

HIV/AIDS, Sexually Transmitted Disease and Hepatitis C:

An epidemiological synergy between HIV/AIDS and other sexually transmitted diseases (STDs) has been observed and studied for two decades. Researchers have shown that persons with STDs are more likely to become infected with HIV/AIDS. Also, those with HIV/AIDS may be more likely to become infected with other STDs.

“Several studies have explored potential biological mechanisms by which other STDs can facilitate sexual transmission of HIV infection by increasing infectiousness or susceptibility. HIV is detected routinely in the exudates of genital ulcers from HIV-infected men and women. Ulcers bleed easily and can come in contact with vaginal, cervical, oral urethral and rectal mucosa during sex. In men and women, inflammatory STDs (gonococcal and chlamydial infections) appear to increase both the prevalence of HIV shedding and the HIV RNA viral load in genital secretions. Thus, these STDs are likely indicators of HIV infectiousness (CDC, 1998).

ADHS Office of HIV/AIDS examined patterns of all co-morbidity reports of STDs and Hepatitis C among persons reported with HIV/AIDS. The primary modes of transmission of these reportable diseases closely correspond to those of HIV. Unlike many data measures derived from the general population that are used as proxy measures of risk behavior, HIV/STD/Hepatitis C co-morbidity data are direct measures of risk behavior patterns among the HIV/AIDS population, both before and after HIV diagnosis. Patterns in co-morbidity histories may inform improved prevention and targeted testing strategies. New opportunities also emerge to develop integrated prevention strategies for all such reportable diseases that improve efficiencies, and are oriented to the needs of the individual client.

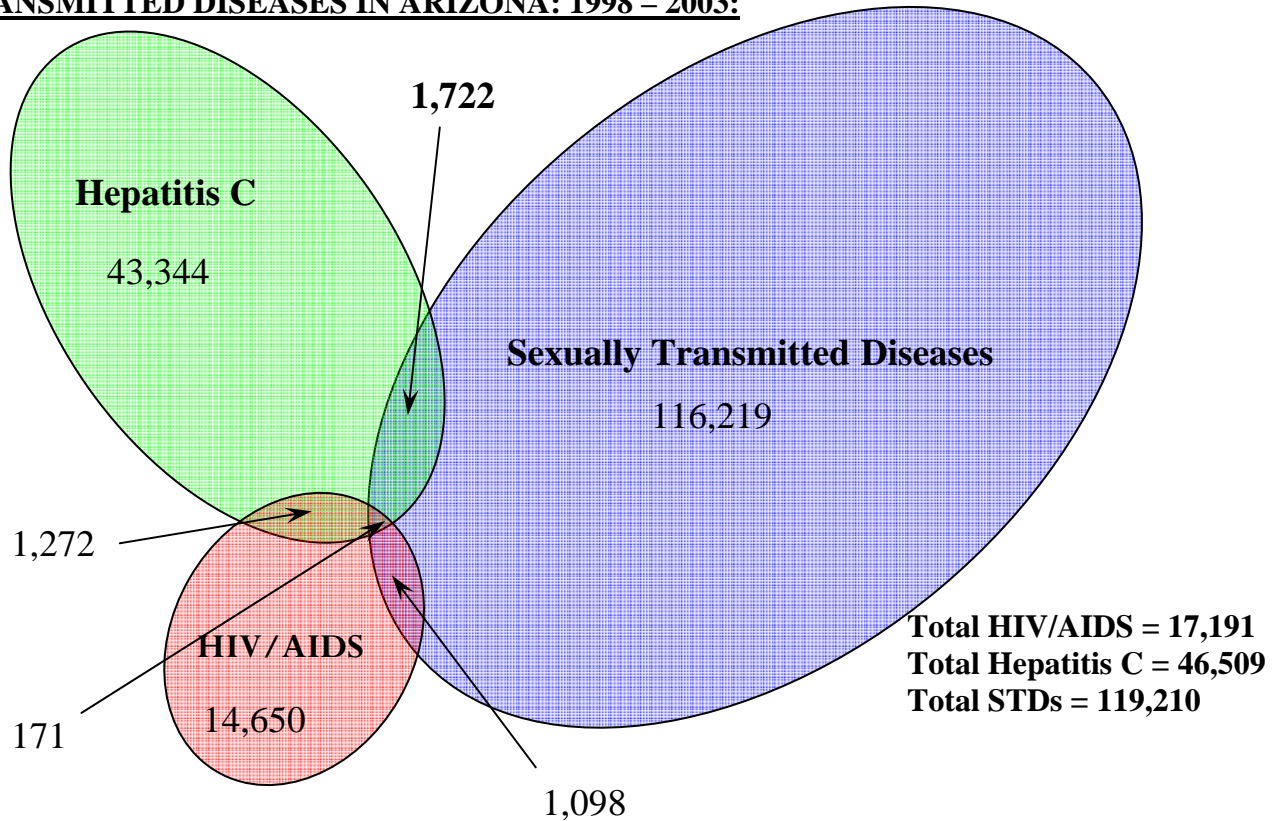
By comparing data from Hepatitis C and four primary sexually transmitted diseases with data from HIV/AIDS, ADHS Office of HIV/AIDS program was able to find 1,904 persons believed to be now living in Arizona, who have a history of HIV infection and also have any lifetime history of diagnosis with Hepatitis C, Chlamydia, Gonorrhea, Herpes, or Syphilis. At the time that this cross-match study was completed, the prevalence of reported HIV infection in Arizona was 9,962 persons. Results of this analysis are presented in Illustrations 1 and 2:

Illustration 1: SUMMARY COUNTS, RATES, AND ODDS OF CURRENT HIV AMONG PREVALENT PERSONS WITH ANY LIFETIME HISTORY OF HEPATITIS C INFECTION, OR INFECTION WITH ANY SEXUALLY TRANSMITTED DISEASE

Total Population:	5,580,811
Now HIV Infected with no STD or HepC Diagnosis History:	8,058
Any STD or HepC Diagnosis History but not HIV Infected:	181,466
Now HIV Infected with any STD or HepC Diagnosis History:	1,904
Estimated HIV Prevalence Rate:	179 per 100,000
Estimated Prevalence Rate of Persons with any STD or HepC Diagnosis History:	3,286 per 100,000
Estimated Prevalence Rate of HIV among Persons with any STD or HepC Diagnosis History:	1,038 per 100,000
Estimated Prevalence Rate of STD or HepC Diagnosis History among HIV Positive Persons:	19,113 per 100,000
Estimated Odds of Current HIV Infection with any History of STD or HepC Diagnosis:	5.8 times greater

In this analysis, nearly 3.3% of the current Arizona population have a history of diagnosis with an STD or Hepatitis C, and 0.2% are living with HIV/AIDS. These data suggest that at least 19% of persons now living with HIV/AIDS in Arizona also have a history of Hepatitis C or STD infection. The odds of current HIV infection among persons with a history of STDs or Hepatitis C are nearly 6 times greater than the general population.

Illustration 2: LIFETIME CO-MORBIDITY PATTERNS AMONG PERSONS DIAGNOSED WITH HIV/AIDS, HEPATITIS C, OR SEXUALLY TRANSMITTED DISEASES IN ARIZONA: 1998 – 2003:



Only persons reported in Arizona with any diagnosis of HIV/AIDS, Hepatitis C, or a sexually transmitted disease (STD) during the 1998-2003 time frame were included in this analysis, a total of 178,476 persons. 1998 - 2003 were the only years for which data from all disease groups was available. A lifetime diagnostic history of HIV, AIDS, Hepatitis C or STD's was constructed for persons in this analysis using all available data. Illustration 2 shows the lifetime co-morbidity configuration among those persons. The proportions of reported co-morbidity are 6.8% of those with Hepatitis C (3,165/46,509), 2.5% of those with Sexually Transmitted Diseases (2,991/119,210), and 14.8% of those with HIV/AIDS (2,541/17,191).

Reporting data in Hepatitis C and the STD do not track current address and living status for persons ever reported with those diseases, information needed to estimate prevalence. Therefore, in this analysis persons reported with Hepatitis C or an STD are used as an estimate of prevalence of persons with any lifetime history of Hepatitis C or STD. This was considered to be reasonable because this analysis examines total reported lifetime history against current HIV status. Because of the significant growth in Arizona's population due to migration, persons in this analysis who have since died, or moved out of state will likely have been replaced by others moving in state with a lifetime history of

Hepatitis C or STDs, or by persons in Arizona who have acquired new infections of Hepatitis C or STDs but not yet been reported.

Sensitivity estimates suggest that 75-85% of reported co-morbidities are detected using the cross-matching method employed for this analysis, and that 15-25% will not be detected. Proportions and rates reported above are expected to be conservative, but present a reasonable picture of the correlation between HIV and these other diseases.

HIV and Hepatitis C

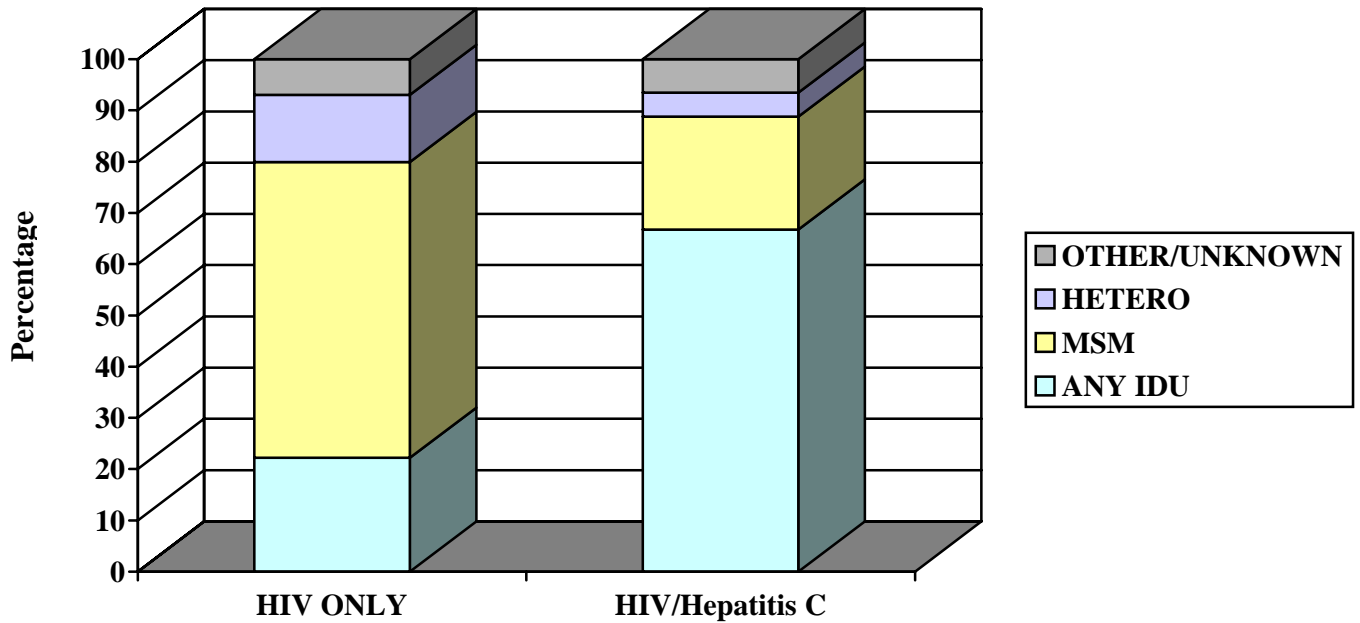
The most significant single disease co-morbidity associated with HIV is Hepatitis C. According to the CDC, about one quarter of those with HIV infection in the United States are also infected with HCV (CDC, 2002). Illustration 3 presents co-morbidity case counts, estimated prevalence rates, and odds ratios of HIV among persons with a history of Hepatitis C infection:

Illustration 3: SUMMARY COUNTS, RATES, AND ODDS OF CURRENT HIV AMONG PREVALENT PERSONS WITH ANY LIFETIME HISTORY OF REPORTED HEPATITIS C INFECTION

<u>Total Population:</u>	5,580,811
<u>HIV Infected with no HepC Diagnosis History:</u>	8,793
<u>HepC Diagnosis History but not HIV Infected:</u>	54,165
<u>HIV Infected with any HepC Diagnosis History:</u>	1,169
<u>Estimated HIV Prevalence Rate:</u>	179 per 100,000
<u>Estimated Prevalence Rate of Persons with any HepC Diagnosis History:</u>	992 per 100,000
<u>Estimated Prevalence Rate of HIV among Persons with any HepC Diagnosis History:</u>	2,113 per 100,000
<u>Estimated Prevalence Rate of HepC Diagnosis History among HIV Positive Persons:</u>	11,735 per 100,000
<u>Estimated Odds of Current HIV Infection with any History of HepC Diagnosis:</u>	11.8 times greater

Of 1,904 persons found with HIV and any Hepatitis C or STD co-morbidity history, 1,169 (61.4%) are living with HIV and Hepatitis C. Hepatitis C infection has been reported among nearly 12% of persons living with HIV/AIDS in Arizona, and at least 2% of more than 55,000 persons known to be living with Hepatitis C are also infected with HIV. In this analysis, the odds of current HIV infection among persons with any history of Hepatitis C infection are nearly 12 times as great as those in the general population. In an earlier study of Hepatitis C, ADHS Office of HIV/AIDS compared the reported risk behaviors among persons with HIV/AIDS and those with HIV/AIDS and Hepatitis C co-morbidity. The results are presented in Illustration 4:

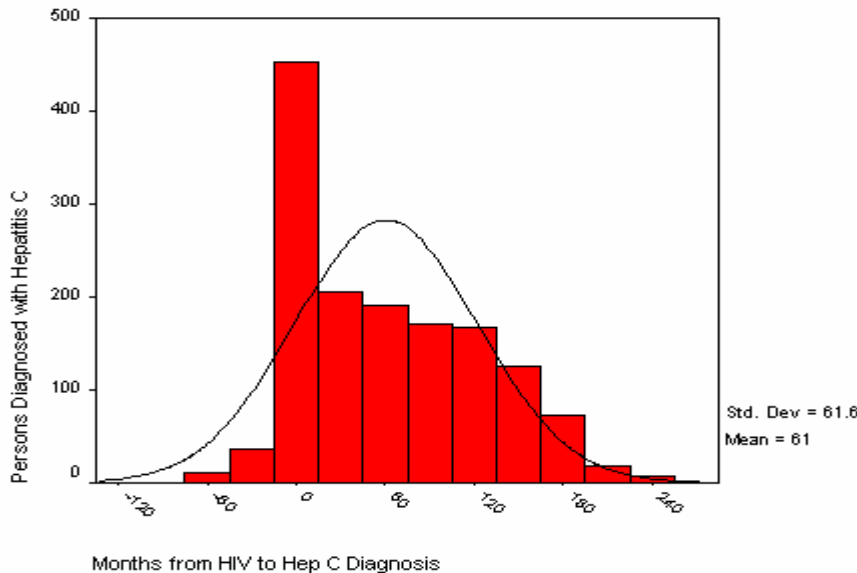
Illustration 4: REPORTED HIV RISK AMONG HIV/HEPATITIS C COINFECTED PERSONS IN ARIZONA: 1999 - 2003



Consistent with documented modes of Hepatitis C transmission, a majority (67%, n= 554) of 830 identified in this earlier study of co-infected persons report injection drug use behavior. This conforms to CDC estimates that 60% of persons infected with Hepatitis C acquired infection through injection drug use. Of the remaining 33% (n=276) of cases reporting no injection drug use behavior, more than 92% (n=255) reported no other risk factor for Hepatitis C, such as dialysis, hemophilia, intranasal drug use, tattooing, piercing, or other blood exposures. The majority of these cases (66%, n= 169) were men reporting sexual contact with other men. Risk behavior data relating to Hepatitis C surveillance are often not reported.

Because of the lengthy latency period of Hepatitis C (estimated 20 – 30 years), the Hepatitis C diagnosis date should not be equated with occurrence of Hepatitis C infection. Comparison of first HIV diagnosis date with first Hepatitis C diagnosis date indicates that many cases of Hepatitis C infection may escape detection at the initial HIV diagnosis. Illustration 5 represents the distribution of time transpired between earliest HIV diagnosis and earliest Hepatitis C diagnosis among all persons, both prevalent and not prevalent, identified as co-infected (n=1466). The time is measured in number of months:

Illustration 5: DISTRIBUTION OF TIME LAPSE IN MONTHS BETWEEN EARLIEST HIV DIAGNOSIS AND HEPATITIS C DIAGNOSIS AMONG REPORTED HIV CO-INFECTED PERSONS



The majority of persons with Hepatitis C and HIV co-infection in Arizona are diagnosed for Hepatitis C after their HIV diagnosis is already known (mean equals 61 months after HIV diagnosis). There are significant considerations for treatment and care with HIV and Hepatitis C co-infection. Higher HCV viral load and faster progression to chronic liver disease have been noted among the co-infected. In some studies more rapid progression of HIV disease has also been reported.

HIV and Syphilis

In a cross-match analysis persons now prevalent with HIV/AIDS with any lifetime history of reported Syphilis infection were identified. Illustration 6 presents co-morbidity case counts, estimated prevalence rates, and odds ratios of HIV among persons with any history of Syphilis infection.

Illustration 6: SUMMARY COUNTS, RATES, AND ODDS OF CURRENT HIV AMONG PREVALENT PERSONS WITH ANY LIFETIME HISTORY OF REPORTED SYPHILIS INFECTION

<u>Total Population:</u>	5,580,811
<u>HIV Infected with no Syphilis Diagnosis History:</u>	9,601
<u>Syphilis Diagnosis History but not HIV Infected:</u>	15,817
<u>HIV Infected with any Syphilis Diagnosis History:</u>	361
<u>Estimated HIV Prevalence Rate:</u>	179 per 100,000
<u>Estimated Prevalence Rate of Persons with any Syphilis Diagnosis History:</u>	290 per 100,000
<u>Estimated Prevalence Rate of HIV among Persons with any Syphilis Diagnosis History:</u>	2,231 per 100,000
<u>Estimated Prevalence Rate of Syphilis Diagnosis History among HIV Positive Persons:</u>	3,624 per 100,000
<u>Estimated Odds of Current HIV Infection with any History of Syphilis Diagnosis:</u>	12.5 times greater

In this analysis, 3.6% of those living with HIV/AIDS in Arizona have a history of ever being reported with Syphilis, and 2.2% of those reported with Syphilis have also been reported with HIV. The odds of a person now being HIV infected who has any lifetime

history of syphilis based on this study is 12.5 times greater than the general population of Arizona. Studies have also noted that those infected with HIV may falsely test negative (the prozone phenomenon) when tested for syphilis (Southern Medical Journal, 1997).

Illustration 7: DISTRIBUTION OF TIME LAPSE IN MONTHS BETWEEN EARLIEST HIV DIAGNOSIS AND MOST RECENT SYPHILIS DIAGNOSIS AMONG REPORTED HIV CO-INFECTED PERSONS

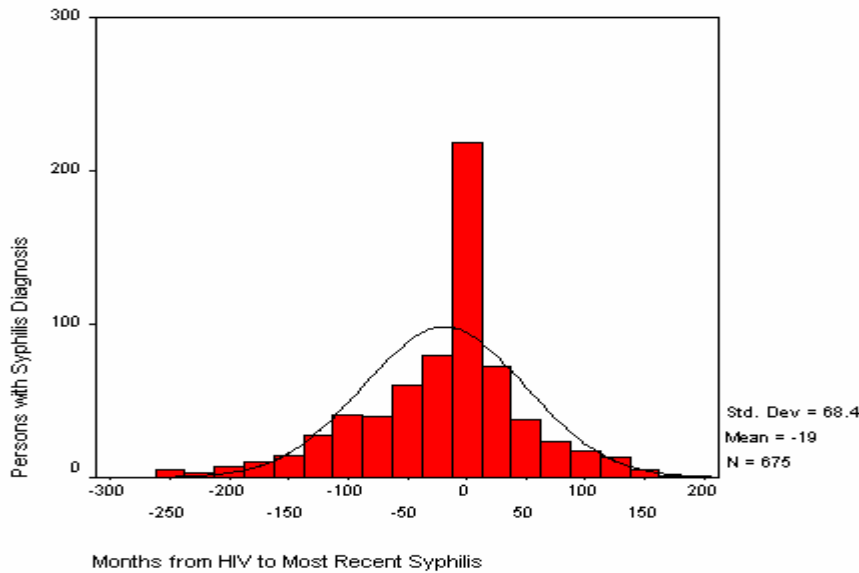


Illustration 7 represents the distribution of time transpired between earliest HIV diagnosis and most recent Syphilis diagnosis among all persons, both prevalent and not prevalent, identified as co-infected (n=676). The time is measured in number of months:

Considering the most recent syphilis diagnosis only, many syphilis diagnoses occur prior to the initial HIV diagnosis (mean equals 18.9 months prior to HIV diagnosis). The greatest frequency of syphilis diagnosis among co-infected persons occurs at diagnosis of HIV infection. Lengthy latency periods associated with HIV infection suggest that syphilis may be used as a sentinel event for elevated risk of HIV infection.

HIV and Gonorrhea

In a cross-match analysis persons now prevalent with HIV/AIDS with any lifetime history of reported gonorrhea infection were identified. Illustration 8 presents co-morbidity case counts, estimated prevalence rates, and odds ratios of HIV among persons with any history of gonorrhea infection.

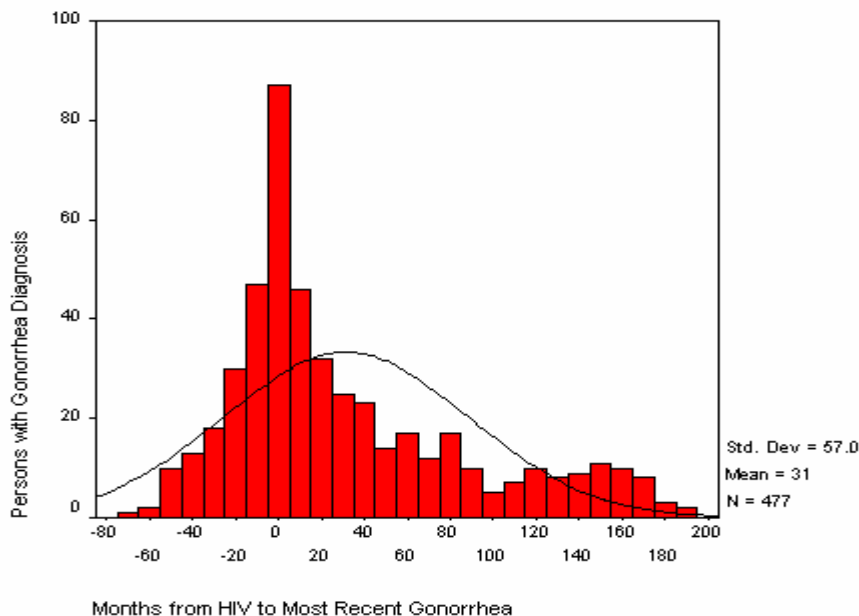
In this analysis, 4.4% of those living with HIV/AIDS in Arizona have a history of ever being reported with gonorrhea, and 1.6% of those reported with gonorrhea have also been reported with HIV. The odds of a person now being HIV infected who has any lifetime history of gonorrhea based on this study is 9.1 times greater than the general population of Arizona.

Illustration 8: SUMMARY COUNTS, RATES, AND ODDS OF CURRENT HIV AMONG PREVALENT PERSONS WITH ANY LIFETIME HISTORY OF REPORTED GONORRHEA INFECTION

<u>Total Population:</u>	5,580,811
<u>HIV Infected with no Gonorrhea Diagnosis History:</u>	9,526
<u>Gonorrhea Diagnosis History but not HIV Infected:</u>	26,292
<u>HIV Infected with any Gonorrhea Diagnosis History:</u>	436
<u>Estimated HIV Prevalence Rate:</u>	179 per 100,000
<u>Estimated Prevalence Rate of Persons with any Gonorrhea Diagnosis History:</u>	479 per 100,000
<u>Estimated Prevalence Rate of HIV among Persons with any Gonorrhea Diagnosis History:</u>	1,631 per 100,000
<u>Estimated Prevalence Rate of Gonorrhea Diagnosis History among HIV Positive Persons:</u>	4,377 per 100,000
<u>Estimated Odds of Current HIV Infection with any History of Gonorrhea Diagnosis:</u>	9.1 times greater

Illustration 9 represents the distribution of time transpired between earliest HIV diagnosis and most recent gonorrhea diagnosis among all persons, both prevalent and not prevalent, identified as co-infected (n=477). The time is measured in number of months:

Illustration 9: DISTRIBUTION OF TIME LAPSE IN MONTHS BETWEEN EARLIEST HIV DIAGNOSIS AND MOST RECENT GONORRHEA DIAGNOSIS AMONG REPORTED HIV CO-INFECTED PERSONS



The majority of diagnoses of gonorrhea among persons now infected with HIV occur after HIV diagnosis (mean equals 31 months after HIV diagnosis). Of 436 persons now prevalent with HIV and reported with gonorrhea in this analysis, 91% (n=398) are men, and 9% (n=38) are women. Gonorrhea

in men is usually reported within two weeks of infection due to the painful nature of disease manifestation. Illustration 9 may be used as an index of ongoing high-risk sexual activity among those with HIV and gonorrhea. Because not every person engaging in such activity will contract a sexually transmitted disease, it is expected that the numbers of persons with gonorrhea infection after HIV diagnosis is a fraction of those participating in high-risk sexual behaviors among the HIV infected population.

HIV, Chlamydia and Herpes

Of the reportable sexually transmitted diseases, Chlamydia and herpes showed the least significant measure of correlation with an HIV positive outcome. The odds of being HIV positive among persons with any diagnostic history of Chlamydia were the same as those of the general population, suggesting that Chlamydia diagnostic history does not augment the likelihood of HIV infection. Herpes diagnosis was the most infrequently reported among STDs (1,094 mean annual case reports 1997-2003 for Arizona). Yet when diagnosed, the odds of HIV co-morbidity were elevated, particularly among males, those with herpes were nearly 5 times as likely to have HIV infection as the general population. Yet the total number of co-morbidity cases identified was so small (71 cases) that no reliable inference may be drawn from calculated rates and odds.

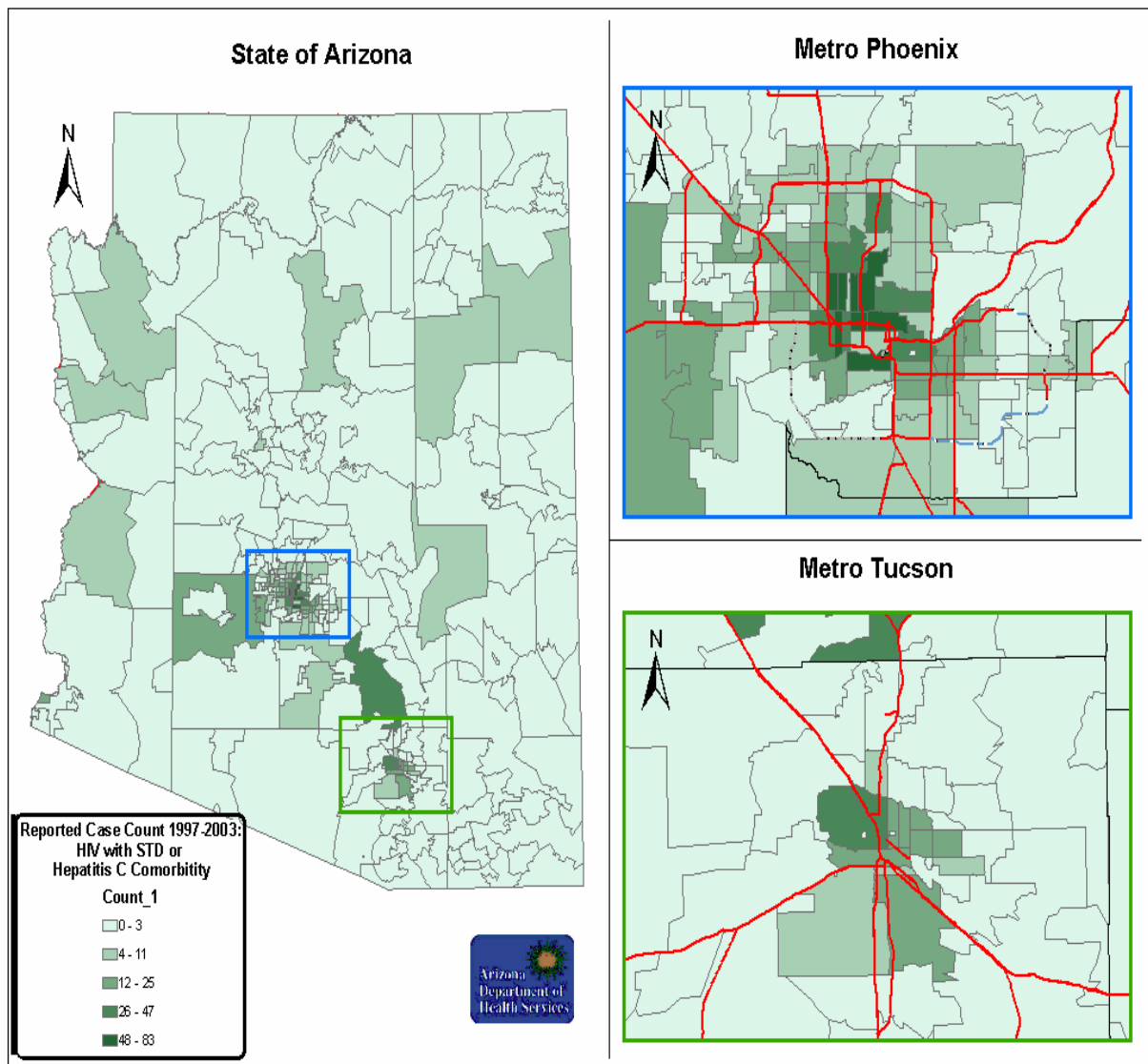
Overall, the combination of Hepatitis C, syphilis, and herpes together accounted for 94 % of all identified co-morbidity with HIV among Hepatitis C or any STD (1,790 of 1,904 persons).

Geographic Analysis of HIV and STD Co-morbidities:

By assigning a geographic coordinate to each diagnostic event of an STD or Hepatitis C, located at the center-point of the zip code tabulation area of residence at diagnosis, a historical pattern map of STD diagnosis can be presented. Zip Code Tabulation Areas (ZTAs) are used, rather than postal zip code areas because these may be associated with U.S. Census population counts. Illustration 10 shows the geographic distribution of all reported STD and Hepatitis C diagnoses among persons with an HIV outcome.

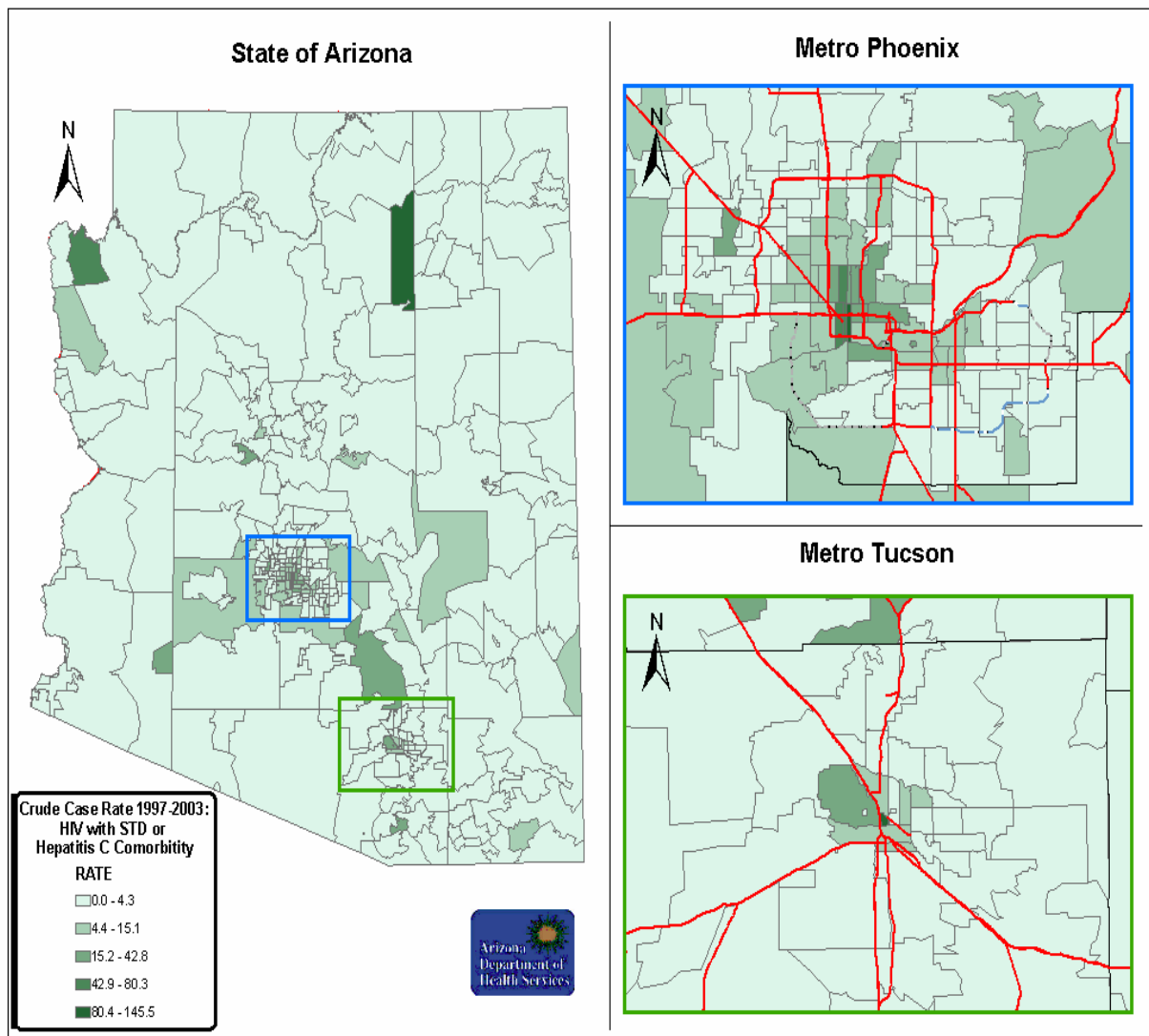
The highest geographic frequency of HIV/STD/Hepatitis C co-morbidity events are found in urban ZTAs, or ZTAs with large prison populations. Presentation of diagnostic event data may be standardized to correct for differences in regional population distribution by presenting a geographic distribution of co-morbidity rates. Illustration 49 presents the same data expressed as a co-morbidity case rate per 100,000 persons of the ZTA population.

Illustration 10: GEOGRAPHIC DISTRIBUTION OF SEXUALLY TRANSMITTED DISEASE AND HEPATITIS C DIAGNOSIS EVENTS AMONG REPORTED HIV COINFECTED PERSONS: 1997-2003:



In illustration 11 on the next page, rates for each ZTA are geographically presented. Two ZTA regions in the northern part of the state with rural populations and case counts below 4 experience rates of HIV/STD/Hepatitis C co-morbidity that equal or exceed those of the most urbanized portions of the state where the greatest numbers of case events are found. These regions may experience HIV co-morbidity incidence at the same intensity as equivalent urban regions, but the scope of cases involved in these differing regions means that the bulk of the epidemic still occurs in urban regions.

Illustration 11: GEOGRAPHIC DISTRIBUTION OF SEXUALLY TRANSMITTED DISEASE AND HEPATITIS C DIAGNOSIS RATES AMONG REPORTED HIV COINFECTED PERSONS: 1997-2003:

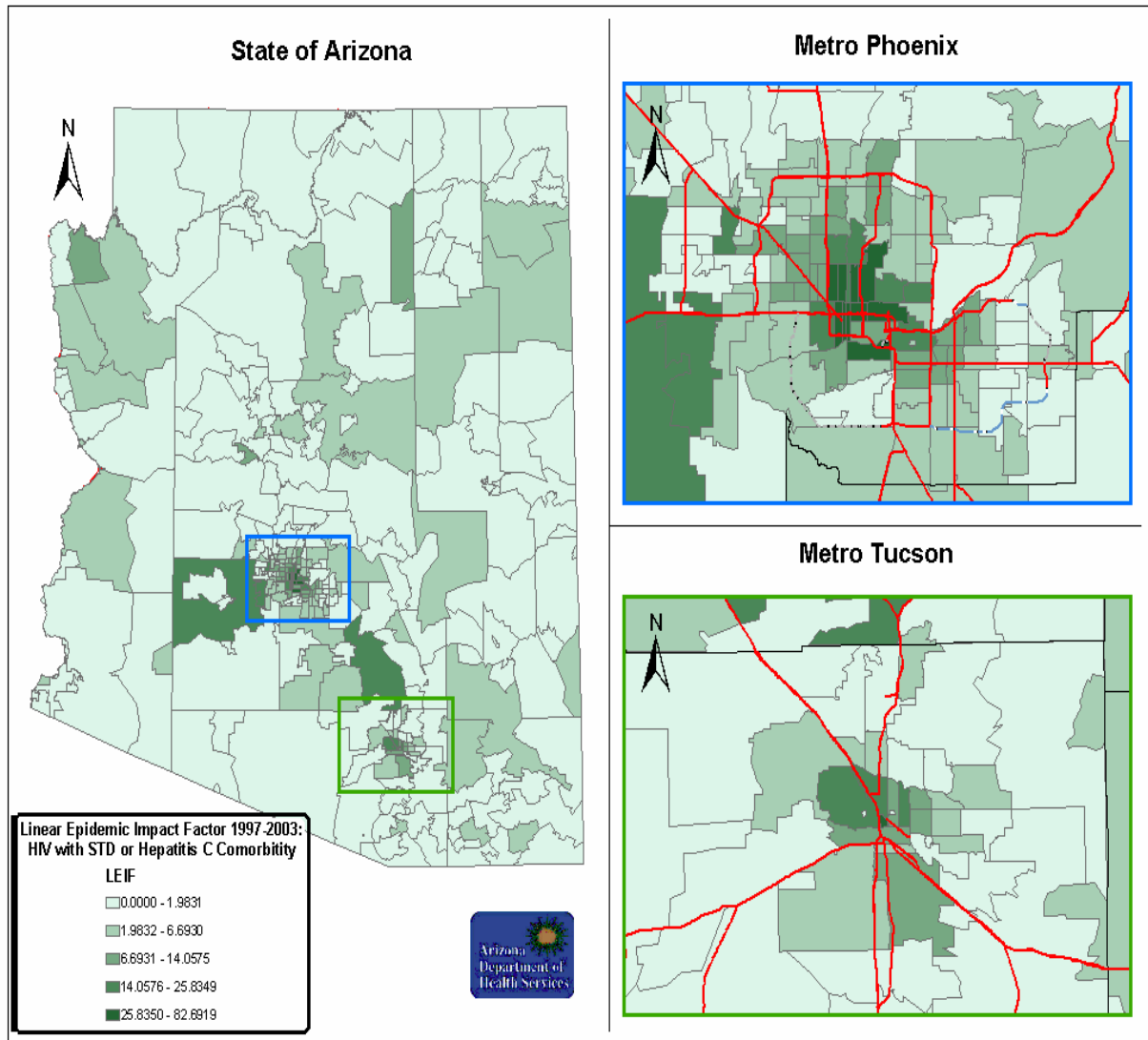


Whether presenting these data by case counts or by relative rates, each presentation may distort the full impact of HIV co-morbidity. In the case of counts of diagnostic events presented in Illustration 10, sufficient information on population is not presented to portray a complete picture of relative disease burden on the local community. A complete picture of epidemic impact must include information on both case counts, and standardized rates in one presentation.

To resolve this difficulty, and to facilitate the priority setting process mandated for regional and statewide planning groups, ADHS Office of HIV/AIDS used a convenience method for evaluating the epidemic impact of HIV. This method needed to consider both standardized rates, and the number of case events, but had to be simple enough to be used and understood by persons in the Planning Groups who were uncomfortable with statistical calculations. This convenience method, called the Epidemic Impact Factor (EIF), was derived by multiplying the relative rate and the number of cases (Rate x

Count). This method will evaluate both case counts and rates with equal weight, producing a raw number that may be used for purposes of comparison to contrast epidemic impact between regions of the state, or between defined groups. Illustration 12 presents Linear Epidemic Impact Factor (EIF as a linear expression – see the Priority Setting appendix for a complete discussion on EIF and LEIF) of HIV/STD/Hepatitis C co-morbidity by geographic region.

Illustration 12: LINEAR EPIDEMIC IMPACT FACTOR OF SEXUALLY TRANSMITTED DISEASE AND HEPATITIS C DIAGNOSIS AMONG REPORTED HIV COINFECTED PERSONS: 1997-2003:



This presentation shows that urbanized regions (metropolitan Phoenix and Tucson) experience the greatest epidemic impact of HIV co-morbidities in the state. By contrast, most rural regions experience the lowest epidemic impact of HIV co-morbidities, but there are several apparent exceptions. A region in the northern half of the state roughly corresponding with the I-40 corridor from Flagstaff, Ariz., on the west to Winslow, Ariz., on the East reports moderate HIV co-morbidity epidemic impact. Another region experiencing moderate impact of HIV co-morbidities appears to be a region contained within the south and central area of the Navajo Nation and Hopi Indian Reservation,

roughly following route 264 to the New Mexico border. Additionally, the regions of Mohave County nearest Las Vegas, NV, see some elevated impact, as do regions of La Paz county south of Parker Dam in a region containing the Colorado River Indian Reservation. Illustration 13 shows that STD and Hepatitis C diagnostic events in these same regions display similar regional patterns, suggesting that elevated patterns of risk activity conducive to HIV infection are also being observed in the same regions.

Illustration 13: DIAGNOSTIC REPORTS OF SEXUALLY TRANSMITTED DISEASE AND HEPATITIS C DIAGNOSIS: 1997-2003:

