## Discussion

Epidemiology is the study of disease in context of the attributes described as a triad of "time, place, and person" (Lilienfeld and Stolley 1994). Spatial and temporal perspectives are crucial and are part and parcel of conventional epidemiology studies, but these may not have been explored to the fullest extent. Normally, epidemiologic study is conducted on the assumption that the causative agent of the disease is randomly distributed in the society. For infectious disease epidemiology, infectivity of the agent and immunity (size and duration) of the host are the key determinants of trends of spread of the infection. These premises are inadequate for the study of chronic conditions like addiction, which results from a complex interplay between human behaviors, environments, and is intricately linked with other forms of morbidity, notably HIV, and other blood-borne infections. A multilevel approach has been advocated for the study of HIV and sexually transmitted infection epidemiology (Aral, Padian, and Holmes 2005). The same principle actually applies to addiction epidemiology, though the definition of "transmission" is dissimilar – that there's the propagation of a behavior and social phenomenon, rather than an infective agent.

In our pilot study in addiction epidemiology, it is evident that a GIS-based approach can add value to the current mechanism of public health assessment with its capability in delivering information in an easy-to-understand visual medium (Lang 2000). Using the new framework, we are able to illustrate the pattern of heroin addiction and its multiple dimensions at district level in the territory of Hong Kong. The ecologic approach allows the incorporation of aggregate data from multiple data sources, which echoes the multilevel approach of epidemiology studies in other infections (Aral, Padian, and Holmes 2005). The study has enabled a number of new observations to be made, which would otherwise not be revealed through conventional mechanisms of assessment. First, despite the well-known declining

trend of heroin use in Hong Kong, the pattern clearly varied from one district to another. The discovery of a higher proportion of heroin users in selected districts could prompt policy makers to prioritize their strategy on addiction. Second, behavioral practices were not identical among communities. Peer influence and social relatedness are the underlying reasons for the spatial variability. In recent years, we saw an increasing trend of multidrug use in Hong Kong. This has probably arisen from one or some districts and then "propagated" to other districts, a pattern that is otherwise inconspicuous if displayed on frequency tables and charts. Third, the interrelationship between addiction and social factors can be effectively visualized using maps instead of statistical tables. The influence of demographic changes (aging, for example), social deprivations, and education levels may vary from one locality to another, even within the same country. It is apparent that despite the general decline of heroin addiction, the prevalence has remained high in poor and densely populated districts. Again, there is the higher unemployment rates, lower education attainment and common phenomenon of association with crimes and therefore conviction that characterize the heroin-taking population. A GIS-based description would enable public health strategies to be developed to address social inequalities rather than just targeting respective individual behavior (Mackenbach and Bakker 2003).

HIV has become one important dimension of the complications of heroin addiction through the practice of injection and needle sharing. To this day, HIV has not taken root in the drug taking communities in Hong Kong, and a prevalence of less than 1% is consistently observed in surveillance studies (Chan and Lee 2004). The phenomenon can be clearly observed even without any enhancement of the current surveillance mechanism. Our pilot study has, however, enabled us to track the spatial variability of injections in different districts, watch for signals of changes that may predate HIV transmissions, and study factors which could be associated with heroin injection. With the incorporation of data on methadone maintenance, the same platform also serves to evaluate the effectiveness of public health interventions. A broad coverage of methadone maintenance is effective in protecting IHUs from the risk of HIV infection, an observation that has been made in Hong Kong. Coverage rate of methadone treatment can be used as an indicator of harm reduction on a population level (Chan and Lee 2004). Temporospatial assessment of coverage of methadone treatment, if conducted regularly over time, could become a surrogate of effective harm reduction.

The application of GIS in the epidemiological study of addiction is not without limitation. Available data sets are largely secondary data from multiple sources. These data are not uniform both in terms of spatial and temporal scale. With efforts, adjustments can be made to collect data, both in their conversion and standardizations, to support systematic assessment, calculations, and visualization. However, errors in the course of data engineering, although small, may have significant bearings on the interpretation of the final assessments. As currently geocoded data from individual heroin user is not available from the CRDA, nor is it available from methadone clinics, while district-level HIV statistics are likewise unavailable, the only applicable spatial referencing units available for addiction epidemiology are districts and TPU. Though the algorithm of areal interpolation used in this study is

simple, which assumes that the number of population by district is the key factor in estimating the number of heroin users by TPU, the apportionment problem can only be eliminated when individual records georeferenced to point are available, which is unlikely to be practical (Simpson 2002). Population-weighted interpolation can be regarded as a pycnophylactic interpolation technique, on the assumption that the summation of estimated values in some target polygons is the same to the value of their corresponding source polygon (Reibel and Bufalino 2005). Outweighing the drawbacks of population-weighted interpolation, apportioned data can be mapped in a reasonable spatial resolution and can be generated into more informative maps after data interpolation, as shown in our study. Moreover, as areal unit is modifiable and subjective to one's definition, analytical result will be incomparable or biased. This is not a serious drawback knowing that the residential address of an infected individual may not carry significant meaning epidemiologically. Availability of geocoded data may, however, be useful for the planning of HIV services.

## The Way Ahead

The pilot study has so far encompassed an assessment of addiction epidemiology in Hong Kong on a project basis, covering a period of 10 years. Useful results have been generated, leading us to conclude that such an integrated approach is feasible, and that this should be continued and further institutionalized to improve public health. In other words, an ongoing GIS-based system should be established, beginning with the standardization of fields, computerization of the databases, and the plan for a customized template for data entry. While it would be ideal eventually if geocoding of individual heroin user is introduced, apportionment shall continue to be useful to illustrate the distribution of heroin addicts. Apart from TPU, the 405 District Council Constituency Areas offers another means of apportioning heroin users. As each of such areas has approximately the same population size, comparison can be conveniently undertaken while controlling for population sizes. By integrating the various data sources, the pattern of heroin addiction can be presented in a user-friendly manner, with linkage to its association with HIV infection, HIV risk, social demographics, and the use of multiple drugs. The main advantage of an ongoing system is the commitment to the generation of addiction epidemiology results on a regular basis, an output similar to that of the production of surveillance reports in public health epidemiology.

Surveillance aside, the provision of an addiction epidemiology system would enable customized research to be developed. Hong Kong is uniquely positioned as this is one of the few places in the region with a low HIV prevalence in IHUs, against the background of an extensive substitution treatment program operated in the form of methadone clinics. While the reduction of risk behaviors in IHUs on an individual level is well known, the correlation between methadone treatment and population HIV risk has not been quantified with a validated scientific model. The GIS-based approach would allow us to establish practical models to determine the

threshold of coverage that could create public health impacts. The configuration of social networks of IHU would be another dimension for the study of addiction epidemiology (Rothenberg et al. 1998). An integration of spatial epidemiology and social network analysis would be one important next step in the development of a model for studying the growth of the epidemic of addiction, and the effects of interventions. As for other public health issues, projection and prediction of patterns would be invaluable outputs to inform policy development.

Finally, Hong Kong has been an example of best practice in substitution treatment in the past decade (UN Regional Task Force on Drug Use and HIV Vulnerability 2002). The unique history of heroin addiction, low HIV prevalences in IHU, and the high coverage rate of methadone maintenance are hallmarks of a potential model the lessons from which have continued to emerge. The situation is quite different in Mainland China. Of the estimated 650,000 persons living with HIV in China, injection drug users accounted for 44.3% of the total (Sullivan, Metzger, Fudala, and Fiellin 2005). HIV prevalences of 50% or above have been reported in Yunnan Province, Xinjiang and Sichuan (Ministry of Health, UNAIDS, and WHO 2006). In the neighboring cities within the Pearl River Delta Region in Guangdong Province, the HIV prevalence has also reached 5% or above. An integrative study of addiction epidemiology between Hong Kong and neighboring cities would enable new lessons to be learned, which would be of useful reference to countries in or even outside the region. In the Pearl River Delta Region specifically, people sharing the same culture and heritage have been exposed to the same health condition. A GIS-based approach would allow innovative correlation studies to be undertaken on factors associated with the growth of the HIV/heroin addiction epidemic, and attributes of effective intervention. An enhancement of the existing CRDA, the core database of heroin addiction in Hong Kong, would be all that is required to advance addiction epidemiology in the region, beginning from the territory of Hong Kong.