# A New Way To Compare Health Systems: Avoidable Hospital Conditions In Manhattan And Paris

Data on two comparable cities shed light on questions regarding access to primary care.

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**ABSTRACT:** Based on a comparison of discharges for avoidable hospital conditions (AHCs), we find that Paris provides greater access to primary care than Manhattan. Age-adjusted AHC rates are more than 2.5 times as high in Manhattan as in Paris. In contrast, the difference in rates of hospital discharge for "marker conditions" are only about 20 percent higher in Manhattan. Rates of discharges for AHCs are higher among residents of low-income neighborhoods in both cities, but the disparity among high- and low-income neighborhoods is more than twice as great in Manhattan. Our analysis highlights the consequences of access barriers to care in Manhattan, particularly among vulnerable residents. [*Health Affairs* 25, no. 2 (2006): 510–520; 10.1377/hlthaff.25.2.510]

An immense literature compares national health care systems and attempts to assess their performance and derive "lessons" from countries' experiences.[1] Although there are major differences between countries, the focus on national aggregates masks important variations within countries.[2] In contrast, the World Cities Project examines cities that share characteristics and problems; this approach provides notable advantages for more refined comparisons and cross-national learning.[3]

Here we analyze avoidable hospital conditions (AHCs), an indicator of access to primary health care, in Manhattan and Paris, cities that are more alike than their respective countries are (Exhibit 1). The selection of AHCs is only one dimension of health system performance. But in thinking about how health systems can assure access through a combination of health insurance coverage and the

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**EXHIBIT 1**
**Basic Population, Health Care System, And Health Status Indicators, Manhattan, United States, Paris, And France, 1999–2000**

| Indicator | Manhattan | U.S. | Paris | France |
|---|---|---|---|---|
| Population characteristics | | | | |
| Total population | 1.5 million | 281 million | 2.1 million | 57.3 |
| Percent of population >65 years old | 13.9 | 12.6 | 15.4 | 16.1 |
| Population density per square mile | 64,860 | 79.4 | 51,829 | 284.9 |
| Percent living below poverty (half median household income) | 28.4 (1994) | –[a] | 12.7 (1994) | –[a] |
| Percent foreign-born | 28.4 | 10.4 | 22.7 | 5.6 |
| Health care system | | | | |
| No. of practicing physicians per 10,000 population | 85.5 (2004) | 27 | 85 (2005) | 30 |
| No. of acute hospital beds per 1,000 population | 5.5 (2002) | 3.1 | 7.0 (2002) | 4.3 |
| Total age-adjusted discharges from acute care hospitals per 1,000 population | 185 | 98.6 | 250 | 245.1 |
| Health status | | | | |
| Infant mortality rate (2003) | 6.5 | 6.9 | 3.6 | 2.8 |
| Age-adjusted hospital discharge rate per 100,000 for AMI, ages 45–64 | 107.6 | 265.2 | 76.9 | 164.9 |
| Age-adjusted hospital discharge rate per 100,000 for AMI, age 65+ | 235.7 | 504.5 | 128.7 | 267.2 |
| Life expectancy (years) at age 65, males[b] | 17 | 16.4 | 17.7 | 16.9 |
| Life expectancy (years) at age 65, females[b] | 20.1 | 19.4 | 21.7 | 21.3 |

**SOURCES:** U.S. census, 1995 and 2000; New York City Health Department, Office of Vital Statistics; Ministere de l'emploi et de la solidarité, Service des statistiques, des études, et des systèmes d'information, Repertoire ADELI (Automatisation des listes), 1 January 2002; Ministry of Health (France), *Annuaire des statistiques sanitaires et sociales, 2000* (Paris: La documentation française, 2001); and C. Chambaz, F. Guillaumat-Tailliet, and J.M. Hourriez, "Le Revenu et le patrimoine des ménages," in *Données sociales* (Paris: Institut national de la statistique et des études économiques, 1999).

**NOTE:** AMI is acute myocardial infarction.

[a] Not available.

[b] Life expectancy numbers are for New York City and for Paris and its three surrounding departments.

availability of primary care doctors and safety-net providers, AHCs are recognized in the literature (in the United States, Canada, Spain, and the United Kingdom) as a valid indicator of access to primary care.[4]

## A Tale Of Two Cities: Manhattan And Paris

■ **Convergent characteristics.** New York City (population 8.0 million) and Paris, including its surrounding *départements* of Hauts de Seine, Seine Saint-Denis, and Val de Marne (population 6.2 million), are two of the largest cities among the higher-income countries of the Organization for Economic Cooperation and Development (OECD). But these cities have never been compared with respect to their population health and health systems.

Studies often define New York and Paris as enormous "city-regions."[5] Consistent with previous studies we have conducted, we focus on their "urban cores": Manhattan and Paris.[6] Both are centers of medical excellence, with a disproportionate share of hospitals, physicians, and indigent patients in comparison with their surrounding rings. Their per capita rates of physicians and acute hospital

beds are virtually the same (Exhibit 1). Both cities are destinations for large immigrant communities from around the world.

■ **Divergent characteristics.** Despite their similar characteristics, the cities also diverge with regard to the balance among primary care and specialist physicians (Exhibit 2). Although the primary care system in France might not be as strong as those in other OECD countries, it is much stronger than in Manhattan.[7] In Manhattan, less than 30 percent of all physicians are in primary care. In Paris, half are in primary care, and there are few financial barriers to care.

National health insurance (NHI) covers the entire population legally residing in France, who have met residency requirements.[8] Coinsurance results in out-of-pocket spending, but most people have always had complementary insurance through a system that resembles Medigap for U.S. Medicare beneficiaries.[9] In contrast to Medicare, French NHI coverage increases when a patient's costs increase, there are no deductibles, and drug benefits are extensive. Moreover, patients with debilitating or chronic illnesses are exempted from coinsurance if they consult physicians who accept NHI reimbursement as payment in full.

In Paris, 61 percent of physicians in private practice do not accept NHI reimbursement as payment in full.[10] If patients choose to consult with physicians who require coinsurance, they are eligible for some coverage under complementary insurance. If this constitutes a financial barrier, they can choose physicians who accept NHI rates as payment in full or can consult physicians at one of fifty health centers located in every *arrondissement* of the city.[11] These centers serve as a safety net for all patients who fall through the cracks, but they are used by a broad segment of Parisians. Even after the extension of NHI in 2000 to the 3–4 percent of

**EXHIBIT 2**
**Primary Care And Specialist Physicians In Manhattan (2000) And Paris (1997)**

| | Manhattan | Paris |
|---|---|---|
| Total physicians | 7,540 | 15,610 |
| Primary care[a] | 2,128 | 7,699 |
| Percent of total | 28% | 49% |
| Specialists[b] | 5,412 | 7,911 |
| Percent of total | 72% | 51% |
| Medical subspecialties | 806 | 1,340 |
| Surgical specialties | 1,290 | 774 |
| Other specialties | 3,316 | 5,797 |

**SOURCES:** New York City: New York State Department of Health, 2000. Paris: Ministère de l'emploi et de la solidarité, *Statistiques du SESI* no. 318 ("Les médecins par specialité au 1er janvier 1998") (except generalists, which come from the Caisse nationale des assurances-maladies, or CNAM, 31 December 1996).

[a] Includes obstetrics/gynecology, general/family practice, internal medicine, pediatrics, and geriatrics.

[b] Medical subspecialties include pulmonary disease medicine, cardiology, endocrinology, oncology, nephrology, neurology, and infectious disease. Surgical specialties include general surgery, neurologic surgery, orthopedic surgery, plastic surgery, thoracic surgery, other surgical subspecialties, and urology. Other specialties include ophthalmology; ear, nose, and throat (ENT); dermatology; anesthesiology/critical care/emergency medicine; radiology; nuclear medicine; rheumatology; psychiatry; occupational medicine/preventive medicine; pathology/biology; allergy/immunology; and physical medicine.

Parisians who were previously not covered, illegal immigrants and others still make use of these centers.[12]

The contrast between the two cities is remarkable. In addition to greater income inequality in Manhattan than in Paris, 24 percent of the Manhattan population is uninsured, and gaps in access to primary care exist, despite the presence of a strong safety net, including the largest U.S. public hospital system.[13] Our comparison of AHCs in Manhattan and Paris can shed light on how health coverage and availability of primary care might affect AHCs.

## AHCs As A Measure of Health System Performance

Studies have found that the uninsured are more likely than the insured to be admitted to hospitals with AHCs because they are less likely to receive appropriate and timely primary care.[14] Differences in disease prevalence, not in access to care, could explain the differences in hospital discharge rates for AHCs among areas with low and high socioeconomic status (SES).[15] Based on the relevant literature, however, we are confident that the prevalence or severity of disease in a population does not explain the differences.

Unlike discharge rates for AHCs, hospital discharge rates for "marker conditions" are not influenced by access to ambulatory care. These are conditions for which previous use of ambulatory care does not affect the risk of hospitalization. They do not vary greatly by SES and access to primary care. Another contrast to AHCs are hospital discharge rates for referral-sensitive procedures that are not immediately life-threatening and that require referral to a specialist.

Previous research has examined hospital discharge rates of these three categories of hospitalization in major U.S. urban areas. Our study is the first such comparison between Manhattan and Paris.

We expect that AHCs are higher among residents of Manhattan than among Parisians, while rates for referral-sensitive conditions are higher among Parisians. Because residents of Manhattan are less healthy than residents of Paris (Exhibit 1), we also expect that hospital discharge rates for marker conditions are higher in Manhattan, but not as high as the differences among rates of AHCs.

If disparities among discharge rates for AHCs reflect only differences in the use of hospitals as a site of care, we would expect higher discharge rates for AHCs in Paris than in Manhattan (Exhibit 1).

Finally, we expect that after age, race, sex, severity of illness, and area of residence are controlled for, people with no health insurance and Medicaid recipients have higher incidence of AHCs than people with private coverage in Manhattan. We also expect that blacks and Hispanics have higher incidence of AHCs. In Paris, we expect that after age, sex, and severity of illness are controlled for, people living in *arrondissements* with the lowest median household incomes and in *arrondissements* with the lowest levels of education have higher incidence of AHCs, but we expect that differences are not as great in Paris as they are in Manhattan.

## Methods, Definitions, And Data Sources

To calculate hospital discharge rates for AHCs, we used the definition of AHCs developed by Joel Weissman and colleagues, as validated by previous studies.[16] For "marker conditions," we calculated discharge rates for appendicitis, gastrointestinal (GI) obstruction, and hip fractures; and for "referral-sensitive procedures," we examined lower-extremity joint replacements and organ transplants.[17]

We calculated rates of these three indicators for age-adjusted cohorts, employing the direct standardization method using the 2000 U.S. standard population to obtain adjustment weights.[18] We present age-adjusted rates for each city for neighborhoods above and below median income, and we used difference-of-means tests to examine the statistical significance of the differences.

We relied on existing administrative boundaries and data availability to define neighborhoods. For Manhattan, we used the twelve community districts for our ecological comparisons and ZIP codes in the logistic regression analysis. For Paris, we examined the twenty *arrondissements*.

In addition to our city- and neighborhood-level comparisons, we present results from multiple logistic regression models for each city.[19] These estimate the effects of both individual and neighborhood characteristics on the probability of hospitalization for AHCs.

For Manhattan, our model estimated the probability that a person is hospitalized with an AHC. The primary independent variables were age, sex, race/ethnicity, primary payers, and number of diagnoses on the record (as a measure of severity of illness). The model also controlled for a number of the neighborhood variables at the ZIP code level: income quartile, physician density, and dummy variables for ZIP codes in which more than 15 percent of the households are linguistically isolated and more than 40 percent of the adult population does not have a high school degree. We ran a model with secondary payers and interactive terms relating race and ZIP code, income and race, and insurance. These variables did not change the results, so we dropped them from the final model.

For Paris, the individual independent variables include age, sex, number of diagnoses, and the French hospital index of severity of illness (IGS-2); the neighborhood variables at the *arrondissement* level include indicators for income quartile, physician density, and an education dummy variable for *arrondissements* in which more than 40 percent of the adult population does not have a baccalaureate degree.[20] The Paris model does not include race/ethnicity or "linguistic isolation," because the French census does not include such indicators. Nor does the model have a measure for "payer source," because the Programme de médicalisation des systèmes d'information (PMSI—the Ministry of Health's Hospital Reporting System) does not include this information. Although French NHI includes multiple payers, the benefit packages and reimbursement levels are virtually identical, so there is no meaningful difference among them.

Because observations on individuals from the same neighborhood might be cor-

related, we tested for bias attributable to unobserved neighborhood-level heterogeneity by estimating the models with a dummy variable for each ZIP code or *arrondissement* as a replacement for neighborhood-level variables. The parameter estimates for the individual characteristics were not appreciably different from those generated by these models.[21]

To ensure an adequate number of hospital discharges and procedures for statistically meaningful comparisons and to reduce the likelihood of having an annual anomaly affect the results, we calculated averages over a three-year period (1999–2001) for each city.

■ **Data sources.** Hospital data for Manhattan are from the Statewide Planning and Research Cooperative System (SPARCS), which includes information for all Manhattan residents discharged from all nonfederal hospitals in the state, excluding the population cared for in Veterans Affairs (VA) hospitals. For Paris, data are from the PMSI, which centralizes discharge data by patients' diagnosis, procedure, age, and residence. The PMSI includes data from all hospitals (public and private) having more than 100 beds, thus possibly excluding a small number of discharges for AHCs in Paris. The city-level hospital discharge data are for residents of both cities, regardless of whether they were hospitalized within or outside these cities.

In calculating the hospital discharge rates, we relied on French and U.S. census data to calculate our population denominators: the number of adults age eighteen and older living in each city. For income, we used a similar measure of pretax median household income, by neighborhood. For the logistic regressions, we calculated neighborhood income quartiles based on currencies in each city.

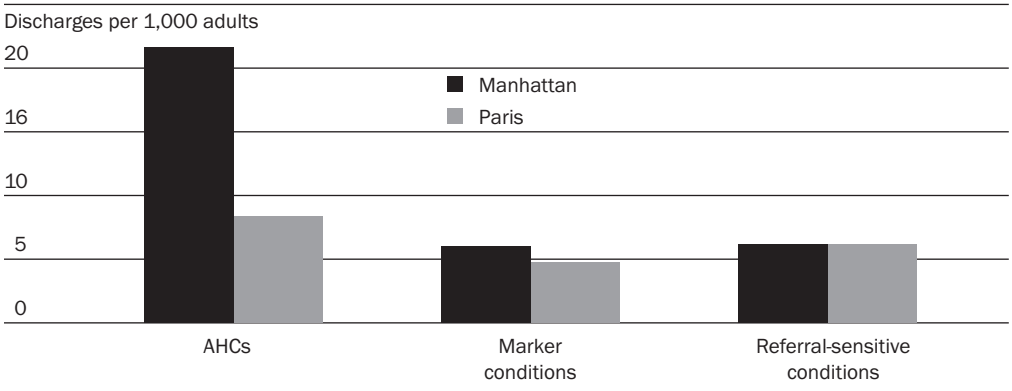
## Study Findings

■ **City-level differences.** We found that for people age eighteen and older, the age-adjusted discharge rate for AHCs in Manhattan is more than two and a half times that of Paris. This is much greater than the differences found among large U.S. cities.[22] In contrast, discharge rates for marker conditions are only about 20 percent higher in Manhattan than in Paris. Discharge rates for referral-sensitive procedures are identical in these cities (Exhibit 3).

■ **Neighborhood-level differences.** Discharge rates for AHCs are higher in lower-income neighborhoods of Manhattan and Paris, but the differences among residents of below-median-income neighborhoods compared with residents of above-median-income neighborhoods are much greater in Manhattan (56 percent) than in Paris (20 percent). As for marker conditions, there is no difference in Manhattan and very little difference in Paris between higher- and lower-income neighborhoods. There are about 20 percent fewer discharges for referral-sensitive procedures among residents of lower-income areas in Manhattan. In Paris, however, there is virtually no difference between residents of higher- and lower-income areas for these procedures (Exhibit 4).

■ **Multiple logistic regression analysis.** The odds ratios calculated for Paris re-

**EXHIBIT 3**
**Hospital Discharges For Avoidable Hospital Conditions (AHCs), Marker Conditions, And Referral-Sensitive Procedures, Manhattan And Paris, 1999–2001**




**SOURCES:** For Manhattan, Statewide Planning and Research Cooperative System (SPARCS), 1999–2001; for Paris, Programme de médicalisation des systèmes d'information (PMSI), 1999–2001.
**NOTE:** Age-adjusted rates per 1,000 population age 18 and older.

veal a statistically significant, but very small, influence for age, indices of severity of illness, and number of physicians per 1,000 population, while being female decreases the odds of admission for an AHC by about 30 percent. The neighborhood income and education variables are not significant in Paris (Exhibit 5).

In Manhattan, as in Paris, females have much lower odds of admission for AHCs. There are also statistically significant, but very small, influences for age, number of diagnoses, the density of physicians, and education. The percentage of households that are "linguistically isolated" is not significantly related to discharges for AHCs (Exhibit 5).

In Manhattan, the relationships among median household income, by ZIP code of residence, race, and insurance status on AHCs, are statistically significant and

**EXHIBIT 4**
**Hospital Discharges For Avoidable Hospital Conditions (AHCs), Marker Conditions, And Referral-Sensitive Procedures In Neighborhoods With Above- And Below-Median Incomes, Manhattan And Paris, 1999–2001**

| | AHCs | | Marker conditions | | Referral-sensitive procedures | |
|---|---|---|---|---|---|---|
| | Manhattan | Paris | Manhattan | Paris | Manhattan | Paris |
| Above-median income | 15.6 | 7.4 | 6.2 | 4.6 | 7 | 6.2 |
| Below-median income | 28.7 | 9.2 | 6.2 | 4.8 | 5.5 | 6.1 |
| Percent difference | −56% | −20% | 0% | −4% | 21% | 2% |
| *z* scores | 50.3*** | 12.8*** | 0.17 | 1.8 | −10.9*** | −0.74*** |

**SOURCES:** For Manhattan, Statewide Planning and Research Cooperative System (SPARCS), 1999–2001; for Paris, Programme de médicalisation des systèmes d'information (PMSI), 1999–2001.
**NOTE:** Age-adjusted rates per 1,000.
***$p < .01$

**EXHIBIT 5**
**Logistic Regression Results For Characteristics Associated With Avoidable Hospital Condition (AHC) Admissions (Dependent Variable) In Paris And Manhattan, Population Age 18 And Older, 1999–2001**

| | Paris, population age 18 and older | | |
|---|---|---|---|
| **Independent variable** | **Coefficient (SE)** | ***p*** **> \|z\|** | **Odds ratio (95% CI)** |
| Age (continuous) | 0.0169 (0.0003) | .000 | 1.0171 (1.0164, 1.0176) |
| Female (omitted = male) | −0.3562 (0.0104) | .000 | 0.7005 (0.6863, 0.7149) |
| Income quartile of *arrondissement* (omitted = highest) | | | |
| Lowest | 0.0243 (0.0244) | .320 | 1.0246 (1.0058, 1.0101) |
| Second | 0.0229 (0.0188) | .226 | 1.0231 (0.9766, 1.0748) |
| Third | −0.0091 (0.0184) | .621 | 0.9909 (0.9558, 1.0273) |
| *Arrondissement* with more than 40% adult population without a baccalaureate degree | 0.02759 (0.0157) | .079 | 1.0279 (0.9967, 1.0601) |
| Number of diagnoses on record (continuous) | 0.0829 (0.0018) | .000 | 1.0865 (1.0826, 1.0904) |
| French IGS-2 index of severity for Paris (continuous) | 0.0089 (0.0005) | .000 | 1.0089 (1.0078, 1.0101) |
| Physicians per 1,000 *arrondissement* population | −0.0118 (0.028) | .000 | 0.9882 (0.9827, 0.9937) |
| | **Manhattan, population age 18 and older** | | |
| Age (continuous) | 0.0231 (0.0003) | .000 | 1.0234 (1.0227, 1.0239) |
| Female (omitted = male) | −0.1244 (0.0015) | .000 | 0.8830 (0.8673, 0.8990) |
| Race/ethnicity (omitted = white) | | | |
| Black | 0.2528 (0.0144) | .000 | 1.2876 (1.2518, 1,3243) |
| Hispanic | 0.3275 (0.0144) | .000 | 1.4691 (1.4282, 1.5112) |
| Other race | 0.1147 (0.0139) | .000 | 1.1215 (1.0915, 1.1225) |
| Income quartile of ZIP code (omitted = highest) | | | |
| Lowest | 0.3605 (0.0205) | .000 | 1.4340 (1.3776, 1.4928) |
| Second | 0.2437 (0.0186) | .000 | 1.2760 (1.2305, 1.3233) |
| Third | 0.1384 (0.0163) | .000 | 1.1485 (1.1123, 1.1859) |
| Number of diagnoses on record (continuous) | 0.0231 (0.0003) | .000 | 1.0240 (1.0209, 1.0272) |
| Insurance status (omitted = private insurance) | | | |
| Medicare | 0.1884 (0.0154) | .000 | 1.2073 (1.1714, 1.2444) |
| Medicaid | 0.3275 (0.0149) | .000 | 1.3875 (1.3473, 1.4288) |
| Uninsured | 0.5963 (0.0210) | .000 | 1.8155 (1.7422, 1.8919) |
| Other government programs[a] | 0.3327 (0.0210) | .000 | 1.3836 (1.2822, 1.4930) |
| ZIP code with more than 15% households linguistically isolated (dummy) | −0.0125 (0.0154) | .420 | 0.9876 (0.9582, 1.0179) |
| ZIP code with more than 40% adult population not high school graduates | 0.0515 (0.0186) | .006 | 1.0528 (1.0151, 1.0919) |
| Physicians per 1,000 ZIP code populations | −0.0015 (0.00078) | .0460 | 0.9985 (0.9970, 0.9999) |

**SOURCES:** For Manhattan, Statewide Planning and Research Cooperative System (SPARCS), 1999–2001; for Paris, Programme de médicalisation des systèmes d'information (PMSI), 1999–2001.

**NOTES:** SE is standard error. CI is confidence interval.

[a] For example, CHAMPUS/Tricare, prison, or another public source.

large. The odds of AHC discharges are about 29 percent higher among blacks and 47 percent higher among Hispanics than whites. The odds of AHC discharges for uninsured people are about 82 percent greater than for people with private insurance. The odds are 39 percent higher among Medicaid recipients and 21 percent higher among Medicare beneficiaries than among people with private coverage.

■ **Limitations of analysis and alternative explanations.** We cannot account directly for any effect of differences in disease prevalence on discharge rates for AHCs, but previous research suggests that this is unlikely to explain the differences we observed. For example, Ady Oster and Andrew Bindman argue that higher discharge rates for AHCs among African Americans and Medicaid patients do "not appear to be explained by either the differences in disease prevalence or disease severity."[23] Similarly, James Laditka and colleagues find that higher discharge rates for AHCs among African Americans and Hispanics, compared with non-Hispanic whites, are not attributable to differences in disease prevalence.[24] The notion that underlying prevalence of disease is unlikely to explain differences in these rates is reinforced further by the work of John Wennberg, who finds that population illness rates do not explain hospitalization rates.[25]

Similarly, the race and insurance effects we observed in Manhattan and the sex effects noted for both cities could be the result of patients' compliance or care-seeking behavior. It is also possible that physicians' behavior influences these rates.[26] Despite this concern, others suggest that physician practice style is unlikely to explain the differences we observed.[27] Our data did not permit us to test these alternative hypotheses.

Finally, although our use of dummy variables is an accepted technique when both individual and group-level variables are included in the same model, we plan to refine this analysis by using multilevel modeling in future work on Manhattan and inner London.[28]

## Summary And Policy Implications

In Manhattan and Paris, AHCs are related to neighborhood-level income. Women have much lower odds of being admitted to a hospital for AHCs in both cities, which is consistent with well-known sex differences in the use of ambulatory care—higher among women than men.[29]

Despite these similarities, Manhattan stands out in comparison to Paris. Although age-adjusted discharge rates for marker conditions are only slightly higher, age-adjusted rates of discharge for AHCs are more than two and a half times as high in Manhattan as in Paris. Since the aggregate discharge rate is higher in Paris (Exhibit 1), this is striking. Our findings therefore provide strong evidence that the health care system in Paris, which provides better access to primary care, performs better in terms of admitting far fewer patients for AHCs.

Also, although AHCs are related to neighborhood-level income in both cities, the magnitude of the disparity among high- and low-income neighborhoods is higher by a factor of two in Manhattan than in Paris. The findings from our analysis of Manhattan data are consistent with those of other studies and suggest that the higher rates of AHCs in Manhattan are explained by multiple barriers to care, including race and ethnicity, income of residence, sex, and insurance status. Medicare beneficiaries, Medicaid recipients, and the uninsured are all more likely than

the privately insured to be hospitalized for AHCs. Blacks and Hispanics are also more likely to be hospitalized for AHCs than non-Hispanic whites.

Because of inadequate insurance coverage in the United States, lack of timely, effective primary care often results in unnecessary illness, loss of productivity, and costly hospitalizations. It is difficult to quantify the magnitude of unnecessary illness and loss of productivity. But our analysis documents some important consequences of access barriers in a city known for its strong health care safety net. In Manhattan, the magnitude of AHCs is considerably higher than in Paris, where all residents benefit from an NHI system that has effectively eliminated financial barriers to care. Although our findings suggest that insurance is only one of several barriers to care in Manhattan, it is clearly an important one.

Often, we assume in the United States that the existence of public hospitals, community health centers, and other safety-net institutions enables the uninsured to obtain the care they need.[30] An important implication of our analysis is that we should not devote disproportionate attention to strengthening the health care safety net at the expense of extending health insurance coverage.[31]

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## NOTES

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16. The Weissman definition includes the following conditions: pneumonia, congestive heart failure, asthma, cellulitis, perforated or bleeding ulcer, pyelonephritis, diabetes with ketoacidosis or coma, ruptured appendix, malignant hypertension, hypokalemia, immunizable conditions, and gangrene. J.S. Weissman, C. Gatsonis, and A.M. Epstein, "Rates of Avoidable Hospitalization by Insurance Status in Massachusetts and Maryland," *Journal of the American Medical Association* 268, no. 17 (1992): 2388–2394. Studies validating this definition include L. Backus et al., "Effect of Managed Care on Preventable Hospitalization Rates in California," *Medical Care* 40, no. 4 (2002): 315–324; Pappas et al., "Potentially Avoidable Hospitalizations"; and Parchman and Culler, "Primary Care Physicians and Avoidable Hospitalizations."
17. Billings et al., "Recent Findings."
18. R.J. Klein and C.A. Schoenborn, "Age Adjustment using the 2000 Projected U.S. Population," Healthy People Statistical Notes 20 (Atlanta: Centers for Disease Control and Prevention, January 2001).
19. We ran separate regression equations, instead of pooling the hospital data and including a dummy variable for each city, because we did not have identical covariates for each city. The PMSI does not include information about payer or race/ethnicity.
20. The French baccalaureate degree is the U.S. equivalent of completing high school and a first year of college.
21. In addition to examining models with dummy variables, we used STATA (version 8) to examine the variance inflation factor (VIF), as a test of collinearity (STATA command: collin). Since the VIF is less than 10 for all of our independent variables, we concluded that the correlations among them are not causing unacceptable biases. For further discussion of VIF, see W.H. Greene, *Econometric Analysis,* 4th ed. (Upper Saddle River, N.J.: Prentice-Hall, 2000).
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