

PRHI Readmission Brief

Patterns of Hospitalizations Among HIV-Positive Patients in Southwestern Pennsylvania April 2012 Update

Introduction

The purpose of this Pittsburgh Regional Health Initiative (PRHI) Readmission Reduction Brief is to update and expand upon the July 2010 publication, *Readmission Brief II: Patterns of Hospital Admission and Readmission among HIV-Positive Patients in Southwestern Pennsylvania*.¹ This brief extends that analysis, not only by including an additional year of data, but by adding new analyses based on de-identified longitudinal patient data, enabling an examination of patterns of patient admissions over time. As with the initial brief, this update aims to provide information about reasons for hospital admissions and readmissions in order to inform quality improvement efforts among patients, providers, payers, and community-based organizations seeking to improve care for HIV-positive people in southwestern Pennsylvania (SWPA).

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I. Methods

This observational study utilizes hospital discharge data as reported to the Pennsylvania Health Care Cost Containment Council (PHC4), an independent agency mandated by the Pennsylvania legislature in 1986 to collect a wide range of all-payer, inpatient data. It includes information on all admissions for patients 19 years and older who had at least one documented HIV hospital admission (ICD-9 code² 042 or v08) in any of 52 hospitals³ in the 11-county SWPA region⁴ between October 1, 2007-September 30, 2009.

Analyses were performed on two separate data sets specific to HIV-positive patients. Group One, referred to as “admission view data,” provides information on all 2,040 admissions for individuals with HIV, noting that some of the 909 unique patients will have had more than one admission. Group Two, referred to as “patient view data” examines the pattern of all-cause admissions and readmissions over time among all 909 (de-identified) HIV-positive patients.

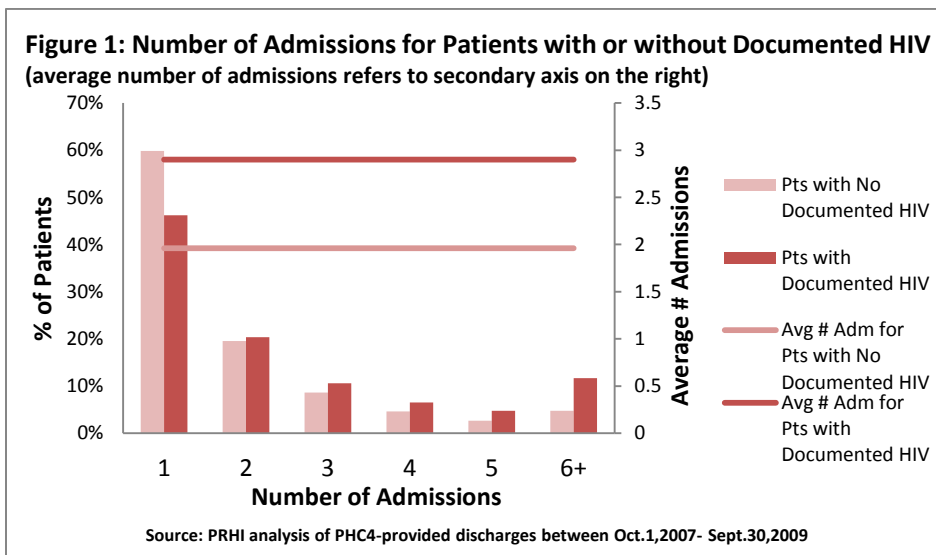
	Group One: Admissions View	Group Two: Patient View
Description	All admissions with ICD-9 of 042 or v09	All all-cause admissions for patients who had at least one HIV admission in 24 months.
Number	2,040 HIV admissions	909 patients with 2,638 all-cause admissions ⁵

II. Characteristics of HIV-Positive Patients

This section examines the characteristics of the 909 unique HIV-positive patients who were hospitalized at least once in the study’s two years. While they represent only 0.2% of the 442,257 patients hospitalized in the SWPA region and 0.3% of total admissions, their rates of admission and readmission point to the importance of identifying opportunities for improving care.

Characteristics of HIV-positive Patients vs. All SWPA Patients

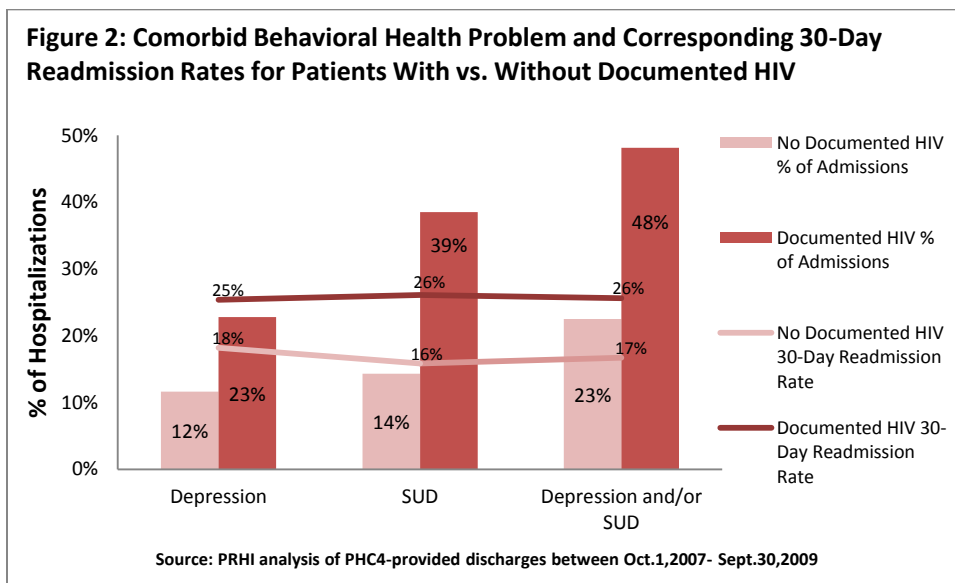
Figure 1 shows the differences between the number of admissions by patients *with* documented HIV, compared to the average among patients *without* documented HIV. On average, patients with documented HIV had three hospitalizations in the two-year timeframe compared to two hospitalizations for all other patients. Overall, approximately one in eight patients with HIV had six or more hospitalizations, compared to one in twenty patients without HIV.



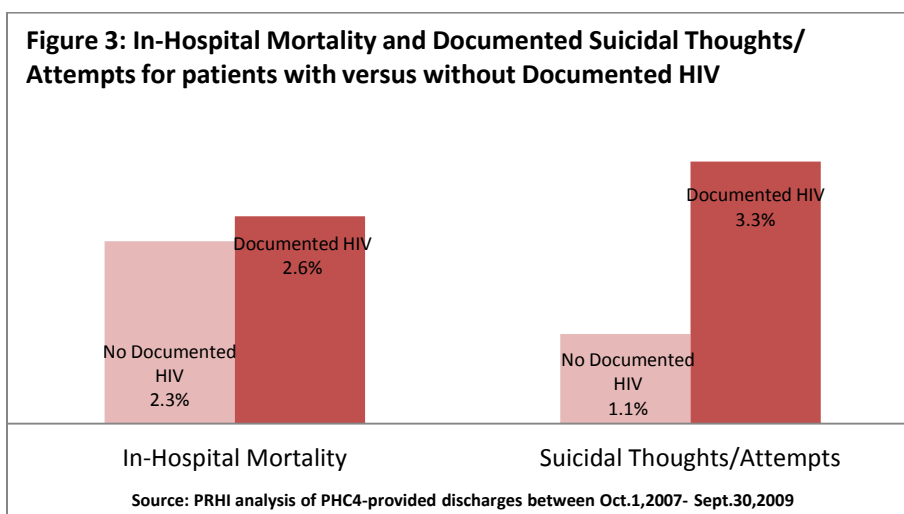
Brief II highlighted the high incidence of behavioral health comorbidities in HIV-positive patients. Figure 2 compares the incidence of depression and substance use disorders (SUD) in admissions of people with HIV compared to all other admissions and highlights the following differences:

- Nearly half of HIV-positive admissions have documented depression and/or SUD, compared to a quarter of non-HIV admissions ($p < 0.001$).
- The 30-day readmission rate for HIV-positive admissions was 26% compared to 17% for all non-HIV admissions ($p < 0.001$).

This difference varied only slightly when looking at the 30-day readmission rates for each of the behavioral conditions separately, as shown by the lines in Figure 2. While HIV-positive hospitalizations have relatively stable, albeit very high, 30-day readmissions, the non-HIV-positive hospitalizations tend to be lower for patients with comorbid SUD.

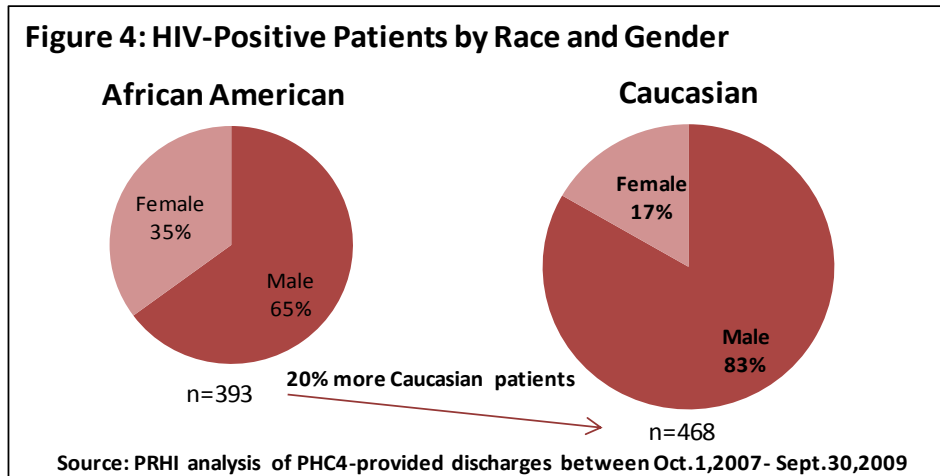


Two additional comparisons between HIV-positive admissions versus non-HIV-positive admissions are shown in Figure 3. In-hospital mortality is slightly higher for admissions of HIV-positive individuals than for non-HIV hospitalizations (though not statistically different), but the incidence of documented suicidal thoughts/attempts is more notable (statistically significant; $p < 0.001$).



Race, Gender and Age

Although the incidence of newly diagnosed HIV among African Americans in the U.S. is twice that of Caucasians,⁶ Figure 4 shows that more Caucasians than African Americans were hospitalized in southwestern PA. Males dominate in both racial groups, but HIV-positive Caucasians were more likely to be males (83%) than were African Americans (65% male). More than half of females (61%) were African Americans, while just 35% of Caucasians were female.⁷

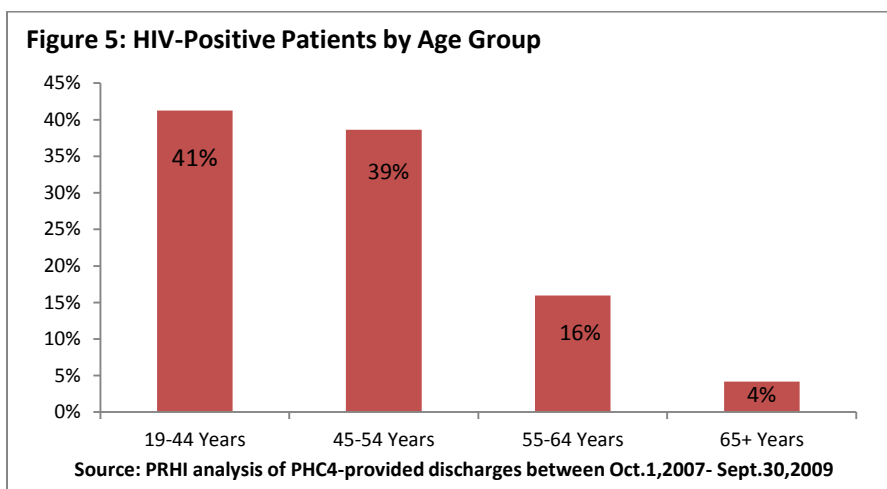


Compared to the regional population (Table 1), patients with documented HIV are much more likely to be African American males.

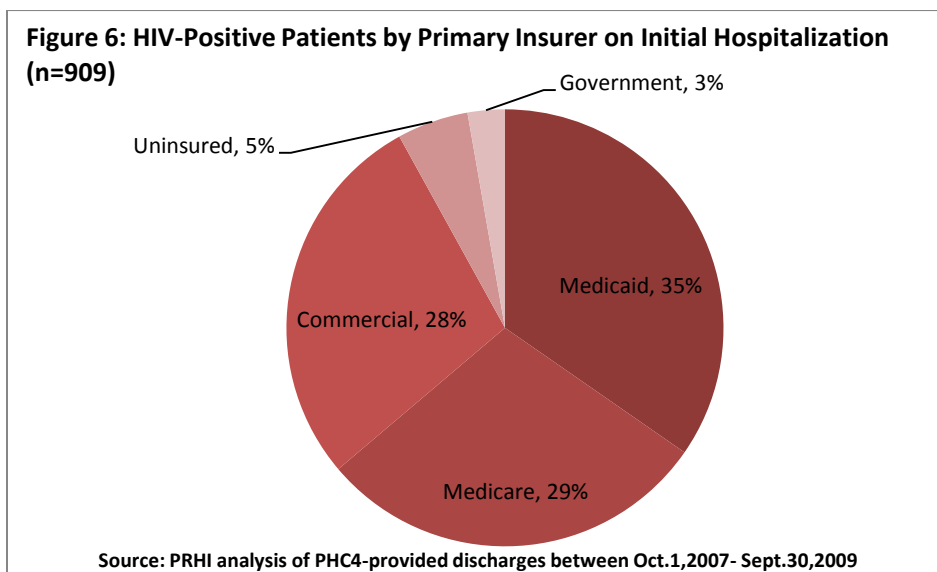
Table 1. Population Demographics

	PHC4 HIV-Positive Patient Data	Regional HIV population ⁸	Regional Population
Caucasian	51%	54%	90%
African American	43%	40%	8%
Female	25%	20%	52%
Total	909	3,000	1.2 million

Consistent with the evidence that HIV-positive patients are living longer, Figure 5 indicates that, while just over 41% of HIV-positive patients are less than 45 years of age, nearly the same proportion are between 45 and 54 years of age, and 20% are 55 or older.



Finally, Figure 6 depicts the primary insurer on the initial hospitalization for each HIV-positive patient in the two year time frame. Just over a quarter of patients have commercial insurance. The remainder are either uninsured or rely on a public insurer (Medicare, Medicaid, or government).



III. Common Diagnoses in Hospital Admissions of HIV-Positive Patients

Sections III and IV primarily use “Admissions View Data” to sort through the complexity of reasons for admissions and readmissions in order to identify the most prevalent diagnoses in HIV-positive admissions. The picture that emerges is one of extraordinarily complex patients – with conditions ranging from HIV-related infections, to common chronic diseases, to the side effects of mental illness, drug abuse, chronic diseases, and of side effects of the medications used to treat HIV itself.

Most Prevalent non-HIV Diagnoses

For each admission, a diagnostic ICD-9 code is provided for the principal reason the patient was hospitalized, and up to eight ICD-9 codes for comorbidities, or secondary diagnoses, present on that admission. Table 2 summarizes the most common conditions present in 10% or more of the 2,040 admissions of HIV-positive patients, other than HIV, which must be present on all⁹. (This list is slightly expanded from the earlier brief, which looked only at the top 10 comorbidities.) In order to provide a broad summary of the types of conditions present in this population, the ICD-9 codes (up to 5 digits) were condensed to ICD-9 code group (the first 3 digits). Since it is possible for several codes within one code group to be present on any admission (for example, nondependent alcohol use and tobacco use are part of the same code group), each code group was counted once per admission. It is also important to note that since it is possible to record up to nine diagnoses per admission, patients may have one or more of the conditions listed in Table 2.

Table 2: Most Prevalent (non-HIV) Diagnoses of HIV-Positive Patients

Most Prevalent Principal or Secondary Diagnoses (by ICD-9 code groups)	Number of Hospitalizations	Percent of Hospitalizations
1. Nondependent abuse of drugs	601	29%
2. Viral hepatitis	449	22%
3. Disorders of fluid, electrolyte, and acid-base balance	448	22%
4. Essential hypertension	416	20%
5. Episodic mood disorders (previously called Affective Psychoses)	272	13%
6. Diabetes mellitus	259	13%
7. Depressive disorder, not elsewhere classified	249	12%
8. Diseases of esophagus	240	12%
9. Other and unspecified anemias	226	11%
10. Chronic kidney disease	220	11%
11. Drug dependence	211	10%

The most common ICD-9 code groups identified in Table 2 include:

- *Nondependent abuse of drugs*: Present on 29% of hospitalizations, this category applies to a broad range of diagnoses, from misuse of habit-forming medications, to tobacco and alcohol abuse.
- *Viral hepatitis*: Present on 22% of hospitalizations of HIV-positive patients in SWPA, this diagnosis is consistent with the fact that approximately 30% of HIV-infected patients in the United States are co-infected with the *Hepatitis C* virus and about 8% are co-infected with *Hepatitis B*.^{10,11}
- *Disorders of fluid, electrolyte and acid-base balance*: Present on 22% of hospitalizations, this diagnosis often relates to clinical dehydration. Nausea and vomiting are common symptoms in HIV-positive patients, and may be a marker of intolerance to HIV medications,¹² among other reasons.
- *Essential hypertension (20%), Diabetes mellitus (13%), and Chronic kidney disease (11%)*. While the older age of HIV-positive patients may be associated with increased risk of these chronic conditions, the HIV infection has been shown to increase the risk of non-AIDS-related cardiovascular disease, renal disease, liver disease, and malignancies.¹³ Further, renal failure can be related to HIV nephropathy or a side effect from medication. Similarly, *Diabetes* in HIV-positive patients may be a long-term side effect of certain AIDS medications, especially protease inhibitors.¹⁴

Highlighting Variations from Brief I: Adding an additional year of data to *Readmission Brief II* resulted in a few changes. *Other and unspecified anemias*, currently the ninth most common comorbidity, did not make the top 10 in the initial brief. In addition, *Episodic mood disorders*, which includes diagnoses such as bipolar disorder, manic disorders, and major depressive disorders, went from the tenth most common comorbidity to the fifth most common comorbidity with the addition of another year of data.

Behavioral Health Comorbidities

As seen in Table 2, mental health diagnoses and substance use disorders (SUD) make up four of the top 11 most prevalent diagnoses. This is not surprising given the prevalence of depression (23%) and SUD (39%) among patients with HIV (see Figure 2 above). In this section, we widen our examination by looking at the prevalence of behavioral health comorbidities in the presence of the seven most common non-behavioral health diagnoses.¹⁵ For the purposes of this analysis, comorbid depression includes major depressive disorders, depressive disorders not elsewhere classified, and dysthymic disorders; SUD

includes alcohol dependence, drug dependence, and nondependent abuse on drugs. Table 3 provides the percentage of hospitalizations in which the patient had comorbid depression and/or SUD for each of the seven most prevalent non-behavioral health diagnoses.

Table 3: Behavioral Health Comorbidities by Most Prevalent Diagnoses

Most Prevalent Non-Behavioral Health Principal or Secondary Diagnoses (ICD-9 code groups)	Percent of Hospitalizations with Comorbid Depression	Percent of Hospitalizations with Comorbid SUD	Percent of Hospitalizations with Comorbid Depression and/or SUD
2. Viral hepatitis	25%	47%	56%
3. Disorders of fluid, electrolyte, and acid-base balance	17%	34%	44%
4. Essential hypertension	28%	38%	51%
6. Diabetes mellitus	21%	31%	42%
8. Diseases of esophagus	34%	35%	55%
9. Other and unspecified anemias	16%	28%	36%
10. Chronic kidney disease	13%	24%	34%
All 2040 HIV-Positive Hospitalizations	23%	39%	48%

Notable results include the following:

- Nearly half (47%) of admissions with *viral hepatitis* have documented SUD.
- More than one-third (34%) of admissions with *diseases of the esophagus* also have comorbid depression.
- Overall, almost half (48%) of all admissions involved patients with either documented comorbid depression and/or substance use disorder.

IV. Patterns of Hospital Admissions and Readmissions

This section identifies patterns of hospital admissions and readmissions for HIV-positive patients with the common diagnoses shown in Table 1, with particular attention to the following:

- 30-day and 12-month readmission rates
- Average number of days between hospitalizations
- Length of stay (LOS), total hospital charges, and estimated per day charges on the initial (or “index”) admission compared the 30-day and 12-month readmissions.
- In-hospital mortality

30-Day and 12-Month Readmission Rates

Readmissions within 30-days are often used as a marker for quality of care, as they may reflect poor care in the hospital or community and/or poor transitions of care. Table 4 shows both 30-day readmission rates and (to understand the frequency with which hospitalizations recur within a year) 12-month readmission rates¹⁶ for all admissions of HIV-positive patients, by most prevalent diagnoses.

Among the key findings for:

- 30-day readmission rates:
 - 26% of HIV-positive admissions were followed by a readmission within 30 days, compared to the SWPA region’s average 30-day readmission of 17%.

- Readmission rates varied by diagnosis on the index admission, and ranged from 23% (*Depressive disorder*) to 37% (*Chronic kidney disease*).
- 12-month readmission rates:
 - 64% of HIV-positive hospitalizations were followed by at least one additional hospitalization within 12 months (compared to 48% for all of SWPA).
 - The rate ranged from 60% (following hospitalizations for *Nondependent abuse of drugs*) to 84% (following hospitalizations for *chronic kidney disease*).

Table 4: Readmission Rates by Most Prevalent Principal or Secondary Diagnoses

Most Prevalent Principal or Secondary Diagnoses (ICD-9 code groups)	30-day Readmission Rate	12-Month Readmission Rate
1. Nondependent abuse of drugs	25%	60%
2. Viral hepatitis	32%	74%
3. Disorders of fluid, electrolyte, and acid-base balance	31%	68%
4. Essential hypertension	24%	62%
5. Episodic mood disorders	29%	70%
6. Diabetes mellitus	34%	76%
7. Depressive disorder, not elsewhere classified	23%	66%
8. Diseases of esophagus	32%	75%
9. Other and unspecified anemias	32%	62%
10. Chronic kidney disease	37%	84%
11. Drug dependence	34%	80%
All HIV Positive Hospitalizations	26%	64%

Readmissions by Race and Gender

Across the 2,040 HIV-positive hospitalizations of 909 patients, 26% were followed by a readmission within 30 days, and 64% were followed by a readmission within 12 months (Table 5). The following differences by race and gender stand out:

- 30-day readmissions rates:
 - Caucasian females were significantly more likely than African American females to be readmitted within 30 days (37% vs. 25%; $p=0.004$).
 - The opposite is true for males; African American males were significantly more likely than Caucasian men to be readmitted within 30 days (28% vs. 23%; $p=0.018$).
 - Caucasians females were significantly more likely than Caucasian males to be readmitted within 30 days (37% vs. 23%; $p<0.001$).
- 12-month readmission rates:
 - Overall, nearly seven out of ten African Americans were readmitted within 12-months compared to six out of ten Caucasians ($p=0.011$).
 - African American males were 25% more likely to be hospitalized within 12 months than Caucasian men (71% vs. 57%; $p<0.001$).
 - Among Caucasians, females were 30% more likely to be readmitted than males (74% vs. 57%; $p=0.001$).

Table 5: Readmission Rates by Race and Gender

Demographic Group	Overall Hospitalizations	30-Day Readmission Rate	12-Month Readmission Rate
Female	562	29%	67%
African American	320	25%	64%
Caucasian	226	37%	74%
Male	1,478	25%	62%
African American	707	28%	71%
Caucasian	712	23%	57%
Overall (all races)	2,040	26%	64%
African American	1,027	27%	69%
Caucasian	938	26%	61%

Readmissions by Hospital

There were 52 admitting hospitals in the SWPA region, but 42 hospitals had documented HIV admissions. While 42 hospitals in SWPA treated HIV-positive patients between October 1, 2007 and September 30, 2009, 84% of all admissions occurred at one of ten facilities (see Table 6). Both UPMC Presbyterian Shadyside and Allegheny General Hospital have affiliated HIV clinics, explaining the fact that more than half of these admissions occurred in their hospitals.

Table 6: Hospitalization and Readmission Rate Summary for the Ten Facilities with the most HIV-positive Hospitalizations

Facility Name	Numbers of Hospitalizations	Share of All HIV-Positive Hospitalizations	30-Day Readmission Rate	12-Month Readmission Rate
UPMC Presbyterian Shadyside	814	40%	29%	69%
Allegheny General Hospital	264	13%	23%	52%
UPMC Mercy	142	7%	36%	66%
Western Psychiatric Institute & Clinic	105	5%	26%	68%
Western Pennsylvania Hospital	81	4%	23%	58%
UPMC McKeesport	75	4%	21%	71%
Heritage Valley Beaver	69	3%	35%	79%
UPMC Braddock	61	3%	22%	67%
Magee-Womens Hospital of UPMC	50	2%	18%	50%
Jefferson Regional Medical Center	44	2%	23%	57%
All HIV-Positive Hospitalizations	2,040	100%	26%	64%

While risk-adjusting readmission rates is beyond the scope of this analysis, reasons for striking differences in readmission rates are worth exploring. Overall, 26% of hospital discharges are followed within 30 days by a readmissions; these rates range from a low of 18% at Magee-Womens to 36% at UPMC Mercy. The variation in rates is similar for 12-month readmission rates which ranged from 50% at Magee-Womens to 79% at Heritage Valley.

Readmissions by Insurer

Table 7, provides the 30-day readmission rate by primary payer across all of the 2,040 admissions. Readmission rates following hospitalizations in which Medicaid or Medicare was the primary payer were 30%, a third higher than 30-day readmission rates when commercial insurers were the primary payer.

The lower commercial 30-day readmission rate may be a reflection of the relative health of patients well enough to be working and qualifying for employer-purchased health insurance.

Table 7: Readmissions by Primary Payer for all HIV-Positive Hospitalizations

Primary Insurer Type	Numbers of Hospitalizations	Share of All HIV-Positive Hospitalizations	30-Day Readmission Rate	12-Months Readmission Rate
Medicaid	802	39%	30%	68%
Medicare	689	34%	30%	71%
Commercial	448	22%	19%	50%
Uninsured	62	3%	7%	39%
Government	38	2%	14%	47%

The very low uninsured readmission rate (7%) is worrisome and may point to a possible barrier to care. To explore this question, we used patient view data to compare individual patients' primary payer on their index hospitalization to that on their second hospitalization (Table 8), as the primary insurer may change from one admission to another. Specifically, a patient with commercial or no insurance on an initial hospitalization may later qualify for Medicaid and/or Medicare coverage for later hospitalizations. Patients under the age of 65 qualify for Medicare if they are "permanently disabled" due to an impairment that prevents them from working for a year or more, is expected to result in death, and if they have earned enough work credits to receive Social Security Disability Insurance (SSDI). Typically, after disability determination, someone with HIV (but without end-stage renal disease) must wait five months before receiving SSDI and 24 months before receiving Medicare coverage.¹⁷ Table 8 shows that, while almost a third of the patients (29%) remained uninsured on their second hospitalization, more than half of patients who were uninsured on their index admission transitioned to Medicaid on their second admission.

Table 8: Distribution of Primary Payer on Second Hospitalization based on Primary Payer from Initial Hospitalization (each row adds to 100%)

		Primary Payer on Second Hospitalization (489 Patients)				
		Medicaid	Medicare	Commercial	Uninsured	Government
Primary Payer on Index Hospitalization	Medicaid	88%	4%	7%	1%	0%
	Medicare	0%	95%	4%	0%	1%
	Commercial	12%	4%	85%	0%	0%
	Uninsured	54%	8%	8%	29%	0%
	Government	8%	0%	8%	8%	75%

Focusing on the 16% of patients who had five or more hospitalizations, all who were uninsured on their index admission had transitioned to either Medicaid or Medicare by their fifth hospitalization (see Table 9).

Table 9: Distribution of Primary Payer on Fifth Hospitalization based on Primary Payer from Initial Hospitalization (each row adds to 100%)

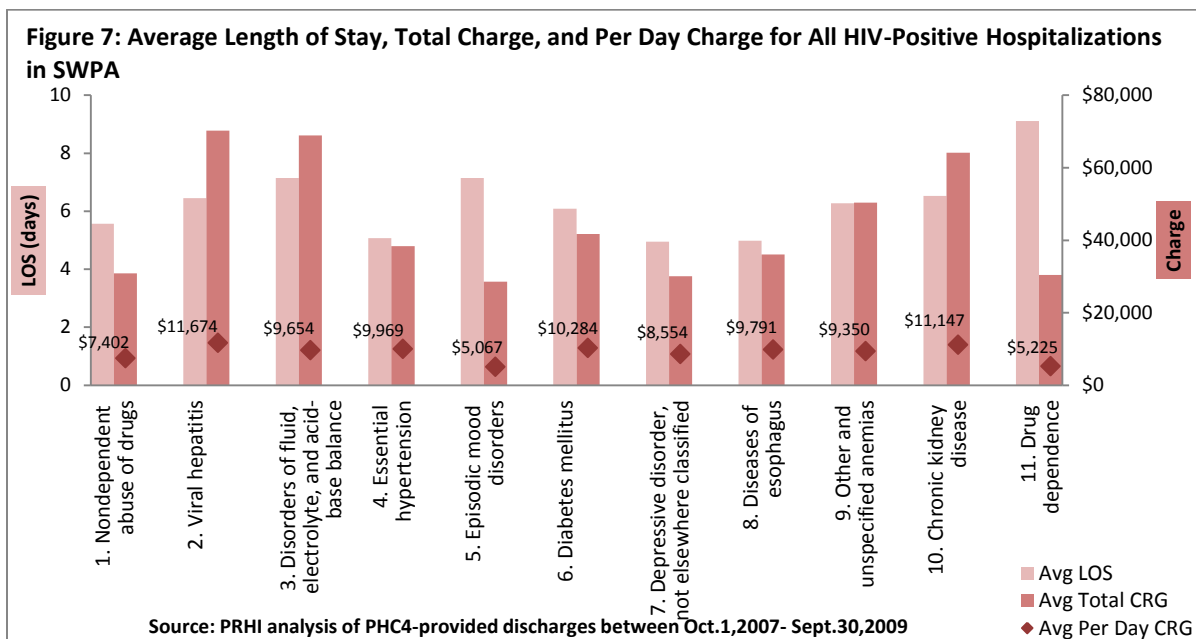
		Primary Payer on Fifth Hospitalization (149 Patients)				
		Medicaid	Medicare	Commercial	Uninsured	Government
Primary Payer on Index Hospitalization	Medicaid	84%	8%	8%	0%	0%
	Medicare	0%	94%	6%	0%	0%
	Commercial	36%	4%	57%	4%	0%
	Uninsured	75%	25%	0%	0%	0%
	Government	100%	0%	0%	0%	0%

Tables 8 and 9 also show that while 85% of patients with commercial insurance on their index admission continued to have commercial insurance on their second admission, this dropped to 57% on their fifth hospitalization, with most of the remaining patients shifting to Medicaid (36%) or Medicare (4%). These findings underscore the importance of evaluating need in the time period before a patient qualifies for public insurance.

Hospitalization Length of Stay, Total Charges, and Per Day Estimated Charges

To offer some perspective on the advantages to both patients and payers of reducing hospital readmissions, this section highlights the differences between patient length of stay (LOS) and hospital charges¹⁸ on initial hospitalizations compared to 30-day readmissions. Total charges represent the hospital's bill to insurers and not the amount the insurer actually pays. For this reason, it is important to focus not only on absolute charges, but on the relative differences between charges on admission and readmission.

Overall average LOS was 6.7 days, with an average total charge of \$56,982 and an average per day charge of \$10,134 for all 2,040 HIV-positive admissions. Figure 7 shows the LOS and charge summary for all HIV-positive admissions, by the most prevalent diagnoses. LOS ranged from five days (*Depressive disorder, not elsewhere classified*, and *Diseases of esophagus*) to nine days (*Drug dependence*). Total charges and average daily charges (noted as a diamond on the Total Charge bar) were lowest for *Episodic mood disorders* (\$28,563 average total charge and \$5,067 average per day charge estimate) and highest for *Viral hepatitis* (\$70,268 average total charge and \$11,674 average per day charge estimate).



Figures 8 through 10 compare LOS and average total charges on the 30-day readmission and the index admission of those 30-day readmissions (thereby excluding index admissions that are not followed by 30-day readmissions), by most prevalent diagnoses.

Figure 8 shows that LOS was 20% longer on the 30-day readmission than the admissions when *Nondependent abuse of drugs* was documented as a diagnosis. Similarly, *Chronic kidney disease* average LOS was 10% longer on the 30-day readmission. Conversely however, several diagnoses were associated with shorter readmissions, including *Drug dependence* (20% shorter stay on the 30-day readmit),

Depressive disorder not elsewhere classified (17% shorter LOS on the 30-day readmit), and *Disorders of fluid, electrolyte, and acid-base balance* (16% shorter LOS on the 30-day readmit).

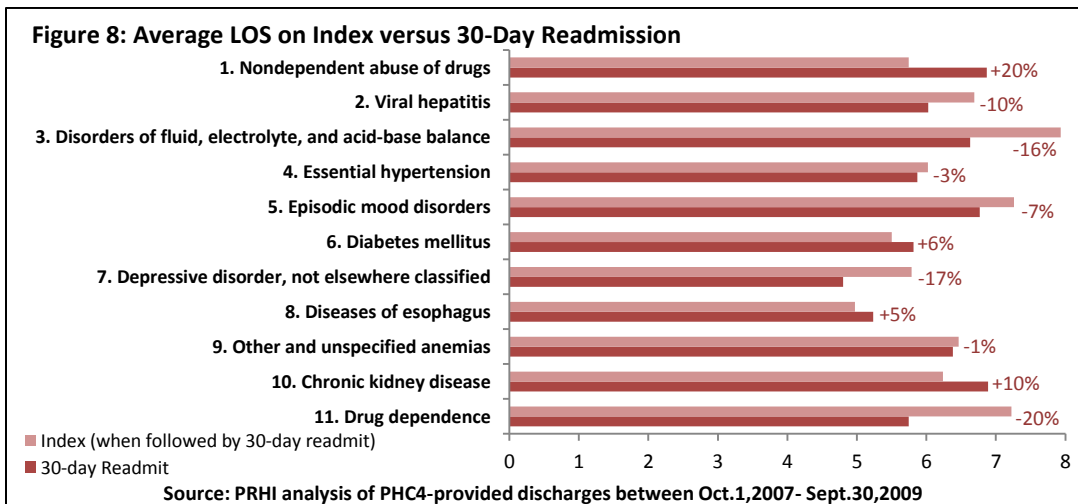


Figure 9 shows average total charge by condition for index and 30-day readmissions. The most striking difference was for documented *Disease of esophagus* which had a 73% higher average total charge on the 30-day readmission. *Depressive disorder not elsewhere classified* was associated with a 17% lower average total charge on the 30-day readmission.

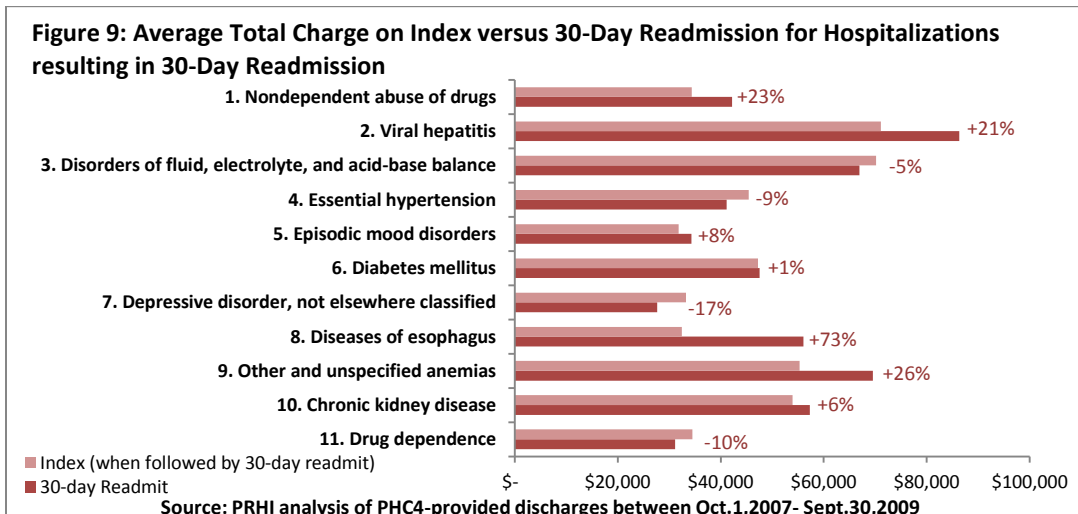
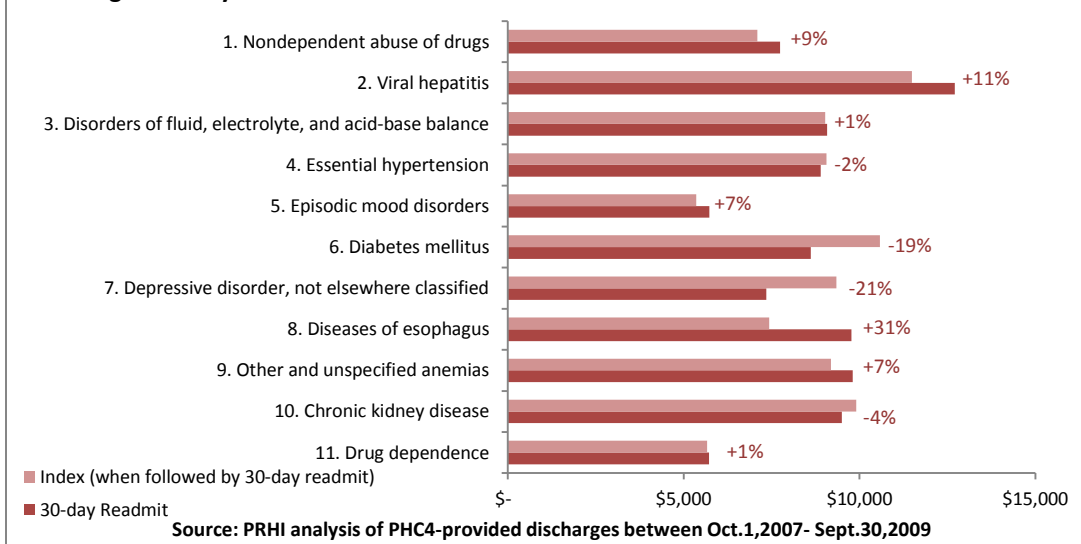


Figure 10 shows the pattern of average per day charge by condition for index and 30-day readmissions. The results in Figure 10 differ from Figure 9 for several conditions. Two conditions that showed a lower average total charge on 30-day readmission in Figure 9 show a higher average per day charge estimate: *Disorders of fluid, electrolyte, and acid-base balance* had 5% lower average total charge on 30-day readmission but 1% higher per day charge on 30-day readmission, and *Drug dependence* had a 10% lower average total charge on the 30-day readmission but a 1% higher average per day charge. Two conditions also showed the inverse relationship: *Diabetes mellitus* had average total charges that were 1% higher on the 30-day readmission but 19% lower average per day charge on the 30-day readmission, and *Chronic kidney disease* had a 6% higher average total charge on 30-day readmission but a 4% lower per day charge on the 30-day readmission. Other conditions differ in the difference between index and 30-day readmission, but they didn't change from positive to negative or vice versa.

Figure 10: Average Per Day Charge on Index versus 30-Day Readmission for Hospitalizations resulting in 30-Day Readmission



In-Hospital Mortality

Three percent all 2,040 HIV-positive hospitalizations documented an in-hospital mortality (compared to region-wide in-hospital mortality of 2%). Table 10 shows the percent of in-hospital deaths by comorbidity. *Disorders of fluid, electrolyte, and acid-base balance* was documented in 49% of all in-hospital deaths, much higher than any of the other top comorbidities.

Table 10: In-Hospital Mortality by Comorbidity

Most Prevalent Principal or Secondary Diagnoses (ICD-9 code groups)	Number of Hospitalizations	Share of All In-Hospital Mortalities
1. Nondependent abuse of drugs	7	13%
2. Viral hepatitis	11	21%
3. Disorders of fluid, electrolyte, and acid-base balance	26	49%
4. Essential hypertension	2	4%
5. Episodic mood disorders	3	6%
6. Diabetes mellitus	4	8%
7. Depressive disorder, not elsewhere classified	1	2%
8. Diseases of esophagus	0	0%
9. Other and unspecified anemias	5	9%
10. Chronic kidney disease	6	11%
11. Drug dependence	1	2%
All HIV-Positive Hospitalizations	53	100%

V. Opportunities for Reducing Hospitalizations

This section focuses on details of hospitalizations that may help clinicians and community providers to identify patients at high risk for readmission and to arrange appropriate support to prevent future readmissions. We look at diagnoses that are associated with significantly higher 30-day readmission rates and examine the timeframe following hospital discharge during which most readmissions occur. Finally, we explore the extent to which hospital providers are able to manage and coordinate patient care by examining the frequency in which patients are readmitted to the same facility from their

previous admission and the prevalence of patients not complying with medical treatment or leaving the hospital against medical advice – both latter conditions circumscribing provider control.

Flags for 30-Day Readmissions

Overall, 26% of HIV-positive hospitalizations resulted in a readmission within 30 days. To explore possible flags for 30-day readmissions, Table 11 compares the 30-day readmission rates for the hospitalizations with one of the most prevalent comorbidities to 30-day readmission rates for the hospitalizations when these comorbidities were absent. Seven of the 11 most common comorbidities were significantly more likely to be followed within 30 days by a readmission compared to hospitalizations without the comorbidity. These include: *Chronic kidney disease, Diabetes mellitus, Drug dependence, Viral hepatitis, Other and unspecified anemias, Diseases of the esophagus, and Disorders of the fluid electrolyte and acid-base balance.*

Table 11: Difference in 30-Day Readmissions in the Presence or Absence of the Top 11 Comorbidities

Most Prevalent Principal or Secondary Diagnoses (ICD-9 code groups)	30-Day Readmit when Comorbidity is Present	30-Day Readmit when Comorbidity is Absent	Comparison of 30-Day Readmission Rates
1. Nondependent abuse of drugs	25%	27%	Not significantly different (p=0.250)
2. Viral hepatitis	32%	25%	Readmit rate significantly higher when comorbidity present (p=0.001)
3. Disorders of fluid, electrolyte, and acid-base balance	31%	25%	Readmit rate significantly higher when comorbidity present (p=0.026)
4. Essential hypertension	24%	27%	Not significantly different (p=0.211)
5. Episodic mood disorders	29%	26%	Not significantly different (p=0.356)
6. Diabetes mellitus	34%	25%	Readmit rate significantly higher when comorbidity present (p=0.004)
7. Depressive disorder, not elsewhere classified	23%	27%	Not significantly different (p=0.153)
8. Diseases of esophagus	32%	26%	Readmit rate significantly higher when comorbidity present (p=0.045)
9. Other and unspecified anemias	32%	26%	Readmit rate significantly higher when comorbidity present (p=0.038)
10. Chronic kidney disease	37%	25%	Readmit rate significantly higher when comorbidity present (p<0.001)
11. Drug dependence	34%	25%	Readmit rate significantly higher when comorbidity present (p=0.009)

Days to Next Hospitalization

Table 12 shows the average number of days between discharge and readmission, by each of the top 11 comorbidities. Among 30-day readmissions, patients return to the hospital, on average, within just 12 days. The window of opportunity for preventing a 30-day readmission, therefore, occurs within the first two weeks post-discharge. Without an intervention to reduce readmissions, patients readmitted within a 12-month window will return on average within 3 months of the index admission.

Table 12: Average Number of Days to Next Hospitalization by Comorbidity

Most Prevalent Principal or Secondary Diagnoses (ICD-9 code groups)	Avg Number of Days to 30-Day Readmit	Avg Number of Days to 12-Month Readmit
1. Nondependent abuse of drugs	11.6	84.2
2. Viral hepatitis	11.8	79.3
3. Disorders of fluid, electrolyte, and acid-base balance	10.7	73.9
4. Essential hypertension	12.6	84.5
5. Episodic mood disorders	9.5	84.5
6. Diabetes mellitus	11.8	71.6
7. Depressive disorder, not elsewhere classified	11.5	90.4
8. Diseases of esophagus	11.7	94.5
9. Other and unspecified anemias	13.3	75.4
10. Chronic kidney disease	9.5	74.7
11. Drug dependence	11.8	68.5
All HIV-Positive Hospitalizations*	11.6	80.8

*2,040 HIV-positive hospitalizations in the sample for 30-day readmit; 1,072 HIV-positive hospitalizations in the sample for 12-month readmit

Dissecting the days to the next hospitalization further, Figure 11 shows the distribution of days to the 30-day readmission. Forty percent of the 30-day readmissions occur within 1 week of the initial hospitalization.

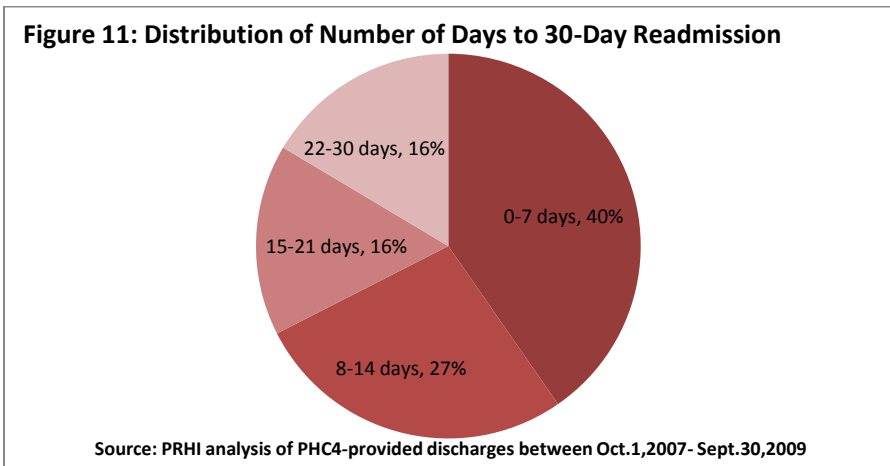
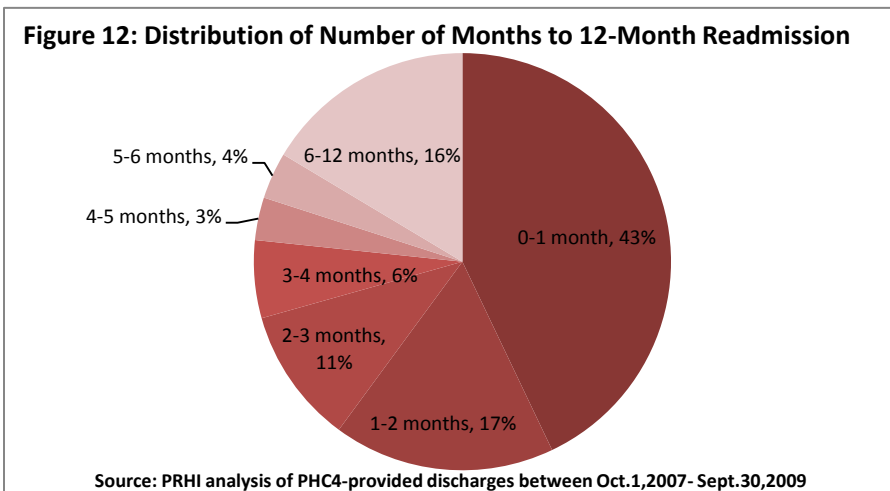


Figure 12 shows the distribution of months to the 12-month readmission. More than 70% of the 12-month readmissions occur within 90 days (3 months) of the initial hospitalization.



Limitations on Provider Ability to Influence Patient Outcomes

Working rapidly to prevent readmissions will require effective in-hospital flagging of patients most likely to be readmitted, better discharge planning and coordination across transitions of care, and productive provider-patient communication. This analysis notes some barriers to effective readmission reduction efforts. For example, in nearly one-third of hospitalizations that are followed by a readmission within 30 days, patients are readmitted to a different hospital than the one from which they were discharged. This means not only that the patient is likely to interact with a new set of clinicians, but that, without portable electronic health records, there are likely to be challenges in terms of care continuity and care coordination.

Patient choices may also limit the ability of providers to influence patient outcomes. For example, 5% of hospitalizations document “personal history of noncompliance with medical treatment presenting hazards to health” (ICD-9 code v1581). In a similar vein, Table 13 shows that in 3% of hospitalizations patients “left against medical advice” and almost 40% of those were readmitted in 30 days. Both may be seen as markers either for patients who are unable or unwilling to comply with a treatment regimen, and/or as a signal for poor patient-provider communication.

Table 13: Discharge Status for all HIV-Positive Hospitalizations

Discharge Status	Share of Hospitalizations	30-Day Readmission Rate	12-Month Readmission Rate*
Discharged Home	71%	26%	63%
Discharged Home with Home Health Care	10%	32%	70%
Discharged/Transferred to Nursing Facility	6%	29%	74%
Further Hospital-Related or Long-Term Care	6%	17%	59%
Left Against Medical Advice	3%	37%	69%
Patient Died During Hospitalization	3%	-	-
Discharged/Transferred to Psychiatric Hospital	1%	24%	38%
Discharged/Transfered to Hospice	1%	12%	17%
Discharged/Transferred to Another Type of Facility	0.2%	20%	100%

*includes initial hospitalizations from the initial four quarters only

Special Readmission Reduction Focus: Patients with Multiple Admissions

Among the 909 HIV-positive patients in the two years of data is a subset with especially high rates of hospitalization. This section focuses on the 26 patients with 12 or more hospitalizations in the 2 years of data. This averages to one hospitalization every other month for two years. While this subset represents just 3% of patients, they account for:

- 24% of all admissions
- 17% of cumulative hospital days
- 13% of cumulative total hospital charge

A serious effort to reduce the volume of readmissions among HIV-positive patients will benefit from a deeper understanding of the characteristics of this group of patients and targeted readmission reduction supports.

In order to understand the reasons for the initial hospitalization among the high utilizers, Table 14 shows their most common diagnoses compared to those of all HIV-positive patients – on their index admission.

Table 14. Most Prevalent Diagnoses on Index Admission

Most Prevalent Principal or Secondary Diagnoses Among the High Utilizers (ICD-9 code groups)	High Utilizers	All HIV-Positive Patients
Viral hepatitis	38%	19%
Nondependent abuse of drugs	35%	31%
Disorders of fluid electrolyte and acid-base balance	31%	20%
Chronic kidney disease	27%	7%
Pneumonia, organism not otherwise specified	19%	9%
Acute kidney failure	19%	9%
Drug dependence	15%	8%
Diabetes mellitus	15%	12%
Hypertensive chronic disease	15%	4%
Other forms of chronic ischemic heart disease	15%	7%
Chronic airway obstruction not elsewhere classified	15%	6%
Other disorders of urethra and urinary tract	15%	5%

Patients who went on to have 12 or more admissions were much more likely to have had the following (primary or secondary) diagnoses on their index admission: *Chronic kidney disease or Hypertensive chronic disease* (both almost 300% higher); *Chronic airway obstruction NEC and Other disorders of urethra and urinary tract* (150-200% higher); and *Viral hepatitis, Pneumonia, Acute kidney failure & Other forms of chronic ischemic heart disease* (all approximately 100% higher).

Table 15 compares demographic information for the 26 high utilizers compared to the average for all 909 HIV-positive patients. A higher proportion of high utilizers were African American (62%) compared to all of the HIV-positive patients overall (43%). Additionally, high utilizers had higher rates of Medicaid (42%) and Medicare (38%) as the primary insurer on their initial admission than overall HIV-positive patients (35% and 29%, respectively).

Table 15. Demographics of Patients with Multiple Admissions

	High Utilizers	All HIV-Positive Patients
Male	81%	75%
African American	62%	43%
55 and older	27%	20%
Medicaid on Initial Admission	42%	35%
Medicare on Initial Admissions	38%	29%
Uninsured on Initial Admission	4%	5%

Finally, Table 16 provides a summary of the discharge status following the patient’s initial admission (in the data set) for both the high utilizer patients as well as all HIV-positive patients. Patients classified as high utilizers are more likely to be discharged to home with home health care, or to be discharged to a nursing facility or psychiatric hospital.

Table 16. Discharge Status Following Index Admission

Discharge Status of Initial Admission	High Utilizers	All HIV-Positive Patients
Discharged home	69%	75%
Further hospital-related or long-term care	12%	6%
Discharged home with home health care	8%	8%
Nursing facility	8%	4%
Psychiatric hospital	4%	1%
Left against medical advice	0%	2%
Hospice	0%	1%
Patient died	0%	2%
Total	26	909

VI. Key Findings

This report updates a July 2010 PRHI brief¹ by adding another year of data which expanded the number of patients from 562 to 909, and the number of admissions from 1,072 to 2,040. The goal of both briefs is to inform the network of clinical and community providers serving the HIV-community, as they seek to continually improve their care. Because an additional year of data primarily confirmed earlier findings, we focus here only on those findings that were significantly strengthened and those findings that emerged with the additional analyses of patient admissions over time.

Admissions and Readmissions, by common primary and secondary diagnoses:

- The most common diagnoses across all admissions continue to be *Nondependent Abuse of Drugs* (29% of hospitalizations); *Viral Hepatitis* (22% of hospitalizations); *Disorders of Fluid Electrolyte and Acid-Base Balance* (22% of hospitalizations). In addition, several chronic diseases are also among the most prevalent diagnoses, including *Hypertension*, *Diabetes* and *Chronic kidney disease* (Table 2).
- Behavioral health diagnoses continue to feature prominently, making up three of the top 10 most prevalent non-HIV diagnoses (Table 2). Almost half (48%) of all hospitalizations involved patients with either comorbid depression and/or a substance use disorder. As noted in the 2010 brief,¹ clinical management of HIV patients with behavioral health problems may be especially challenging. Psychological symptoms may be manifestations of common depression or anxiety, but may also be HIV-related neurocognitive dysfunction. Regularly screening for behavioral health comorbidities, and concomitant medical and pharmaceutical support, as well as behavioral health counseling, may improve overall management of HIV.
- **Diagnoses:** 26% of all hospitalizations were followed within 30 days by another hospitalization, compared to 17% for all SWPA hospitalizations – making targeted readmission reduction initiatives relevant for HIV-positive patients.
 - The rate ranged from 23% (*Depressive disorder*) to 37% (*Chronic kidney disease*) among the most prevalent non-HIV diagnoses. Further, 64% of hospitalizations were followed

by at least one additional hospitalization within 12 months, ranging from 60% (following hospitalizations for *Nondependent abuse of drugs*) to 84% (following hospitalizations for *Chronic kidney disease*) (Table 4).

Insurance Status:

- The primary insurer for 78% of admissions was a public provider (e.g., Medicare), indicating that most patients may no longer be employed. The prevalence of public payers points to possible economic vulnerability with implications for needed services.
- Readmission rates following hospitalizations in which Medicaid or Medicare was the primary payer were 30%, a third higher than 30-day readmission rates when commercial insurers were the primary payer (Table 7). The readmission rate for hospitalizations on which the patient was uninsured, at 7%, is very low and may point to a possible barrier to care until the patient qualifies for Medicaid and/or Medicare.
 - Over multiple admissions, many patients appear to transition between being commercially-insured or uninsured status to receiving Medicaid and/or Medicare over the course of multiple hospitalizations (Tables 8 and 9). These findings underscore the importance of evaluating patient needs in the time period before a patient qualifies for public insurance.

Readmissions, Length of Stay (LOS) and Hospital Charges:

- Among all HIV-positive hospitalizations, average LOS was 6.7 days and the average total charge was just over \$56,000 with an estimated average per day charge at just over \$10,000.
- Hospitalizations with seven of the top 11 comorbidities had total charges that were at least as high or higher on the readmission than they were on the initial admission (Figure 9).
- Admissions in which *Diseases of the esophagus* were a recorded comorbidity, average total charge on the 30-day readmission were 73% higher than on the initial hospitalization. *Depressive disorder not elsewhere classified* was associated with a 17% lower average total charge on the 30-day readmission (Figure 9).

Opportunities for Reducing Readmissions:

- **Diagnoses:** Hospitalizations in which the patient had primary and/or secondary diagnoses in the following the ICD-9 code groups were significantly more likely to be followed by a readmission within 30 days: *Chronic kidney disease, Diabetes mellitus, Drug dependence, Viral hepatitis, Other and unspecified anemias, Diseases of the esophagus, and Disorders of the fluid electrolyte and acid-base balance* (Table 11).
- **Window of Opportunity to Prevent Readmission:** This brief strengthens previous findings about the very short window of opportunity to prevent readmissions. Forty percent of 30-day readmissions occur within one week of discharge and 67% occur within two weeks of discharge (Figure 11) – emphasizing to an extraordinary extent the importance of immediate, community-based post-discharge follow-up.

- Hospital Span of Control:** Our analyses document variations in readmissions rates by hospital, with highest readmit hospitals having rates twice that of low readmit hospitals (Table 6). The readmissions flags based on diagnoses may help target readmission reduction efforts, but additional factors may limit hospital span of control over readmissions. For example, in 31% of hospitalizations that are followed by a 30-day readmission, patients are admitted to a different hospital than the one from which they were discharged, severely curtailing the initial hospital's ability to even know a readmission has occurred. Such findings confirm the important role that community-based organizations may play in preventing avoidable hospitalizations.

¹ Kanel K, Elster S, Vrbin C. PRHI Readmission Brief; Brief II: Patterns of Hospital Admission and Readmission Among HIV-Positive Patients in Southwestern Pennsylvania. Pittsburgh Regional Health Initiative, July 2010.

<http://www.prhi.org/docs/Final%20Readmission%20Brief%20HIV.pdf>.

² ICD-9 (International Statistical Classification of Diseases and Related Health Problem). Published by the World Health Organization, ICD codes are a classification of diseases in which all health conditions can be assigned a unique code, up to six characters long. The "9" refers to a version (soon to be replaced by ICD-10) and is used worldwide.

³ Hospital admissions in the SWPA region include: general acute care, specialty general acute care, long-term acute care, psychiatric, rehabilitation, specialty, and ambulatory surgery centers

⁴ The 11-county Southwest PA region includes Allegheny, Armstrong, Beaver, Butler, Fayette, Greene, Indiana, Lawrence, Somerset, Washington, and Westmoreland counties.

⁵ Note: HIV-positive individuals are supposed to have a code indicating that status on each hospitalization, although our analysis indicated that this is not always the case. This could be a coding oversight, patient omitting that information, or in some cases the disease may not have been detected. Therefore, it is important to note that not every hospitalization in a patient's chain of hospitalizations has a documented HIV code.

⁶ Centers for Disease Control and Prevention, State of the HIV/AIDS Epidemic, HIV Incidence in the United States, August 2009, <http://www.cdc.gov/hiv/surveillance/incidence/sote/race-ethnicity.htm>.

⁷ Note that nine females did not have a documented race.

⁸ Southwestern Pennsylvania AIDS Planning Coalition. Data for Priority Setting; HIV Surveillance Data. Updated August 3, 2010. <http://www.swpapc.org/priority_setting.htm> Accessed September 28, 2011.

⁹ Since every patient in our dataset is HIV-positive, an HIV code of 042 (Human immunodeficiency virus) or v08 (Asymptomatic human immunodeficiency virus infection status) will be present on every admission – whether as principal or secondary diagnoses.

¹⁰ Kellerman, SE, Hanson, DL, McNaghten, AD, Fleming, PL. Prevalence of chronic hepatitis B and incidence of acute hepatitis B infection in human immunodeficiency virus-infected subjects. *J Infect Dis* 2003; 188:571.

¹¹ Weber, R, Sabin, CA, Friis-Moller, N, et al. Liver-related deaths in persons infected with the human immunodeficiency virus. The D:A:D Study. *Arch Intern Med* 2006; 166:1632.

¹² Chubineh S, McGowan J. Nausea and vomiting in HIV: a symptom review. *Int J STD AIDS* 2008; 19: 723-728

¹³ Phillips, A. Morbidity and mortality in the HAART era. Presented at the 15th Conference on Retroviruses and Opportunistic Infections, Boston, MA, February, 3-6, 2008; Plenary Session 5.

¹⁴ Schambelan, M, Benson, CA, Carr, A, et al. Management of metabolic complications associated with antiretroviral therapy for HIV-1 infection: recommendations of an International AIDS Society-USA panel. *Journal of Acquired Immune Deficiency Syndrome* 2002; 31:257.

¹⁵ Comorbid depression includes all the ICD-9 codes related to depression: 296.20, 296.21, 296.22, 296.23, 296.24, 296.25, 296.26, 296.30, 296.31, 296.32, 296.33, 296.34, 296.35, 296.36, 298.0, 300.4, 309.1, 311; Comorbid substance use disorder (SUD) includes all ICD-9 code groups related to alcohol or legal and illegal drug use include: 303 (alcohol dependence), 304 (drug dependence) and 305 (nondependent abuse of drugs).

¹⁶ Since hospitalization data were not available after the fourth quarter 2009 at the time of data analysis, the 12-month readmission rate refers to the initial hospitalizations between October 1, 2007 and September 30, 2008 (1,042 hospitalizations).

¹⁷ Kaiser Family Foundation, HIV/AIDS Policy, Fact Sheet February 2009, http://www.kff.org/hiv/aids/upload/7171_04.pdf.

¹⁸ Total charges in the PHC4 data include room and board, drug, equipment, specialty, ancillary, and other total charges.