Appendix A: List of Clinical Classification Software Diagnostic Categories Excluded from Calculation of HIV-Related Inpatient Days

| CCS Category | Description |
|---|---|
| 80 | Multiple sclerosis |
| 92 | Otitis media and related conditions |
| 120 | Hemorrhoids |
| 142 | Appendicitis and other appendiceal conditions |
| 170 | Prolapse of female genital organs |
| 171 | Menstrual disorders |
| 172 | Ovarian cyst |
| 173 | Menopausal disorders |
| 174 | Female infertility |
| 175 | Other female genital disorders |
| 176 | Contraceptive and procreative management |
| 177 | Spontaneous abortion |
| 178 | Induced abortion |
| 179 | Postabortion complications |
| 180 | Ectopic pregnancy |
| 181 | Other complications of pregnancy |
| 182 | Hemorrhage during pregnancy; abruptio placenta; placenta previa |
| 183 | Hypertension complicating pregnancy; childbirth and the puerperium |
| 184 | Early or threatened labor |
| 185 | Prolonged pregnancy |
| 187 | Malposition; malpresentation |
| 188 | Fetopelvic disproportion; obstruction |
| 189 | Previous C-section |
| 190 | Fetal distress and abnormal forces of labor |
| 191 | Polyhydramnios and other problems of amniotic cavity |
| 192 | Umbilical cord complication |
| 193 | OB-related trauma to perineum and vulva |
| 194 | Forceps delivery |
| 195 | Other complications of birth; puerperium affecting management of mother |
| 196 | Normal pregnancy and/or delivery |
| 203 | Osteoarthritis |
| 204 | Other non-traumatic joint disorders |
| 205 | Spondylosis; intervertebral disc disorder |
| 206 | Osteoporosis |
| 207 | Pathological fracture |
| 208 | Acquired foot deformities |
| 209 | Other acquired deformities |
| 210 | Systemic lupus erythematosus and connective tissue disorders |
| 212 | Other bone disease and musculoskeletal deformities |

213 Cardiac and circulatory congenital anomalies
214 Digestive congenital anomalies
215 Genitourinary congenital anomalies
216 Nervous system congenital anomalies
221 Respiratory distress syndrome
222 Hemolytic jaundice and perinatal jaundice
223 Birth trauma
224 Other perinatal conditions
225 Joint disorders and dislocations; trauma-related
226 Fracture of neck of femur (hip)
227 Spinal cord injury
228 Skull and face fractures
229 Fracture of upper limb
230 Fracture of lower limb
231 Other fractures
232 Sprains and strains
233 Intracranial injury
234 Crushing injury or internal injury
235 Open wounds of head; neck; and trunk
236 Open wounds of extremities
217 Other congenital anomalies
218 Liveborn
219 Short gestation; low birth weight; and fetal growth retardation
220 Intrauterine hypoxia and birth asphyxia
239 Superficial injury; contusion
240 Burns
2603 E Codes: Fall

## Appendix B: Unit Cost Calculations

**Inpatient Costs per Day.** Medical record data do not contain expenditure information, and most patients cannot accurately report the costs of their care. Consequently, we obtained inpatient cost information from the Healthcare Expenditure and Utilization Project (HCUP) State Inpatient Database (SID), which contains hospital discharge abstract data covering inpatient stays from all short-term non-federal community hospitals in participating states. SID data include primary and all secondary diagnoses for each inpatient stay, the length of stay (LOS, calculated as the difference between the admission and discharge date) and the total charges for the hospitalization. We used data for calendar year 2006 from 10 states: California, Colorado, Florida, Iowa, Illinois, Kansas, Maryland, New Jersey, New York, and Washington.

We identified HIV-related hospitalizations in patients who were $\geq$ 18 years old at admission by examining all primary and secondary diagnoses listed in the discharge abstract. All hospitalizations with a primary or secondary International Classification of Diseases, ninth edition (ICD-9 CM) diagnosis codes that included 042.0 through 044.9, inclusive, were selected as HIV-related hospitalizations.

Hospital charges for each admission were converted to expenditures by multiplying by an inpatient expenditure-to-charge (ICC) ratio.[1] All-payer hospital-specific ICC ratios were based on data from standard accounting files of the Centers for Medicare and Medicaid Services. If a hospital-specific ICC was not available, then a group average ICC was used, where the grouping was based on the hospital's state, ownership, urban or rural location, and size. The group average ICC was used for 19% of the admissions, and the hospital-specific ICC was used for the rest.

For 84,906 HIV-related admissions in the SID with data available for total charges and LOS, the mean expenditure per day was $2,014.66. Total inpatient expenditures were obtained by multiplying the number of inpatient days between enrollment and December 31, 2007 by the mean daily expenditure.

**Pharmaceutical Costs.** Price discounts for medications are available to certain entities. For example, AIDS Drug Assistance Programs (ADAPs) can purchase drugs using the 340B Drug Pricing Program, which provides drug price ceilings.[2] The Congressional Budget Office estimated that the 340B ceiling price averaged 51% of the average wholesale price in 2003, although this estimate was not focused on antiretroviral medications.[3] Not all state ADAPs take advantage of 340B prices, however. [2] Prices for specific drugs under the 340B program are not publicly available.

Computation of monthly costs for each medication was based on 2006 Red Book average wholesale price (AWP). It is recognized that the AWP overestimates the actual pharmaceutical costs. A report by the Office of the Inspector General for the Department of Health and Human Services[4] compared AWP to the average manufacturer's price (AMP), which is the average unit price paid to manufacturers by wholesalers for retail drugs, calculated from actual sales transactions. For single source brands, at the median the AMP was 23% less than the AWP; for generic drugs, the AMP was 70% less than the AWP at the median. We discounted the published AWP by 23% for all ARV/OI Px medications, as most are not available in generic form. (Zidovudine is available generically, but is rarely prescribed by itself.) For sulfamethoxazole/trimethoprim and azithromycin, which are available in generic form, we used monthly costs of $9.91 and $112.18, respectively. We assumed that standard dosages were prescribed. The discounted monthly expenditure was multiplied by the number of months a patient was prescribed the medication, between enrollment date and December 31, 2007. These products were then summed across drugs for each patient to obtain total ARV and OI Px medication expenditures.

**Outpatient Visit Expenditures.** The estimated unit cost for an outpatient visit with the HIV primary care provider was based on the Medicare national Physician Fee Schedule for 2006.[5] The facility unit cost for an outpatient visit was based on CPT-4 code 99215, for the most complex level of patient evaluation and management. Unit costs ranged from $91.72 to $107.97

per visit, depending on the geographic location of the clinic. We multiplied the number of visits by the cost per visit to obtain total outpatient visit expenditures between enrollment and 2007.

**Laboratory Expenditures.** We used $38 as the cost of a CD4 test and $90 as the cost of an HIV-1 RNA test. These prices were based on reimbursement rates established by the Ryan White CARE Act in one site.

**Total Expenditures.** We summed outpatient, inpatient, ARV, OI Px, CD4, and HIV-1 RNA expenditures to obtain total expenditures between enrollment and 2007 for each patient.

Expenditure estimates were based on unit expenditures of services or discounted prices of medications. The unit expenditures are themselves estimates and may only approximate true opportunity costs. Variations in the intensity of inpatient treatment or the length of outpatient visits, which could affect expenditures, were not incorporated into the analyses.

**References**


1. Friedman B, Basu J. The rate and cost of hospital readmissions for preventable conditions. Med Care Res Rev 2004;61:225-240.
2. U.S. Department of Health and Human Services, Office of Inspector General. AIDS Drug Assistance Program Cost Containment Strategies. September, 2000. (OEI-05-99-00610).
3. Congressional Budget Office. Prices for brand-name drugs under selected Federal programs. June, 2005.
4. Office of Inspector General DHHS. Medicaid Drug Price Comparisons: Average manufacturer price to published prices. June, 2005. OEI-05-05-00240
5. Centers for Medicare and Medicaid Services. Physician Fee Schedule Search. http://www.cms.hhs.gov/PFSlookup/02_PFSSearch.asp. Accessed July 21, 2009.

Appendix C: Sensitivity Analyses

The main analyses removed any patient with the first HIV-1 RNA test after enrollment $\leq$ 400, assuming that they had all received HIV care prior to HIVRN enrollment. To check the sensitivity of the results to this assumption, we repeated analyses including 2,368 additional patients with viral suppression and complete data, but no other evidence of service receipt prior to enrollment. Separately, we repeated analyses including 1,236 patients who met all inclusion criteria but had intermittent years out of care. Third, we examined the impact of adopting a more inclusive definition of "in care" in a year: either $\geq$1 outpatient visit or $\geq$1 CD4 test (instead of both). Fourth, late presenters may be diagnosed with HIV during an inpatient episode, and differences in inpatient use may account for expenditure differences. We checked whether the pattern of expenditures changed if inpatient costs were excluded from cumulative expenditures. Finally, we removed data for 731 patients known to have died, to examine whether relatively high end-of-life expenditures contribute to differential expenditures. The table below reports observed mean expenditures, by initial CD4 and number of years in care, for each of these analyses.

Mean HIV Treatment Expenditures, by CD4 Cell Count at Entry and Number of Years in Care: Sensitivity Analyses

| Years in Care (Y) | CD4<201 | CD4 201-350 | CD4 351-500 | CD4 > 500 |
|---|---|---|---|---|
| $Y \leq 1$ | $36,901 | $16,260 | $11,608 | $10,305 |
| | 37,057 | 15,465 | 11,279 | 9,829 |
| | 33,962 | 13,341 | 9,090 | 9,485 |
| | 13,498 | 9,421 | 5,872 | 5,814 |
| | 31,129 | 14,551 | 9,437 | 9,130 |
| $1 < Y \leq 2$ | 47,476 | 28,231 | 21,335 | 18,655 |
| | 48,583 | 26,622 | 18,806 | 15,668 |
| | 44,283 | 22,476 | 15,355 | 13,417 |
| | 22,914 | 16,573 | 11,756 | 7,607 |
| | 42,017 | 25,153 | 16,389 | 14,278 |
| $2 < Y \leq 3$ | 62,731 | 40,081 | 32,046 | 25,656 |
| | 63,471 | 40,346 | 27,044 | 23,430 |
| | 61,091 | 35,910 | 22,822 | 18,401 |
| | 36,651 | 26,366 | 20,726 | 15,692 |
| | 57,730 | 35,956 | 25,272 | 19,902 |
| $3 < Y \leq 4$ | 74,062 | 51,565 | 41,877 | 34,573 |
| | 75,502 | 53,130 | 36,306 | 29,460 |
| | 70,673 | 49,089 | 32,746 | 24,923 |
| | 48,582 | 41,279 | 26,775 | 20,182 |
| | 68,268 | 47,756 | 35,784 | 24,633 |
| $4 < Y \leq 5$ | 91,318 | 64,118 | 54,639 | 39,831 |
| | 93,467 | 65,517 | 52,056 | 33,169 |
| | 88,589 | 59,889 | 46,911 | 36,006 |
| | 62,346 | 51,401 | 39,330 | 23,182 |
| | 85,616 | 64,305 | 53,072 | 28,847 |
| $5 < Y \leq 6$ | 103,484 | 81,695 | 74,085 | 50,564 |
| | 103,692 | 80,750 | 66,243 | 44,606 |
| | 101,240 | 76,987 | 64,173 | 38,124 |
| | 72,727 | 66,098 | 50,697 | 32,411 |
| | 100,414 | 76,421 | 62,705 | 43,448 |
| $6 < Y \leq 7$ | 115,506 | 96,949 | 78,287 | 70,919 |
| | 117,760 | 94,262 | 75,668 | 61,206 |
| | 115,122 | 89,324 | 74,239 | 52,146 |
| | 85,937 | 79,773 | 59,488 | 40,558 |
| | 117,315 | 93,192 | 76,031 | 53,202 |
| $7 < Y \leq 8$ | 137,127 | 113,838 | 90,855 | 80,016 |
| | 135,827 | 112,432 | 89,871 | 86,721 |
| | 130,733 | 107,457 | 81,282 | 74,616 |
| | 98,052 | 88,256 | 76,524 | 61,600 |
| | 135,900 | 112,432 | 88,297 | 86,721 |

First entry in each cell is mean, including patients with first HIV-1 RNA< 400 (n=10,716).
Second entry in each cell is mean, including patients with interruptions in care (n=9,584).
Third entry is mean, main analytic sample, re-defining "in care" criterion. (n=8,766)
Fourth entry is analytic sample, excluding inpatient expenditures (n=8,348).

Fifth entry is mean, excluding patients known to have died (n=7,617)