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Population health and the health system: a comparative analysis of avoidable mortality in three nations and their world cities

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Background: Access to timely and effective medical services can reduce rates of premature mortality attributed to certain conditions. We investigate rates of total and avoidable mortality (AM) and the percentage of avoidable deaths in France, England and Wales and the United States, three wealthy nations with different health systems, and in the urban cores of their world cities, Paris, Inner London and Manhattan. We examine the association between AM and an income-related variable among neighbourhoods of the three cities. **Methods:** We obtained mortality data from vital statistics sources for each geographic area. For two time-periods, 1988–90 and 1998–2000, we assess the correlation between area of residence and age- and gender-adjusted total and AM rates. In our comparison of world cities, regression models are employed to analyse the association of a neighbourhood income-related variable with AM. **Results:** France has the lowest mortality rates. The US exhibits higher total, but similar AM rates compared to England and Wales. Rates of AM are lowest in Paris and highest in London. Avoidable mortality rates are higher in poor neighbourhoods of all three cities; only in Manhattan is there a correlation between the percentage of deaths that are avoidable and an income related variable. **Conclusions:** Beyond the well-known association of income and mortality, persistent disparities in AM exist, particularly in Manhattan and Inner London. These disparities are disturbing and should receive greater attention from policy makers.

Keywords: avoidable mortality, health system, income

Introduction

In comparison with other wealthy nations, the United States has poor health status.[1] Indeed, a recent comparison of England and the US indicates that Americans have inferior health status compared to the English.[2] While such findings are important, most reported health indicators do not distinguish between the determinants of population health not directly related to health care (e.g. poverty, lifestyle or education), so their use in evaluating the performance of the health system is limited.[3]

An alternative approach, as we try to learn from international experience, is to investigate selected causes of mortality that have been linked more directly to health care system performance and to extend this analysis to smaller areas that share many characteristics in common. Our comparison of avoidable mortality (AM) across three nations and their comparable world cities represents a first step in assessing the influence of health systems on population health.

The concept of AM [4] pre-supposes that the occurrence of an avoidable death constitutes evidence of health system failure. Although the analysis of AM is only one dimension of health system performance, it has been widely adopted in Europe.[5] AM assumes that an effective health care system should be able to prevent premature death from diseases amenable to screening and medical intervention. More recently, AM has been refined by differentiating deaths from conditions that are amenable to medical intervention from those that could be prevented by broader health promotion policies such as improving highway safety, reducing medical errors or altering health behaviours. Some have further categorized each cause of AM with respect to conventional concepts of disease prevention as primary, secondary or tertiary.[6]

In France, AM has been used to account for gender disparities in premature mortality with an emphasis on conditions closely related to risk behaviour. French researchers have used gender differences in rates of AM to appeal for more primary prevention.[7] A broader definition of AM, defined as conditions amenable to health care rather than deaths related to risky behaviour, has not previously been applied to a comparison of Paris with other world cities.

Our comparison of AM in world cities is designed to highlight possible opportunities for reducing premature mortality across and within these cities. We provide some initial conclusions about the characteristics of these health care systems that may contribute to these differences, but further research at a more detailed geographical and clinical level is needed to identify effective specific public health interventions.

We employ a comparative, cross-sectional framework used previously for an analysis of infant mortality[8] and examine AM in three countries (France, US and England and Wales, referred to simply as England) and the 'urban cores' of their three world cities (Paris, Manhattan and Inner London). We analysed the association between an income-related indicator and population-based AM rates as well as the percentage of deaths that are avoidable in the urban cores.

Methods

Definitions

City and neighbourhood definitions

The definition of the relevant units of analysis is central to any comparative inquiry. New York, London and Paris are the

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largest cities in these higher income nations of the OECD and represent enormous and diverse 'city-regions'. They are not comparable without some important caveats. We selected Paris as the prototypical 'urban core' against which we match comparable urban cores for New York and London: Manhattan and Inner London.

Our definition of the urban core which we have published elsewhere,[8,9–14] was guided by five criteria. First, the urban cores represent historic centres of their respective metropolitan regions. Second, their populations are similar in size ranging from 1.5 million in Manhattan to 2.1 million in Paris. Third, with regard to the presence of social inequities, the urban cores of these cities combine a mix of high and low income populations. All are marked by wide variation in average household income of about one to four from lowest to highest among Manhattan community districts, one to three among Paris arrondissements and one to three among the percentage of the population that is income deprived among London boroughs. The final two criteria considered are drawn from central place theory in the urban planning literature.[15,16] All three urban cores function as central hubs for employment, attracting large numbers of commuters. Approximately one-third of the employed labour force from the surrounding metropolitan areas, (Outer London boroughs, the three departments of the first ring surrounding Paris, outer boroughs of New York City) commute to Inner London, Paris and Manhattan each day. Finally, these three urban cores serve as centres of medical resources within their respective regions and nations, having large numbers of teaching hospitals, medical schools and high rates of acute hospital beds and physicians per capita.

Despite similarities, these cities exist within very different health systems. New York has a very high level of uninsured patients, while those with insurance are covered by a patchwork system of public and private indemnity insurers and managed care organizations. In contrast, Parisians are covered by national health insurance and Londoners are eligible to receive care through the National Health Service. There are differences between the cities in the specialty mix of physicians and the relative size of the public hospital sector[9] among other factors that affect use of health services.

For Manhattan, we examine its 12 community districts, for London the 14 boroughs of inner London and for Paris its 20 arrondissements. A similar measure of pre-tax, average household income, by neighbourhood subunit is available for Manhattan and Paris. Since household income data are not available in the UK, for London we use the deprivation index in place of a direct income measure.[17] Using income and the deprivation index as explanatory variables in the model would make London and the other two cities difficult to compare. As in our analysis of infant mortality and income[8], we used income and the U.K.'s deprivation index to define an indicator that was used as an independent variable in the model. For Manhattan and Paris, we let income = 1 for neighbourhoods in the lowest quartile (3 in Manhattan; 5 in Paris). For London, we let income = 1 for each of the four boroughs in the highest deprivation quartile. For all other neighbourhoods, we let income = 0. If the deprivation index in London captures the four lowest income neighbourhoods in the most deprived quartile, our combination of income and deprivation indicators select the lowest income quartile neighbourhoods for the three urban cores.

Population health and avoidable mortality

A host of studies suggest that health care contributes little to declines in mortality and the improvement of population health, [18–20] and that some medical interventions are damaging to health.[21] Nevertheless, effective therapies for a variety of conditions have been developed since the mid-twentieth century[22] and many scholars who emphasize the importance of social determinants recognize that health care can prolong life 'after some serious diseases'.[23] Mackenbach,[24] examining the effects of antibiotics on infectious diseases, advances in surgical and anaesthetic techniques on appendicitis and gall bladder disease, and ante- and peri-natal care on infant mortality in the interval 1875/79 to 1970 in the Netherlands, reached the conclusion that between a 5% and 18.5% decline in mortality could be attributed to health care. A study seeking to explain the decline in coronary heart disease mortality in England and Wales between 1981 and 2000 attributed 42% of the decrease to medical treatment of individuals and 58% to population risk factor reductions, primarily smoking.[25] Nolte and McKee recently published an extensive review of the literature on AM and concluded that health care has made an appreciable difference to population health, although the rate varies among countries.[26]

Table 1 Selected avoidable causes of mortality, age group 1-74

Cause of death	ICD-9 codes	ICD-10 codes
Tuberculosis	010–018,137	A15–19, B90
Septicemia	38	A40–41
Malignancy of colon and rectum	153–154	C18–21
Malignancy of skin	172–173	C44
Malignancy of breast	174–175	C50
Malignancy of cervix and uterus	179,180,182	C53–55
Malignancy of testis	186	C62
Hodgkin's disease	201	C81
Leukemia	204–208	C91–95
Endocrine diseases, including diabetes mellitus	240–279	E0–69
Epilepsy	345	G40–41
Hypertension	401–405	I10–13
Cerebrovascular disease	430–438	I60–69
Influenza	487	J10–11
Pneumonia	480–486	J12–18
Ischemic heart disease[a]	410–414	I20–25
Peptic ulcer	531–533	K25–27
Appendicitis, abdominal	540–543	K35–38
herniaand gallbladder	550–553	K40–46
disease	574.0–575.1	K80–82
Nephritis and nephrosis	580–589	N0–7,17–19,25–27
Benign prostatic hyperplasia	600	N40
Maternal death	630–676	O00–99

a: See Methods section in text.

The definition of AM has evolved during the past several decades since death rates from avoidable causes, if properly defined, should decrease faster than other causes of death when appropriate health care is available. Cross-national analysis of trends in AM in Europe indicate that avoidable deaths declined much faster over the last two decades than other causes of mortality. This result lends further credence to the validity of AM as an indicator for the effectiveness of public health interventions and medical care.[27]

We based our selection of causes of death considered avoidable (table 1), on work by Nolte and McKee[26] who presented a detailed justification for the diagnoses they chose. Their list is a modification of the work of Tobias and Jackson,[6] Mackenbach *et al.*[28] and Charlton *et al.*[29] Needless to say, few conditions are either entirely amenable, or not amenable, to intervention and as medical therapies improve, even more deaths may be classified as avoidable. Our list of 'avoidable' causes of death differs from that employed by others in eliminating those causes restricted to people less than 15 years of age (intestinal infections, whooping cough, measles, respiratory diseases other than pneumonia and influenza), all of which are relatively uncommon. Infant mortality is not

Table 2 Total and avoidable mortality in the US, France and England and Wales and the urban cores of their world cities: 1988–90 and 1998–2000

Area	Total Mortality Rate: Age 1–74/1000 Population (*N*)	Avoidable Mortality Rate: Age 1–74/1000 Population w 50% IHD deaths (*N*)	Avoidable Mortality Rate: Age 1–74/1000 Population excluding all IHD (*N*)	Total Mortality Rate: Age 1–74/1000 Population (*N*)	Avoidable Mortality Rate: Age 1–74/1000 Population w 50% IHD deaths (*N*)	Avoidable Mortality Rate: Age 1–74/1000 Population excluding all IHD (*N*)
Nation	1988–1990 average			1998–2000 average		
US	4.54 (1 053 637)	1.38 (319 409)	0.95 (220 061)	4.00 (1 017937)	1.19 (302 175)	0.86 (218 316)
France	3.72 (193 538)	0.87 (45 075)	0.71 (37 020)	3.26 (17 5876)	0.76 (40 815)	0.64 (34 644)
England	4.26 (18 6169)	1.52 (66 723)	0.94 (41 158)	3.57 (169 490)	1.23 (58 407)	0.85 (40 352)
City	1988–1990 average			1998–2000 average		
Manhattan	5.64 (8260)	1.47 (2125)	1.10 (1593)	3.69 (5281)	1.18 (1686)	0.91 (1300)
Paris	3.68 (7637)	0.78 (1614)	0.66 (1370)	2.94 (5809)	0.66 (1306)	0.58 (1151)
Inner London	4.95 (11 969)	1.70 (4042)	1.14 (2521)	4.32 (11 200)	1.49 (3868)	1.07 (2782)

Rates are per 1000 population and are age- and gender-adjusted.

included in this study; age, therefore, starts at 1 year. The upper age limit, since the definition of AM includes the concept of premature death, was set at 75 years because the likelihood that a condition will be amenable to intervention, especially in light of the high probability of serious comorbidities as well as the reliability of death certification, become increasingly questionable at older ages.[30] While any upper age limit for AM is arbitrary, the age of 75 is only slightly below life expectancy at birth in the countries and cities considered in this study. We also include all death due to diabetes mellitus, leukaemia and malignancy of the cervix and body of the uterus. For the sake of simplicity, and because most health care providers we surveyed believe that the ability to prevent deaths from these illnesses is contingent on disease process, not age among those 75 years and younger, we use this upper age limit for all conditions.

Ischaemic heart disease (IHD) is included, but because this diagnosis affects such large numbers of people it may obscure the contribution of some other causes of AM. In response to this concern, we adopt the approach suggested by Nolte and McKee[30] by presenting AM with only half of the deaths from IHD included in the definition. It is clear that primary prevention contributes significantly to reductions in mortality from IHD. Including half of the deaths from IHD is arbitrary, but given the lack of consensus over the extent to which health care contributes to decreasing mortality from this diagnosis, we believe this is a reasonable compromise. We do present the rates of AM with IHD excluded, but we do not believe that this approach is consistent with the literature[31–33] suggesting that the impact of therapy is substantial, such that a considerable proportion of deaths due to IHD are amenable to some level of care.

Data

We obtained mortality and population data by age group (1–4, 5–14, 15–24,. . .,75–84, 85+) and cause of death coded according to versions 9 or 10 of the International Classification of Diseases (ICD).

We use two cross sections of mortality data a decade apart, 1988–90 and 1998–2000. For the US, we extract data from the 2000 Census and National Vital Statistics Reports published by the National Center for Health Statistics division of the Centers for Disease Control and Prevention. Manhattan data was obtained from the Bureau of Vital Statistics of the New York City Department of Health and Mental Hygiene. The Institut National de la Santé et de la Recherche Médicale (INSERM) provided all French mortality data; Institut National de la Statistique et des Etudes Economiques (INSEE) was the source for population information.

The United Kingdom Office of National Statistics contributed population and mortality data for London, and for England and Wales. We report data for England and Wales, rather than for the entire U.K., because the Office of National Statistics reports death by cause and age separately for Scotland from these two areas.

For each nation and world city, our sources indicate that the mortality data is residence-based and no deaths are excluded based on immigration or citizenship status. We adjusted the age and gender data by the direct method, using the 2000 US standard population.[34]

Statistical models

We use Chi-square testing to determine statistical significance for area-level differences. To test the null hypothesis that mortality and area of residence are independent, a variable 'living' consisting of the category survivors, a variable 'area' consisting of the categories US, England and France (or Manhattan, Inner London and Paris) and 'dies unavoidably', and 'dies avoidably' are used for 1988–90 and 1998–2000. If rejected, then the alternative hypothesis is that mortality and area of residence are significantly associated.

We estimated the relationship between the neighbourhood-level income indicator and percentage of avoidable deaths, during the period 1998–2000, using OLS regression. Since avoidable deaths are a rare occurrence, a non-negative count variable, and exhibit greater variation than in a true Poisson process, we used a negative binomial regression model to assess the influence of neighbourhood income on the rate of AM. The number of deaths is the response, population less than 75 years of age is the exposure and the income related variable is the explanatory variable. We do not report the estimate of the underlying coefficient of the income variable but the exponential of the estimate, the estimated incident rate ratio (IRR). This is the ratio of the value of the AM rate in the low-income (or high deprivation) areas to that of the rest of the city. Our null hypothesis was that the IRR is 1, that there is no difference in mortality between the remainder of the city and low-income areas. The alternative hypothesis is that the IRR is greater than 1, i.e. the low-income areas have higher AM rates than the rest of the city.

Results

For all national and city level units of analysis the age- and sex-adjusted total and AM rates, have decreased over the decade studied (table 2). During the two time-periods France had the lowest overall total mortality and AM rates. The total mortality rate for England is lower than that in the US for both time periods, but rates of AM slightly exceed that of the US when half of deaths the due to IHD are included. If IHD is excluded from the definition then England and the US have AM rates that are nearly identical.

Similarly, Paris has the lowest total mortality and AM rates, while Manhattan fared better than Inner London for AM. We conducted a sensitivity analysis in which we included all deaths from IHD in the definition of AM, but this did not change the results. Even when we included all deaths from IHD in the definition, the rate of AM is lowest in Paris and highest in Inner London.

The differences between France and the US and the urban cores of their world cities are larger for AM than for total mortality, whereas the total mortality rate for England is lower than in the US. When we compare AM, England had higher rates. When we compare Inner London and Manhattan, the rates for Inner London are higher for all of the definitions we examined only in the more recent time period; Manhattan previously had a higher total mortality rate.

Over the two time-periods (1988–90 and 1998–2000) the rates of AM declined in all three urban cores, but Manhattan experienced the greatest decline (20%) in comparison to Paris (16%) and Inner London (13%). Once again, the results are comparable when we include all IHD deaths in the definition of AM.

The chi-squared test, based on numbers of avoidable and unavoidable deaths, indicates that the differences we observe among these nations and cities are statistically significant. For both 1988–90 and 1998–2000, the hypothesis that AM and area are independent is rejected by the χ^2 test at the 0.001 level (table 3).

When we estimated the relationship between neighbourhood-level income and percentage of deaths that are avoidable, during the period 1998–2000, using OLS regression, we found a correlation in Manhattan at the 1% level, but no significant correlation in Paris or London at the 5% level (table 4). Despite this correlation, negative binomial regression results reveal that residence in a low income neighborhood, as compared to the remainder of the city, is significantly correlated with increased AM rates/1000 population in all three urban cores, and that the IRR is greatest in Manhattan, followed by Inner London and least in Paris (table 4).

In all three nations and urban cores, IHD was the largest single cause of AM. In France and England, as well as in Paris and Inner London, the second largest category of AM was cancer of the colon, rectum, breast or cervix, followed by hypertension and stroke. In the US and Manhattan, this pattern was reversed, with deaths from hypertension and stroke exceeding those from malignancies. Influenza, pneumonia, asthma and bronchitis and diabetes represent the next largest causes in all areas.

Table 3 Avoidable deaths, unavoidable deaths and survivors in the US, France, England and Wales and the urban cores of their world cities

	Avoidable deaths	Unavoidable deaths	Survivors
1988–1990			
US	319 409	7 34 228	230 831 430
France	45075	1 48 464	51 802 436
England	66723	1 19 446	43 528 331
Chi-square = 13234.26, 4 df*			
Manhattan	2027	5763	1374164
Paris	1530	5710	1963143
London	4042	7927	2385841
Chi-square = 1104.43, 4 df*			
1998–2000			
US	302 175	715 762	253 247 063
France	40 815	135 060	53 714 086
England	58 407	111 084	47 257 610
Chi-square = 12090.56, 4 df*			
Manhattan	1686	3594	1427294
Paris	1306	4503	1968928
London	3868	7332	2582254
Chi-square = 812.97, 4 df*			

*Chi-square significant at the 0.001 level.

Discussion

Limitations of the study

Mortality is an incomplete measure of health system performance but in this era of privacy concerns, reliable population-based level and disease-specific morbidity data are rarely available and can only reflect those who have already sought health care, which typically underestimates those in need of care.

We relied on vital statistics publications, derived from death certificates to determine the cause of death. The 'main cause of death' was used in our rate calculations, which is consistent with the approach of others using these data. We acknowledge that only one 'cause' can be given, even for persons with multiple health problems. In some circumstances, it is difficult to know the precise cause of death. Usage of the vital statistics data always carries the risk that information may be unreliable

Table 4 Regression results for number of avoidable deaths using total mortality and lowest income quartile neighborhoods as independent variables. 1998–2000

	Manhattan[a]			Paris[b]			London[c]		
R^2	0.941			0.987			0.542		
				ANOVA					
F (Sig.)	72.408 (0.000)			667.962 (0.000)			6.510(0.014)		
Df	11			19			13		
				Coefficients					
	B	*t*	sig	B	*t*	sig	B	*t*	sig
(Constant)	6925.194	0.376	0.716	1096.902	0.386	0.704	73 439.734	0.951	0.362
Total number deaths	162.695	8.354	0.000	127.061	29.722	0.000	146.922	3.319	0.007
Lowest income quartile neighbourhood	68461.511	3.661	0.005*	8545.365	2.084	0.053	28 220.435	0.487	0.636

a: IRR(incident rate ratio)=1.66; SE=.302; *Z*-stat=2.81; *P*-value=0.005.
b: IRR=1.06; SE=.098; *Z*-stat=3.01; *P*-value=0.003.
c: IRR=1.19; SE=.077; *Z*-stat=2.81; *P*-value=0.005.
*Significant at $p < 0.05$ level.

for certain conditions, where the cause of death is poorly known, for multiple conditions, or where conditions carry a social stigma.

The comparability of assignment of the cause of death across and within nations is always a concern. If deaths are misclassified more commonly in one geographic area than another, the results could be biased. However, the inclusion of a large group of causes of death makes this problem less likely.

All of these limitations must be compared to the advantages of using mortality statistics in assessing population health. These include their widespread availability and the fact that death is obviously a clearly defined event. Although physician diagnostic habits and preferences could represent another source of bias, differences in AM do persist among different regions even after controlling for disease incidence.[35]

Interpretation

The US does not provide universal access to health care and more than 46 million Americans do not have health insurance. In Manhattan, about 24% of the population is uninsured,[36] and our previous comparison of avoidable hospital conditions in Manhattan and Paris[13] suggests that Manhattanites face greater access barriers to health care than do Parisians. Yet, during the past decade, the US Department of Health and Human Services and the NYC Department of Health and Mental Hygiene have launched aggressive health promotion campaigns designed to encourage early detection and screening for a host of diseases, including breast, cervical, colon and rectal cancer and heart disease.

With respect to declines in infant mortality and tuberculosis since the late 1980s, NYC's public health efforts have resulted in greater population health improvements than have those in London or Paris.[9] As a result, although we had anticipated that the overall rate of AM would remain highest in Manhattan, we did expect over the two time periods that there would be a larger decline in rates of AM in Manhattan than in the other urban cores.

The difference between France and the US, and their world cities, is much greater with respect to AM than to total mortality. This lends support to the hypothesis that at least some of the difference between these countries can be attributed to differences in their health systems. The comparisons between the US and Manhattan with England and London are also revealing. Our analysis shows that the health of residents of Inner London, measured in terms of total and AM, is worse than the health of Manhattan residents. Given the great concentration of deprivation in Inner London, and its longstanding reputation for poor primary care,[37] these results are not surprising. We did not expect to find higher rates of AM in England than in the US unless all deaths due to IHD were excluded. Thus while the NHS, despite its constraints in treating some malignancies, appears to have reduced the rates of many causes of AM, our findings are consistent with concerns that the NHS may provide less access to appropriate health services particularly those aimed at preventing and treating heart disease. To address health inequalities and improve access to primary care, the NHS, in 2004, created primary care trusts (PCTs). All GPs contracting with the NHS are now assigned to PCTs, which are charged with commissioning and providing health care, as well as monitoring the quality of care.[37] In view of the reforms in the NHS, and of our concerns that this analysis is based on only two short time periods, the lack of strictly comparable income data and the major role of IHD in accounting for differences in AM, we cannot conclude that there is evidence of health system failure in the NHS. Rather, our evidence suggests strong grounds to monitor rates of AM in England and Inner London to evaluate the impact of recent NHS reforms.

Manhattan has lower rates of AM than Inner London, (even if deaths from IHD are excluded), and was able to reduce overall rates of AM more than Inner London or Paris during the 1990s. Since we believe that the urban cores of these world cities are more comparable than their respective nations in terms of population and health system measures, we find it especially troubling that inequality of access to timely and effective medical care appears to be a much greater problem in Manhattan than either Inner London or Paris. The observation of more uniform, lower AM rates in Paris implies that the cost of geographic equity in rates of AM across a city need not be the higher overall rates observed in London. In contrast to Inner London and Paris, where there is universal access to health care, in Manhattan those living in the lowest income neighbourhoods appear to exhibit a significantly higher percentage of avoidable deaths than people living in the rest of the borough. Whether this is related to barriers in access to health care services, poor knowledge of the system's operation or poorer ability to communicate with providers is unclear. Perhaps, as suggested in the analysis of infant mortality, this reflects 'patterns of racial segregation, and other forms of discrimination that might affect both the incomes and access to health care of' minorities in Manhattan?[8] Differences may also relate to lifestyle choices, probability of disease detection and patient adherence to medical instructions, all of which have been related to SES.[38,39]

The leading causes of AM in all three nations and urban cores suggest that disparities in access to screening services, primary and specialty health care and prevention may explain the observed differences in rates, however, further research is needed to improve our understanding of these disparities. For example, although the New York City Department of Health and Mental Hygiene has placed great emphasis since the early 1990s on primary and secondary prevention efforts we cannot assess the degree to which these efforts contributed to the observed decline in the rate of AM in Manhattan. Although the changes we observe between the two-time periods may be due to public health interventions, they may also be the result of changes in the populations of these cities. For example, during the 1990s, the population of Manhattan became younger, wealthier and better educated.[40] Comparable changes occurred in Inner London. In contrast, the age distribution of Paris did not change significantly during this time period, yet it experienced a 16% decline in the rate of AM.

Our emphasis on health care does not contradict the body of research that suggests that broad social conditions must be addressed to bring about improvements in population health.[41,42] Rather, we believe it supports the idea that providing access to disease prevention services and health care, along with efforts to improve the social determinants of health, are necessary to improve population health.

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Conflicts of interest: None declared.

Key points

- We investigated the association between age- and gender-adjusted rates of total and AM, and area of residence in three nations and the urban cores of their world cities. We further examined the association of AM rates, as well as percent of avoidable deaths and an income-related variable among neighbourhoods of these cities.
- In comparison to the United States and to England and Wales, France has the lowest age- and gender-adjusted mortality rates. The US exhibits higher total, but similar AM rates compared to England and Wales. Similarly, Paris has the lowest rate of AM, while Inner London has the highest rate.
- Although AM rates are higher in poor neighbourhoods of all three cities, only in Manhattan there is a significant correlation between percentage of deaths that are avoidable and an income-related variable.
- Our analysis supports the thesis that the health system, as well as income, influences the rates of avoidable mortality.

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