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Access to primary care in Hong Kong, Greater London and New York City

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Abstract: We investigate avoidable hospital conditions (AHC) in three world cities as a way to assess access to primary care. Residents of Hong Kong are healthier than their counterparts in Greater London or New York City. In contrast to their counterparts in New York City, residents of both Greater London and Hong Kong face no financial barriers to an extensive public hospital system. We compare residence-based hospital discharge rates for AHC, by age cohorts, in these cities and find that New York City has higher rates than Hong Kong and Greater London. Hong Kong has the lowest hospital discharge rates for AHC among the population 15–64, but its rates are nearly as high as those in New York City among the population 65 and over. Our findings suggest that in contrast to Greater London, older residents in Hong Kong and New York face significant barriers in accessing primary care. In all three cities, people living in lower socioeconomic status neighborhoods are more likely to be hospitalized for an AHC, but neighborhood inequalities are greater in Hong Kong and New York than in Greater London.

In this paper, we compare avoidable hospital condition (AHC) rates among three cities as a way of assessing the extent to which their residents have timely

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and effective access to primary care. AHC is a well-established indicator of access to primary care (Weissman *et al.*, 1992; Casanova and Starfield, 1995; Billings *et al.*, 1996; Parchman and Culler, 1999; Billings and Weinick, 2003; Starfield *et al.*, 2005), but a number of different factors may influence the use of such care. Therefore, we also investigate the individual and neighborhood-level factors associated with AHC to help policy makers better understand how they might improve access to primary care and decrease expensive hospitalisations that result from these barriers. Building on a previous assessment of access to primary care in Manhattan, Inner London and Paris (Gusmano *et al.*, 2010), we evaluate access to primary care in these world cities by comparing residence-based hospital discharge rates for AHC (henceforth referred to as 'AHC rates') among Hong Kong, Greater London and New York.

These cities are similar in size and face similar challenges associated with population ageing, including the burden of managing the increasing prevalence of chronic diseases and adapting their systems of health care provision. In contrast, their primary care systems differ greatly as do their residents' health status. Thus, a comparative assessment of access to timely and effective primary care can shed light on each system's relative strengths and weaknesses.

In the following section, we provide an overview of the three health care systems. Next, we review the concept of AHC and explain how this measure can be used to assess access to primary care. Because AHC rates may reflect differences in health status as well as access to care, we compare the health status among residents of the three cities. Residents of Hong Kong are healthier than their counterparts in Greater London and New York City (NYC), so if AHC rates are driven primarily by population health status, they should be lowest in Hong Kong. We find that, while Hong Kong does have the lowest AHC rate for the entire adult population, the rate among older people (65+) is only slightly lower than NYC and Greater London has the lowest rate among older people. Finally, we conclude that older residents of Hong Kong and NYC have poorer access to timely and effective primary care compared with residents of Greater London and we identify barriers to care in each city.

Three contrasting urban health systems

The health care systems in these world cities present interesting contrasts. Greater London, like the rest of the United Kingdom, is well known for its universal, comprehensive, 'cradle to grave' national health service (NHS). In contrast, NYC, like the rest of the United States has no universal coverage and a health system that is composed of a complex patchwork of public and private insurance with large gaps in coverage. Hong Kong falls somewhere between London and New York in that the public sector provides comprehensive hospital services, but the ambulatory care system is dominated by private fee-for-service general practitioners (GPs).

The English NHS emphasises free care at the point of delivery and aims to provide services on the basis of patient 'need'. The NHS places great emphasis on the role of GPs as the patient's first point of contact with the system (Gusmano and Allin, 2011). Since 2002, Greater London has had more GPs per 1000 than the rest of England, but there are long-standing inequalities in supply within Greater London, with particularly low rates in the eastern part of Outer London (Evandrou, 2006). Greater London also has a higher concentration of acute-care hospital beds than the rest of the nation (Gusmano *et al*., 2010). There is also a well-developed primary care system in the form of primary care trusts, which act as a gatekeeper to hospitals through their control of referrals. Also, they are responsible for preventive screening programmes such as cervical smear, blood pressure and diabetes screening. Residents living in a defined area register with one of the primary care trust in their area. Comprehensive coverage of all registered patients is encouraged through financial incentives to achieve specific performance targets. Clinicians working in primary care trusts therefore engage in outreach activities to encourage all registered patients to participate in preventive programmes. Although payment is required for prescription drugs, for pensioners it is waived (NHS, 2011).

In NYC, most adults under the age of 65 are insured through their employers. Medicaid, the nation's largest health insurance programme, covers nearly 60 million people. In contrast, Medicare covers the population 65 years and over and many other adults with disabilities (nearly 45 million). NYC, despite its extensive Medicaid programme, has about twice the national average rate of people without health insurance. To care for the uninsured, the United Sates relies on a patchwork 'system' of safety-net providers, including public and not-for-profit hospitals, federally qualified community health centers, school-based health centres, municipal/local health clinics, non-profit Visiting Nurse Associations, family planning clinics and public dental clinics. NYC has the largest public hospital system in the United States. The NYC Health and Hospitals Corporation (HHC) operates 11 of NYC's 65 acute-care hospitals, and is responsible for almost 20 percent of all hospital admissions in NYC. HHC is also responsible for delivering primary as well as specialist services in its outpatient departments, emergency rooms and a network of health care centres (Rodwin *et al*., 1992).

In Hong Kong, the Hospital Authority (HA) was established in 1990 as an independent statutory body and is now accountable to the Hong Kong Special Administrative Region Government. HA manages over 40 public hospitals, covering about 90 percent of inpatient services in Hong Kong. HA also manages dozens of outpatient clinics, including general and specialist. Aside from the outpatient clinics operated by HA and the immunisation and other public health programmes operated by the Department of Health, most outpatient medical services, in Hong Kong, are provided by private physicians in fee-for-service practice.

Population health status and access to primary care

How can we evaluate access to primary care among residents of these three cities? Some studies compare 'inputs' (e.g. numbers of primary care doctors or clinics), but it is difficult to compare systems that rely on private office-based physicians (New York) and those that rely on a combination of private office-based physicians and public primary care clinics (Hong Kong). More importantly, there is little agreement about what constitutes a sufficient number of providers and a great deal of evidence that the number of doctors and clinics in a geographic area is only one factor that influences access to care. Financial, cultural and transportation barriers may all limit access to primary care even if a sufficient number of medical professionals are working in a particular neighbourhood or city (Kirby and Kaneda, 2005). Population health surveys can provide helpful information about access to and use of health care services, but there are no local or national surveys that would allow us to compare access to primary health care services across or within metropolitan areas in most countries. Instead, health services and policy researchers often rely on hospital administrative data and indirect measures of access to care.

Residence-based hospital discharge rates for AHC are a well-accepted indicator for assessing access to timely and effective primary care, including disease prevention services (Millman, 1993; Purdy *et al.*, 2009). AHC includes congestive heart failure, bacterial pneumonia, complications of asthma and diabetes and many more conditions. Primary care serves as the first point of contact with a health care system. When it is continuous, comprehensive and coordinated, it should reduce the onset and complications of chronic diseases and promote better use of health care resources (Starfield, 1994).

Although access to primary care may explain differences in AHC rates among these cities, it is also possible that they are explained by differences in population health status. As a result, we first compare differences in health status among Greater London, Hong Kong and NYC. Hong Kong stands out among world cities as having some of the best indicators of population health since the 2000–2003 period. Whether one examines infant mortality, life expectancy at birth, or at 65 years of age, Hong Kong has some of best results (Table 1). Beyond these more widely available measures, however, it is difficult to find other comparable measures of population health status. Those that exist, however, do indicate that residents of Hong Kong are, on average, healthier than residents of Greater London and NYC. Premature mortality, defined as death due to any cause before the age of 74, is another useful measure of population health status. According to Roos and Mustard (1997), premature death is 'one of the most valid single indicators of health status capturing a population's need for health care'. The age-adjusted rate of premature mortality in Hong Kong during the 1999–2003 period was 2.51 per 1000, which is significantly lower than for Inner London (3.86) and Manhattan (3.4; Chau *et al.*, 2011).

Table 1. Population health status in Hong Kong and other world cities

	Infant mortality (deaths before age one year per 1000 live births)	Life expectancy at birth		Life expectancy at 65	
		Males (years)	Females (years)	Males (years)	Females (years)
NYC	6.2 (2000)	74.5 (2000)	80.2 (2000)	17.0 (2000)	20.1 (2000)
Greater London	5.4 (2001)	76.1 (2000–2004)	80.9 (2000–2004)	15.6 (1997–1999)	19.2 (1997–1999)
Paris	4.0 (1999)	77.6 (2002)	83.1 (2002)	17.7 (1999)	21.7 (1999)
Tokyo (23 wards)	2.8 (2001–2004)	77.7 (2000)	na	17.7 (2000)	22.2 (2000)
Hong Kong	2.9 (2000)	78.0 (2000)	83.9 (2000)	17.35 (2000)	21.53 (2000)

NYC = New York City.
Sources: NYC and the United States: National Center for Health Statistics/Centers for Disease Control; Greater London and England: Office of National Statistics, London Health Observatory; Paris and France: INSEE, Observatoire Régional de la Santé de l'Ile de France; Japan and Tokyo: Tokyo Metropolitan General Affairs, Ministry of Health, Labor and Welfare; Hong Kong: Census and Statistics Department.

More recent data (2008) for Hong Kong, Greater London and NYC indicate that life expectancy at 65 years of age is similar for men and significantly higher for women – 18.1 and 22.9 in contrast to 18.4 and 21.2 in Greater London and 18 and 21.3 in NYC (Bureau of Vital Statistics, New York City Department of Health and Mental Hygiene, 2010; Census and Statistics Department, Hong Kong SAR Government, 2010; Office of National Statistics, United Kingdom, 2010). Differences in rates of obesity and self-reported chronic disease among residents of these cities are even greater. Based on community health survey data, <28 percent of the population 65 years and over, in Hong Kong, is obese or overweight (2003/2004), compared with nearly 60 percent in NYC (2006; Department of Health, Hong Kong SAR Government and Department of Community Medicine, The University of Hong Kong, 2005; New York City Department of Health and Mental Hygiene, 2009). In Greater London we only have 2006 survey data for the population 55 years and older, which indicate that nearly 65 percent of older Greater London residents are obese (Coyle and Fitzpatrick, 2009), but these findings are consistent with the literature that documents high rates of heart disease, hypertension, stroke and diabetes among residents of England and the United States (Banks *et al.*, 2006). The community health surveys in Hong Kong and NYC (2008) also provide information about self-reported chronic conditions. A lower percentage of older persons in Hong Kong report having hypertension (41.6 vs 61), diabetes (17.3 vs 21.8) and asthma (2.3 vs 10.8) than in NYC (Census and Statistics Department, Hong Kong SAR Government, 2009; New York City Department of Health and Mental Hygiene, 2009). Older Hong Kong residents are also healthier than their counterparts in Greater London or NYC with respect to prevalence of

cardiovascular diseases. These differences are due, in part, to ethnic and/or lifestyle factors (Chau and Woo, 2008). If differences in AHC rates among these three cities are driven primarily by differences in population health status, we would expect rates to be lowest in Hong Kong and highest in NYC.

Methods

Definitions

Although selection of AHC conditions varies in the literature, most studies concur that identification of areas where there are access barriers to timely and effective primary care are not sensitive to differences in selected conditions. In this paper, we adopt the list of AHC conditions used by Weissman *et al.* (1992) because this is consistent with previous international comparisons. The conditions include ruptured appendix, asthma, cellulitis, congestive heart failure, diabetes, gangrene, hypokalemia, immunisable conditions, malignant hypertension, bacterial pneumonia, pyelonephritis and perforated or bleeding ulcer. These principal discharge diagnoses taken from administrative hospitalisation data were identified based on the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) in Hong Kong and New York City and International Classification of Diseases, 10th Revision, Clinical Modification (ICD-10-CM) in Greater London.

Data

For Hong Kong, we obtained residence-based hospital discharge data from the Hong Kong Hospital Authority's (HA) Clinical Management System (CMS) database. We calculate AHC rates for the Hong Kong population aged 15 years and over for the three-year period, 2006–2008, to provide more stable estimates at the neighbourhood level. The CMS is a computerised system for all aspects of clinical management established by the HA in 1995; by 1999, it was adopted by all HA hospitals. The diagnoses for hospital admission were verified by experts at the HA. Over 90 percent of all hospital bed-days were provided by HA hospitals with private hospitals accounting for the rest (Leung *et al.*, 2005). We consider hospital admissions immediately following the last discharge as part of the same episode and day admissions.

For Greater London, hospital data are from the Department of Health's Hospital Episode Statistics database for the years 2003–2006, which includes information for all residents of Greater London on all hospitalisations (in NHS and private hospitals paid for by the NHS). For NYC, the hospital data are from the Statewide Planning and Research Cooperative System for the years 2006–2008, which includes information for all residents of NYC discharged from all non-federal hospitals in New York State. Since inter-hospital transfers are not common in London and New York, there is no need to exclude admissions occurring on the same day of discharges, as in the case of Hong Kong.

In calculating AHC rates, we rely on population estimates by age, sex and district of residence from the Hong Kong, British and U.S. Census.

Statistical analysis

We calculate age–sex-specific AHC rates by dividing the corresponding age–sex-specific numbers of episodes by the population. We rely on the direct method to calculate age-standardised rates using the World Health Organization World Standard Population (Ahmad *et al*., 2001).

We use multiple logistic regression models to examine the possible association between AHC rates and a range of different individual and neighbourhood-level independent variables. In a previous work (Gusmano *et al*., 2006), age, sex, ethnicity, payer source, number of diagnoses on record (as a measure of co-morbidity), as well as neighbourhood-based income quartile, physician density, hospital density, education level and linguistic isolation were examined. Here, we include all of these variables in the NYC model, but due to differences in data availability, the variables included in the models for Hong Kong and Greater London differ slightly. For Hong Kong, the model includes age, sex and number of diagnoses on record. At the district level, we control for income quartile and proportion of people without upper secondary education (obtained from Census and Statistics Department of Hong Kong). However, as these two variables are highly correlated ($\rho = 0.6$), to avoid multi-collinearity, we include only income quartile in the analysis. Finally, the Hong Kong model includes the density of public general outpatient clinics and the density of public hospital beds. For Greater London, our model includes age, gender, race/ethnicity, number of diagnoses on the record. We also control for three neighbourhood-level variables at the borough level: deprivation quartile, physician density and hospital bed density.

To assess the heterogeneity in the effect of these factors on age, we include all pair-wise interaction terms with age in the model, but we do not present all of interaction terms in the final tables. Finally, we estimate odds ratios (OR) from the model. An OR larger than one, indicated by the 95 percent confidence interval, implies that the corresponding level of that variable is associated with greater risk in comparison to the reference level. We relied on SPSS, version 17.0, for all analyses.

Results

Hospitalisation rates

In 2006–2008 (2003–2006 for Greater London), the standardised hospitalisation rates for all causes (per 1000 population 15 years and over) in Hong Kong, NYC and Greater London are 94.3, 163.6 and 179.8, respectively, and the standardised AHC rates for these populations are 8.1, 16.8 and 10.2, respectively (Table 2).

Table 2. Age-standardized hospitalization rates* (per 1000 population) among the population aged 15 years and over in Hong Kong, NYC and Greater London, 2006–2008

	All causes				AHC			
World city	15–44	45–64	65+	Total	15–44	45–64	65+	Total
Hong Kong	50.3	84.0	364.8	94.3	2.0	5.2	49.5	8.1
NYC	99.8	173.8	398.6	163.6	5.9	19.2	55.7	16.8
Greater London (2003–2006)	129.7	146.8	428.6	179.8	4.3	8.2	36.2	10.2

NYC = New York City; AHC = avoidable hospital condition.
*Rates were standardized by the 2000 World Health Organization Standard Population.

Table 3. Logistic regression results for characteristics associated with AHC admissions (dependent variable) in Hong Kong for adults aged 15+ years

Explanatory variables*	Coefficient	SE	Odds ratio	95% CI
Age (in year)	0.033	0.0006	1.034	1.033–1.035
Sex				
Male	1.372	0.0238	3.941	3.762–4.129
Female	0		1	
Number of diagnoses on record	−0.347	0.0094	0.707	0.694–0.720
Income quartile				
Lowest	0.240	0.0327	1.271	1.192–1.355
Second	0.194	0.0341	1.214	1.135–1.298
Third	0.123	0.0362	1.131	1.053–1.214
Highest	0		1	
GOPC density (per 100,000 population)	−0.108	0.0218	0.898	0.860–0.937
Hospital bed density (per 100,000 population)	0.00003	0.0000	1.00003	1.00002–1.00005

AHC = avoidable hospital condition; SE = standard error; CI = confidence interval; GOPC = general outpatient clinics.
* All explanatory variables were statistically significant at $p < 0.05$.

Based on the standardised population, AHC rates account for 8.6 percent of hospitalisations in Hong Kong, 5.7 percent in Greater London and 10.3 percent in NYC. In all three cities, age-standardised AHC rates are higher for men than for women and substantially higher among people aged 65 years and over compared with younger adults.

Factors associated with AHC rates

Table 3 presents the results of the multiple logistic regression of the AHC rates for Hong Kong. All variables are statistically significant ($p < 0.05$), except interaction between age and hospital bed density, which has been removed from the final model. For every increase of 10 years of age, the risk of a hospital

Table 4. Logistic regression results for characteristics associated with AHC admissions (dependent variable) in Greater London for adults aged 15+ years

Explanatory variables*	Coefficient	SE	Odds ratio	95% CI
Age (in year)	0.000	0.0000	1.000	1.000–1.000
Sex				
Male	0.328	0.0051	1.3880	1.375–1.402
Female	0		1	
Number of diagnoses on record	0.133	0.0010	1.143	1.141–1.145
Deprivation quartile				
Highest	0.111	0.0074	1.117	1.100–1.134
Third	0.089	0.0072	1.093	1.077–1.109
Second	0.046	0.0072	1.048	1.033–1.062
Lowest	0		1	
Ethnicity				
Other race	−0.024	0.0063	0.977	0.965–0.989
Asian	0.065	0.0088	1.067	1.049–1.085
Black	0.196	0.0093	1.216	1.194–1.238
White	0		1	
GP density (per 1000 population)	0.014	0.0051	1.014	1.004–1.025
Hospital bed density (per 1000 population)	0.000	0.0013	1.000	0.997–1.002

AHC = avoidable hospital condition; SE = standard error; CI = confidence interval; GP = general practitioners.
*All explanatory variables except age were statistically significant at $p < 0.05$.

admission for AHC increases by 40 percent. Men, in comparison to women, have almost four times the risk of a hospital admission for AHC (OR = 3.94), but the gender difference narrows with increasing age. Patients with one or more diagnoses on record are associated with a near 30 percent reduced risk of admission for AHC. However, this reduced risk decreases with increased age.

People living in areas with the lowest to the third income quartiles have higher risk of an admission for AHC in comparison with those living in areas with the highest-income quartile (OR = 1.27, 1.22 and 1.13) and the effect diminishes with increasing age. The difference among the lowest three quartiles is not statistically significant.

People living in areas with a higher density of public general outpatient clinics have a lower risk of admission for AHC. An increase in the density of public general outpatient clinics by 1 per 100,000 population reduces the risk admission for AHC by 10 percent. Once again, this effect diminishes with increasing age.

In Greater London (Table 4), we find that the odds of being hospitalised with an AHC are higher among men and residents of higher deprivation neighbourhoods. The odds of AHC are 39 percent higher among men than women. The OR for residents of the most deprived neighbourhoods (second, third and fourth quartiles), as compared with those living in neighbourhoods with the lowest deprivation (first quartile), are 1.12, 1.09 and 1.05, respectively. Every

Table 5. Logistic regression results for characteristics associated with AHC admissions (dependent variable) in NYC for adults aged 15+ years

Explanatory variables*	Coefficient	SE	Odds ratio	95% CI
Age (in year)	0.025	0.0006	1.025	1.024–1.027
Sex				
Male	0.766	0.014	2.152	2.093–2.291
Female	0		1	
Number of diagnoses on record	0.039	0.0020	1.040	1.036–1.044
Income quartile				
Lowest	0.392	0.0285	1.480	1.400–1.565
Second	0.105	0.0288	1.111	1.050–1.175
Third	0.109	0.0281	1.115	1.055–1.178
Highest	0		1	
Ethnicity				
Hispanic	−0.259	0.0060	0.772	0.763–0781
Other race	0.207	0.0193	1.230	1.185–1.278
Black	0.555	0.0175	1.742	1.683–1.802
Asian	−0.538	0.0358	0.584	0.544–0.626
White	0		1	
Primary payer				
Medicare	0.311	0.0302	1.365	1.287–1.448
Medicaid	−0.280	0.0219	0.755	0.724–0.789
Other government	0.009	0.0783	0.991	0.850–1.155
Uninsured	0.386	0.0257	1.472	1.399–1.548
Private health insurance	0		1	
Physicians density (per 1000 population)	−0.016	0.0022	0.985	0.980–0.989
Hospital bed density (per 1000 population)	0.0000	0.0004	1.000	1.000–1.001
>30% with bachelor's degree	−0.043	0.0219	0.959	0.917–0.999
>25% linguistic isolation	0.244	0.0194	1.276	1.228–1.325

NYC = New York City; AHC = avoidable hospital condition; SE = standard error; CI = confidence interval.

*All explanatory variables were statistically significant at $p < 0.05$.

additional diagnosis on the record increases the odds of admission for AHC by 14 percent. The odds of admission for AHC are higher for ethnic minorities compared with Whites (Gusmano *et al.*, 2010). Although interaction terms with age are statistically significant, the effects are so small that they do not give meaningful interpretations.

In NYC (Table 5), we identify several barriers to primary care. The odds of being hospitalised with an AHC are more than twice as high among men compared with women. The odds are also higher among people living in lower-income neighbourhoods compared with the highest-income neighbourhoods of NYC. People without health insurance and those on Medicare have greater odds of being hospitalised with an AHC compared with people with private health insurance, but adults on Medicaid have lower odds of being hospitalised with

AHC. Blacks and people living in linguistically isolated neighbourhoods have greater odds of AHC hospitalisation. Older people, people with additional diagnoses on the record have higher odds of AHC hospitalisation. Finally, people living in neighbourhoods in which at least 30 percent of the population has a high level of education have lower odds of being hospitalised with an AHC compared with those living in neighbourhoods in which the population is less well educated. Unlike Hong Kong, these effects do not always diminish with increasing age. Neither the neighbourhood density of physicians and hospital beds influence the odds of being hospitalised with AHC.

Limitations

Our study has a number of limitations. By using administrative data, our results may be affected by the reliability and validity of the recording systems. By using database from HA, our study included only hospital admissions to public hospitals. Nevertheless, the market share of inpatient services by the public sector is 90–95 percent in Hong Kong (Leung *et al*., 2005). The hospital data for Greater London do not include private hospitalisations that are not paid for by the English NHS. The hospital data in NYC do not include federal hospitals operated by the Veterans Health Administration. Our adoption of the definition of AHC used by Weissman *et al*. (1992) does not suggest that all the conditions sensitive to primary care were included, or that those excluded from the list were not affected by primary care.

Discussion

For the entire adult population, Hong Kong has the lowest rate of hospital admissions for AHC, but among older people (65+) Hong Kong's AHC rate is only slightly lower than NYC, while Greater London has a substantially lower rate than both cities. This suggests that older residents of Hong Kong and NYC have poorer access to timely and effective primary care compared with residents of Greater London, which is consistent with previous findings on avoidable mortality (Chau *et al*., 2011). These findings are striking because older residents of Hong Kong appear to be healthier than residents of these other cities. To the extent that AHC rates reflect population health rather than access to primary care, we would expect AHC rates among older people to be lower in Hong Kong, but this is not the case.

As we found previously, the density of primary care doctors among neighbourhoods in Greater London and NYC has little influence on AHC rates (Gusmano *et al*., 2006). Although some other studies have found that the number of primary care physicians in a region can influence the rate of AHC (Parchman and Culler, 1994, 1999), having a sufficient number of physicians is a necessary, but not a sufficient condition for access to care. In cities with a high

concentration of primary care doctors and excellent public transportation systems, other barriers may limit the use of these services. Our findings indicate that, in NYC, financial and racial barriers are important barriers to access. In contrast, our findings show that neighbourhoods in Hong Kong with a higher density of general outpatient clinics have lower rates of AHC. Consistent with existing literature (Ricketts *et al.*, 2001; Magán *et al.*, 2011), we find that the effect of primary care provision is comparatively small (a reduction of 10 percent risk by increasing 1 clinic per 100,000 population) when compared with the effects related to socio-economic status. Nevertheless, it may be possible for the HA to improve access to primary care and reduce hospitalisations by increasing the number of primary care clinics in underserved neighbourhoods.

Some studies suggest that people living in areas with lower income are more likely to be hospitalised with AHC (Billings *et al.*, 1996; Pappas *et al.*, 1997; Gusmano *et al.*, 2006; Agabiti *et al.*, 2009). As we suggest above, we find that people living in the lowest income quartile (or highest deprivation quartile in Greater London) neighbourhoods have a higher risk of hospital admission for AHC in all three cities, but the reasons may vary among them.

Some researchers argue that AHC may vary with access to hospital care (Saha *et al.*, 2007). Given that the hospital care services are heavily subsidised in Hong Kong, one may question if the relatively high AHC rate in Hong Kong is related to the inexpensive and easily accessible inpatient services. We believe that this is unlikely because the hospitalisation rate from all causes is actually lower in Hong Kong than in NYC and London. If the heavily subsidised hospital care were attracting people to overuse inpatient services, which should apply to all causes, not just AHC. Furthermore, neighbourhood density of hospital beds was not a significant influence on AHC rate in any of these cities.

In both Greater London and NYC, the odds of being hospitalised with an AHC are higher among people with additional diagnoses on the record. Curiously, there is a negative relationship between AHC and number of diagnoses on the record in Hong Kong. This may be due to the inconsistent practice of recording secondary diagnoses on record in Hong Kong. Another possibility is that in Hong Kong, frail elderly people admitted to hospital may have nonspecific geriatric syndromes such as falls, decline in mobility, which are currently not coded. Nevertheless, this finding requires further investigation.

The Hong Kong Government is actively considering government-regulated health insurance to provide better choices to those who choose private health care services (Food and Health Bureau of Hong Kong, 2010). Although Hong Kong Government's policy is to provide comprehensive care by heavily subsidising public services so that out-of-pocket charges are very low (and may be waived altogether if income falls below a certain level), there have been no evaluation studies to assess whether existing services meet the needs of the aging population. Recent reports suggest that there are unmet needs (Woo *et al.*, 2011) and our findings are consistent with this conclusion.

In summary, we find that despite the fact that older residents of Hong Kong are significantly healthier than older residents of Greater London or NYC, the AHC rate among older people in Hong Kong is higher than the rate in Greater London and nearly as high as the rate in NYC. There are important concerns about access to primary care among residents of the most deprived neighbourhoods of Greater London, but overall, residents of this city enjoy the best access to primary care. In NYC, barriers to access faced by racial and ethnic minorities, along with barriers related to insurance, produce the highest AHC rates among the cities we examine. In Hong Kong, residents living in neighbourhoods with fewer primary care clinics have significantly higher AHC rates. This finding suggests that primary care infrastructure in Hong Kong is inadequate to meet the needs of its ageing population. The financial barriers to accessing primary care providers in Hong Kong appears to result in expensive hospitalisations that could be avoided.

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References

Agabiti, N., M. Pirani, P. Schifano, G. Cesaroni, M. Davoli, L. Bisanti, N. Caranci, G. Costa, F. Forastiere, C. Marinacci, A. Russo, T. Spadea and C. Perucci (2009), 'Income level and chronic ambulatory care sensitive conditions in adults: a multicity population-based study in Italy', *BMC Public Health*, **9**: 457.

Ahmad, O., C. Boschi-Pinto, A. D. Lopez, C. J. L. Murray, R. Lozano and M. Inoue (2001), *Age Standardization of Rates: A New WHO World Standard. GPE Discussion Paper Series, No. 31*, Geneva: World Health Organization.

Banks, J., M. Marmot, Z. Oldfield and J. P. Smith (2006), 'Disease and disadvantage in the United States and in England', *Journal of the American Medical Association*, **295**: 2037–2045.

Billings, J. and R. M. Weinick (2003), *Monitoring the Health Care Safety Net, Book I: A Data Book for Metropolitan Areas*, Washington, DC: Agency for Healthcare Quality and Research.

Billings, J., G. M. Anderson and L. S. Newman (1996), 'Recent findings on preventable hospitalizations', *Health Affairs (Millwood)*, **15**: 239–349.

Bureau of Vital Statistics, New York City Department of Health and Mental Hygiene (2010), *Summary of Vital Statistics 2009 – the City of New York*, Electronic: Bureau of Vital Statistics, New York City Department of Health and Mental Hygiene.

Casanova, C. and B. Starfield (1995), 'Hospitalizations of children and access to primary care: a cross-national comparison', *International Journal of Health Services*, **25**(2): 283–294.

Census and Statistics Department, Hong Kong SAR Government (2009), *Thematic Household Survey Report No. 41*, Electronic: Census and Statistics Department, Hong Kong SAR Government.

Census and Statistics Department, Hong Kong SAR Government (2010), *Hong Kong Life Tables, 1971–2010*, Electronic: Census and Statistics Department, Hong Kong SAR Government.

Chau, P. H. and J. Woo (2008), *How Well are Seniors in Hong Kong Doing? An International Comparison*, Hong Kong: The Hong Kong Jockey Club.

Chau, P. H., J. Woo, K. C. Chan, D. Weisz and M. K. Gusmano (2011), 'Avoidable mortality pattern in a Chinese population – Hong Kong, China', *European Journal of Public Health*, **21**: 215–220.

Coyle, N. and J. Fitzpatrick (2009), *Health and Lifestyle in London – Initial Findings from the London Boost of the Health Survey for England*, Electronic: London Health Observatory.

Department of Health, Hong Kong SAR Government and Department of Community Medicine, The University of Hong Kong (2005), *Population Health Survey 2003/2004*, Electronic: Centre for Health Protection, Hong Kong SAR Government.

Evandrou, M. (2006), 'Inequalities Amongst Older People in London: The Challenge of Diversity', in V. G. Rodwin and M. K. Gusmano (eds), *Growing Older in World Cities*, Nashville: Vanderbilt University Press.

Food and Health Bureau, Hong Kong SAR Government (2010), *My Health My Choice: Healthcare Reform Second Stage Public Consultation – Consultation Document*, Electronic: Food and Health Bureau, Hong Kong SAR Government.

Gusmano, M. K. and S. Allin (2011), 'Health care for older persons in England and the United States: a contrast of systems and values', *Journal of Health Politics, Policy and Law*, **36**(1): 89–118.

Gusmano, M. K., V. G. Rodwin and D. Weisz (2006), 'A new way to compare health systems: avoidable hospital conditions in Manhattan and Paris', *Health Affairs (Millwood)*, **25**: 510–520.

Gusmano, M. K., V. G. Rodwin and D. Weisz (2010), *Health Care in World Cities: London, New York and Paris*, Baltimore, MD: Johns Hopkins University Press.

Kirby, J. B. and T. Kaneda (2005), 'Neighborhood socioeconomic disadvantage and access to health care', *Journal of Health and Social Behavior*, **46**(1): 15–31.

Leung, G. M., I. O. L. Wong, W. S. Chan, S. Choi and S. V. Lo, on behalf of the Health Care Financing Study Group (2005), 'The ecology of health care in Hong Kong', *Social Science & Medicine*, **61**: 577–590.

Magán, P., A. Alberquilla, A. Otero and J. M. Ribera (2011), 'Hospitalizations for ambulatory care sensitive conditions and quality of primary care: their relation with socioeconomic and health care variables in the Madrid regional health service (Spain)', *Medical Care*, **49**(1): 17–23.

Millman, M. L. (1993), *Access to Health Care in America*, Washington, DC: National Academy Press.

National Health Service (2011), *Help with Health Costs*, Electronic: NHS.

New York City Department of Health and Mental Hygiene (2009), *Community Health Survey*, Electronic: New York City Department of Health and Mental Hygiene.

Office for National Statistics, United Kingdom (2010), *Life Expectancy at Birth and at Age 65 by Local Areas in the United Kingdom, 2007–2009*, Electronic: Office for National Statistics, United Kingdom.

Pappas, G., W. C. Hadden, L. J. Kozak and G. F. Fisher (1997), 'Potentially avoidable hospitalizations: inequalities in rates between US socioeconomic groups', *American Journal of Public Health*, **87**: 811–816.

Parchman, M. L. and S. D. Culler (1999), 'Preventable hospitalizations in primary care shortage areas. An analysis of vulnerable medicare beneficiaries', *Archives of Family Medicine*, **8**: 487–491.

Parchman, M. L. and S. Culler (1994), 'Primary care physicians and avoidable hospitalizations', *Journal of Family Practice*, **39**: 123–128.

Purdy, S., T. Griffin, C. Salisbury and D. Sharp (2009), 'Ambulatory care sensitive conditions: terminology and disease coding need to be more specific to aid policy makers and clinicians', *Public Health*, **123**(2): 169–173.

Ricketts, T. C., R. Randolph, H. A. Howard, D. Pathman and T. Carey (2001), 'Hospitalization rates as indicators of access to primary care', *Health Place*, **7**(1): 27–38.

Rodwin, V. G., C. Brecher, D. Jully and R. Baxter (eds) (1992), *Public Hospital Systems in New York and Paris*, New York: New York University Press.

Roos, N. P. and C. Mustard (1997), 'Variation in health and health care use by socioeconomic status in Winnipeg, Canada: does the system work well? Yes and No', *The Milbank Quarterly*, **75**(1): 89–111.

Saha, S., R. Solotaroff, A. Oster and A. B. Bindman (2007), 'Are preventable hospitalizations sensitive to changes in access to primary care? The case of the Oregon Health Plan', *Medical Care*, **45**(8): 712–719.

Starfield, B. (1994), 'Is primary care essential?', *Lancet*, **344**: 1129–1133.

Starfield, B., L. Shi and J. Macinko (2005), 'Contribution of primary care to health systems and health', *The Milbank Quarterly*, **83**(3): 457–502.

Weissman, J. S., C. Gatsonis and A. M. Epstein (1992), 'Rates of avoidable hospitalization by insurance status in Massachusetts and Maryland', *Journal of the American Medical Association*, **268**: 2388–2394.

Woo, J., B. Mak, J. O. Cheng and E. Choy (2011), 'Identifying service needs from the users and service providers' perspective: a focus group study of Chinese elders, health and social care professionals', *Journal of Clinical Nursing*, **20**: 3463–3471.