

Care of Injection Drug Users With Soft Tissue Infections in San Francisco, California

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Context: Illicit injection drug use results in serious soft tissue infections that are the number one nonpsychiatric reason for admission to San Francisco General Hospital (SFGH), San Francisco, Calif.

Objective: To establish a specialized clinic to provide accessible, high-quality, and cost-effective medical care to patients with soft tissue infections.

Design, Setting, Intervention, and Outcome Measures: The Integrated Soft Tissue Infection Services (ISIS) Clinic was established to provide coordinated surgical intervention, substance abuse counseling, and social services for patients with soft tissue infections treated in a public hospital. Demographic information, treatment outcome, and hospital utilization data were analyzed.

Results: In the clinic's first year of operation, there were 3365 patient visits and 2255 surgical procedures. A large number of patients reported recent injection of illicit drugs (61%), were homeless (30%), and either

had hepatitis C, hepatitis B, or human immunodeficiency virus infection (62%). Patients using heroin were enrolled in either a detoxification or maintenance program (42%). Few patients were designated as treatment failures (2%) or were lost to follow-up (14%). The ISIS Clinic dramatically reduced emergency department visits (-33.9%), surgical service admissions (-47.3%), inpatient acute care bed days (-33.7%), and operating room procedures (-71%), saving approximately \$8765 200 in the first year of operation.

Conclusions: This clinical intervention was notably cost-effective while preserving a high quality of medical services. Owing to limited data, we can only assume that other communities are similarly confronted with this public health problem. The ISIS Clinic could serve as a model intervention and thus have significant impact on the treatment of this prevalent but often overlooked challenge.

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DURING THE past decade, the use of heroin and other illicit injection drugs has become an irrepressible feature of the urban landscape in the United States. By 1999, an estimated 3.1 million people reported using heroin at some time in their lives, with approximately 154 000 active users and some 104 000 heroin initiates per year.¹ The injection of heroin and other illicit drugs is associated with the transmission of blood-borne diseases, drug overdose, and death. Injection drug users are also at risk for the development of serious soft tissue infections. Although infrequently life threatening, cellulitis and abscesses commonly require treatment.

The precise number of soft tissue infections from injection drug use in the United States is not known, but anecdotal evidence suggests that it represents a significant public health problem.²⁻⁴ This

lack of detailed information likely reflects the low priority typically assigned to the care of injection drug users by medical institutions. Individuals suffering from drug addiction are often simultaneously battling complex psychosocial and medical problems, including poverty, homelessness, psychiatric diseases, and viral infections.⁵ The seemingly intractable nature of these problems, combined with apathy from the public and medical professionals alike, has relegated care for injection drug users to the realm of afterthought and benign neglect. Thus, injection drug users have limited access to medical care and frequently perceive their treatment within traditional health care settings as harsh and dehumanizing.⁶ Furthermore, the paucity of governmental, institutional, and societal interest in the health of injection drug users constitutes a profound disincentive for those individuals and organizations interested

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in the study of drug addiction, its complications, and treatment. Despite or perhaps because of these obstacles to health care, drug users utilize more than their share of health care expenditures.⁷

San Francisco, Calif, is home to an estimated 17 000 heroin addicts and 10 000 to 20 000 recreational users.⁴ Consequently, soft tissue infections are commonly treated throughout the city's health clinics and its public hospital, San Francisco General Hospital (SFGH). Since 1992, coincident with the increased availability of inexpensive high-purity heroin, the incidence of cellulitis and soft tissue infections has progressively increased.³ By 1999, these diagnoses represented the number one nonpsychiatric reason for admission to the hospital, annually accounting for about 3000 emergency department (ED) visits, 2400 hospital admissions, and 1000 cases in the operating room.⁸ Costs to the SFGH for ED and inpatient care alone were conservatively estimated to be in excess of \$20 million per year.⁹ In addition, there was the less readily quantified but nonetheless significant expenditure of time by the physicians, nurses, and ancillary staff engaged in the care of these patients. Despite these efforts, both patients and providers voiced considerable dissatisfaction with the system of care. Herein we report the results of a proactive effort to improve the care of patients in San Francisco with soft tissue infections due to injection drug use. We postulated that an integrated approach to the problem, designed in concert by physicians, nurses, substance abuse counselors, and health department administrators, would enable the delivery of accessible, high-quality, yet cost-effective medical care to patients with soft tissue infections in a user-friendly, nonjudgmental environment that patients would voluntarily utilize.

METHODS

The fundamental goal of the Integrated Soft Tissue Infection Services (ISIS) Clinic was to provide compassionate, efficient, and cost-effective care to patients with soft tissue infections. In addition to rendering timely medical care, the clinic was designed to provide access to other relevant services, including substance abuse counseling and treatment, selected social services, and wound care. The clinic is open every day on a walk-in, first-come, first-served basis and is staffed by academic faculty surgeons, 3 licensed nurses, a substance abuse counselor, a social worker, and an administrative support person. A pain management specialist, pharmacist, and infectious disease physician were available for consultation as needed.

Patients requiring surgical intervention were treated on-site under local anesthesia or moderate sedation in compliance with SFGH guidelines. All clinical decisions were made by the attending surgeon and included the option to admit patients. The nursing staff was trained to interview patients, assist with surgical procedures, administer sedation, assist with patient recovery following procedures, and provide patient education. All patients with wounds were provided follow-up appointments with an adjacent clinic where dressing changes were performed.

DATA COLLECTION

The nursing staff interviewed patients at intake, prospectively collecting a comprehensive panel of data that included age, race, sex, type and pattern of drug use, human immunodeficiency

viral and hepatitis viral seropositivity, residential status, source of the patient's referral to the clinic, and source of medical insurance. These data were entered into a computerized database (Microsoft Access; Microsoft Corporation, Redmond, Wash). The surgeons entered physical findings, diagnoses, treatment plans, and details of all operative procedures.

Data comparing ED visits, hospital admissions, operating room volume, and the costs associated with the care of patients with soft tissue infections before and after institution of the ISIS Clinic were obtained from the SFGH information database. Information from a computerized lifetime clinical record was used to assess patient follow-up and clinical outcome. A clinical success was defined as either a healing wound without evidence of persistent infection or resolving cellulitis. Persistent or progressive infections were considered clinical failures. Patients were designated as lost to follow-up if there were no additional visits recorded in the lifetime clinical record or paper medical records following their ISIS Clinic visit. Clinical outcome was determined by reviewing the lifetime clinical records and medical records for 50 randomly selected patients. In addition, clinical outcome was stratified according to whether patients reported active drug use. Patient follow-up rate as a function of drug use was further analyzed by reviewing the records for 75 randomly selected patients with abscesses 8 cm or larger in diameter. To evaluate the patients' perspectives of the clinic, 75 randomly selected patients completed a brief anonymous questionnaire about services received in the clinic using a graded scale. The questionnaire focused on timely access to health care providers, quality of the patient interactions, pain control, and social services.

The Committee on Human Research at the University of California, San Francisco, approved all procedures for this study.

STATISTICS

Data are presented as mean \pm SD and were compared using *t* tests and χ^2 analysis. *P* \leq .05 was considered significant.

RESULTS

The ISIS Clinic was developed with an emphasis on maintaining high-quality patient care while converting from a predominantly inpatient model of care to an outpatient design. In the clinic's first year of operation, there were 3365 patient visits comprising 2861 new patients and 504 follow-up visits. Demographic data are presented in **Table 1**. Within our patient population, several factors were associated with injection drug use. The incidence of human immunodeficiency viral infection, acquired immunodeficiency syndrome, and hepatitis virus seropositivity were significantly greater in those patients reporting injection drug use than in those patients denying drug use (**Figure 1**). This difference was especially pronounced when comparing the rates of both hepatitis B and hepatitis C viral infection where injection drug use was associated with 4-fold and 6-fold increased incidence compared with nonusers, respectively (*P* $<$.001). Drug use was also associated with a 40% increased incidence of homelessness compared with nonusers (50% vs 35%; *P* $<$.001).

The ISIS Clinic successfully provided methadone treatment to patients using heroin. Only a few active drug users (9%) refused substance abuse counseling. A total of 310 patients were enrolled in a 21-day methadone detoxification program with a mean participation

Table 1. Data Collected During Patient Intake at the ISIS Clinic for the First Year of Operation*

Description	Patients
Sex (n = 1892)	
Male	1321 (70)
Female	571 (30)
Age, mean ± SD, y (n = 1892)	40 ± 5
Ethnicity (n = 1858)	
White	794 (43)
African American	608 (33)
Hispanic	340 (18)
Asian	106 (6)
Native American	10 (<1)
Viral seropositivity (n = 1548)	
Hepatitis B	186 (12)
Hepatitis C	573 (37)
HIV	143 (9)
AIDS	60 (4)
Residence (n = 1780)	
Private home/hotel	1148 (64)
Homeless	530 (30)
County jail	42 (2)
Shelter	37 (2)
Rehabilitation program	23 (1)
Source of referral (n = 3205)	
SFGH emergency department	1025 (32)
Public clinics	518 (16)
SFGH inpatient wards	449 (14)
Walk-in (self-referrals)	957 (30)
Outside clinics/hospitals	141 (4)
County jail	115 (4)
Drug use (n = 1729)	
Not using (clean)	676 (39)
Heroin (black tar)	681 (39)
Crack/cocaine	85 (5)
Metamphetamines	85 (5)
Marijuana	68 (4)
Polysubstance users	134 (8)
Methadone treatment (n = 815)	
Not receiving treatment	472 (58)
Methadone maintenance or detoxification	343 (42)
Refused substance abuse counseling	41 (9)
Source of payment (n = 300)	
General assistance	159 (53)
MediCal	57 (19)
Self-pay	42 (14)
MediCare	21 (7)
Jail	14 (5)
Private insurance	3 (1)
Bad debt	3 (1)
Workers' compensation	1 (<1)

*Data are given as the number (percentage) of patients unless otherwise indicated. ISIS indicates Integrated Soft Tissue Infection Services; HIV, human immunodeficiency virus; AIDS, acquired immunodeficiency syndrome; and SFGH, San Francisco General Hospital.

of 17.2 days. In addition, 33 patients were referred to a methadone maintenance program with a more than 90% retention rate. Of the 815 patients admitting to heroin or polysubstance abuse, 343 patients (42%) were enrolled in either a detoxification or maintenance program (Table 1).

The volume of patients treated in the clinic steadily increased during the first 7 months of operation before stabilizing at 275 to 300 visits per month (Figure 2). Only 6% of patients evaluated each month were admit-

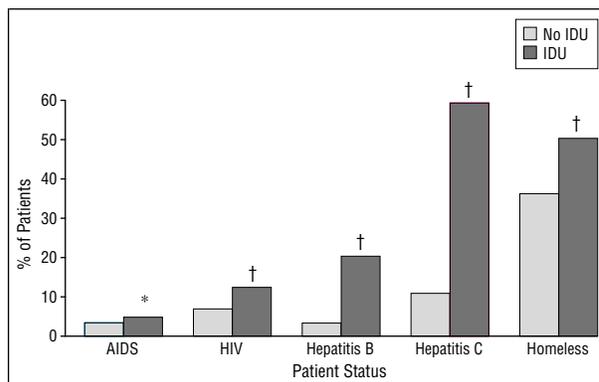


Figure 1. Risk factors associated with injection drug use (IDU) are summarized for patients seen in the Integrated Soft Tissue Infection Services Clinic for 1 year. Asterisk indicates a significant difference between nonusers and users by χ^2 analysis ($P=.01$); daggers, a significant difference between nonusers and users ($P<.001$); AIDS, acquired immunodeficiency syndrome; and HIV, human immunodeficiency virus.

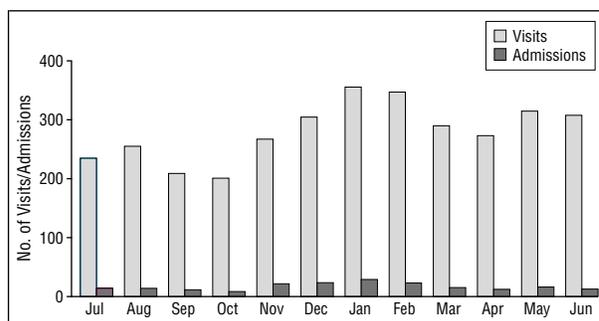


Figure 2. Total visits to the Integrated Soft Tissue Infection Services Clinic and admissions to the hospital from the clinic are summarized by month for the first year of operation.

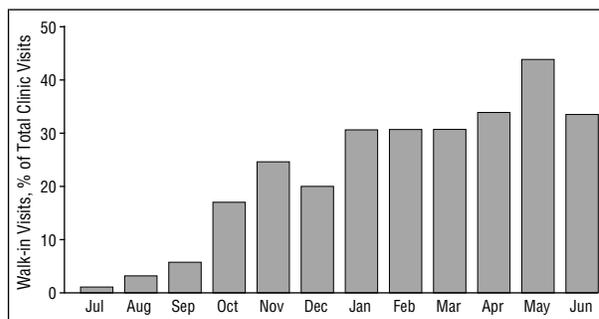


Figure 3. The number of walk-in (self-referred) patients as a percentage of the total number of patients seen in the first year of operation at the Integrated Soft Tissue Infection Services Clinic is shown by month for the first year of operation.

ted to the hospital, a rate that remained constant throughout the year. Although approximately one third of the patients (32%) were referred from the SFGH ED, an equal number of patients were walk-ins (self-referrals, 30%; Figure 3). The remaining patients were directed from city-operated clinics (16%), the SFGH inpatient wards (14%), private hospitals or clinics (4%), and the San Francisco County Jail (4%). Of note, multiple visits to the clinic by the same patient for unique infections were uncommon during the year in review (Figure 4). Two thirds of patients (68%) were treated only once, whereas 15%

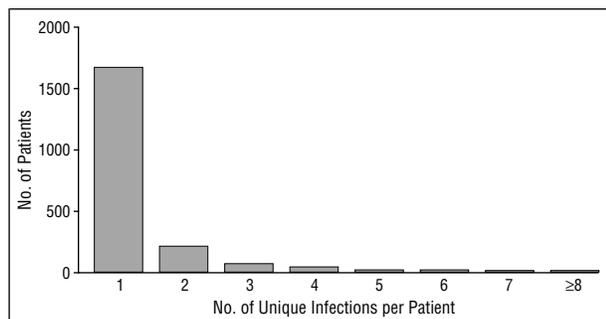


Figure 4. The number of visits per patient for unique infections is summarized for the first year of operation of the Integrated Soft Tissue Infection Services Clinic.

Table 2. Number and Types of Procedures Performed for Soft Tissue Infections in the ISIS Clinic for the First Year of Operation*

Clinical Characteristic	Total	Monthly Mean
Surgical procedures	2255	188
Incision and drainage	1722	144
Hand infection	232	19
Wound debridement	211	18
Perianals/pilonidals	83	7
Necrotizing fasciitis	7	<1
Cellulitis†	943	79

*ISIS indicates Integrated Soft Tissue Infection Services.

†Patients with a soft tissue infection but with no abscess or necrotizing fasciitis were counted as having cellulitis.

Table 3. Annual Use of Hospital Services Before and After the Start of the ISIS Clinic*

Hospital Services	Pre-ISIS		Difference	Savings
	Clinic	Clinic		
Emergency department visit (\$850/visit)	2751	1819	-932	\$792 200
Total inpatient stay, d (\$3000/d)	6378	4228	-2150	\$6 450 000
Operating room cases (\$3000/case)	977	286	-691	\$2 073 000
ISIS Clinic annual budget	-\$550 000
Annual net savings	\$8 765 200

*ISIS indicates Integrated Soft Tissue Infection Services; ellipses, not applicable.

and 11% recorded 2 and 3 visits, respectively, accounting for nearly 95% of the total clinic population. Thus, only a small fraction of patients utilized the clinic with an inordinate frequency.

The ISIS Clinic provided comprehensive treatment of soft tissue infections with good clinical outcomes. The scope of clinical care is presented in **Table 2**. There were 7 cases of necrotizing fasciitis identified, and each patient was admitted to the hospital and treated in the operating room under general anesthesia. One of the patients with necrotizing fasciitis subsequently died due to adult respiratory distress syndrome within 48 hours of admission and accounted for the only death in the clinic.

A total of 190 patients (6%) were admitted to the hospital, 68 (2%) were treatment failures, and 471 (14%) were lost to follow-up. Further analysis of the medical records for 75 randomly selected patients revealed no difference in the lost to follow-up rate for patients as a function of injection drug use (users vs nonusers, 9/58 vs 2/9; $P = .84$; drug use unspecified for 8 patients) with a mean follow-up of 162 ± 127 days.

The ISIS Clinic effectively treated soft tissue infections and decreased utilization of hospital resources previously used to treat these patients. The clinic significantly decreased the number of ED visits, hospital admissions, and inpatient days (**Table 3**). Although the total number of patient encounters in the hospital database (ED, inpatients, and ISIS Clinic) increased from 4709 encounters before opening the clinic to 6437 encounters after opening the clinic (+36.7%), the annual number of ED visits decreased by 34%. The number of admissions and inpatient bed use for soft tissue infections also decreased after the ISIS Clinic opened. Admissions to the surgical service decreased from an annual mean of 1326 to 699 (-47.3%). Inpatient bed use decreased by one third (-33.7%), constituting a decrease of 2150 acute care beds. The ISIS Clinic significantly reduced use of the operating room. Historically, an average of 977 soft tissue infections were treated in the operating room per year. During the clinic's first year, this number decreased by more than 70% (Table 3).

To determine the financial impact of the ISIS Clinic, charges for ED visits and inpatient bed and operating room use were calculated based on estimates provided by the SFGH administration. Thus, considering decreased ED visits (\$792 200), acute care bed days (\$6 450 000), and operating room use (\$2 073 000) minus the cost of operating the ISIS Clinic (-\$550 000), this proactive clinical intervention yielded an estimated net savings of \$8 765 200 (Table 3).

When surveyed, 86% of patients expressed a positive view of the ISIS Clinic, reporting an excellent or very good overall impression of the services (**Table 4**). Most patients (92%) were treated in a timely fashion and evaluated by the surgeon within 60 minutes of arrival. Most patients were satisfied with pain management during and after their surgical procedure. In contrast, assistance with basic living needs was frequently inadequate; 23% of patients indicated that they rarely or never received adequate help in this regard. Yet, respondents noted that they always or usually had access to substance abuse counseling (82%) and were either definitely or very likely to recommend the clinic to a relative or friend (92%).

COMMENT

Heroin use in the United States has dramatically increased during the past decade. By the late 1990s, the number of soft tissue infections related to injection drug use treated at SFGH had reached epidemic proportions. In addition to consuming considerable resources, the customary approach to caring for these challenging patients was taxing health care providers. In response, the

Table 4. Results of the Patient Satisfaction Questionnaire*

Questions	Responses, % of Patients				
	Always	Usually	Sometimes	Rarely	Never
How often do you visit the ISIS Clinic?	My first visit, 54%		Visit occasionally, 35%		Visit frequently, 11%
Do you have a regular health care provider?	Yes, 38%				
How long did you have to wait to see the doctor?	0-15 min, 21%	16-30 min, 25%	31-45 min, 15%	46-60 min, 32%	>60 min, 8%
The doctor listens carefully to what you have to say.	76%	18%	7%	0%	0%
The doctor answers your questions about your medical condition.	85%	12%	1%	1%	0%
You feel the doctor takes your medical problem seriously.	82%	14%	3%	1%	0%
Were you satisfied with the care you received from your nurse?	83%	14%	1%	1%	0%
Did you receive adequate pain control during your procedure?	59%	22%	12%	4%	3%
Did you receive adequate pain medicine after your procedure?	63%	21%	9%	3%	4%
Did you receive enough assistance with basic living needs?	40%	23%	13%	21%	2%
Did you have access to substance abuse counseling in the clinic?	51%	31%	8%	5%	5%
What was your overall impression of the clinic?	Excellent, 50%	Very good, 36%	Good, 11%	Fair, 3%	Poor, 0%
Are you likely to recommend the clinic to a relative or a friend?	Definitely, 71%	Very likely, 21%	Probably, 8%	Probably not, 0%	Definitely not, 0%

*ISIS indicates Integrated Soft Tissue Infection Services.

ISIS Clinic was created with the goal of providing compassionate, quality, yet cost-effective medical care to these patients. Also, we postulated that providing such services as outpatient care would reduce ED visits, hospital admissions, operating room cases, and costs to the hospital.

The clinic significantly reduced use of hospital resources while providing quality medical care for patients with soft tissue infections. Inpatient days and ED visits were each reduced approximately 34%. Operating room use was reduced by more than 70%. The clinic provided a ready alternative for patients who historically used the ED for care of their infections. Corroborative evidence that the ISIS Clinic had a significant impact on ED visits came from the annual Drug Abuse Warning Network report, which revealed a 12% decrease in drug-related ED episodes in San Francisco.¹⁰ During the clinic's first 3 months of activity most patients were referred from the ED. However, as the clinic entered its second quarter of operation the volume of walk-in patients (self-referrals) had noticeably increased. At year's end, the number of self-referrals equaled the number of referrals from the ED. The number of patients referring themselves to the clinic, combined with the very favorable ratings of the clinic by the satisfaction survey, strongly indicated the successful creation of a service preferred by our patients.

Everyone involved in the ISIS Clinic shared concerns regarding the potential risks to the patients of converting from an inpatient-based model of care to an outpatient-based model. Thus, the collection and analysis of prospective, detailed patient information, including outcome data, was deemed critically important. Overall, 84% of patients evaluated in the ISIS Clinic were successfully treated, with a mean follow-up of more than 5 months. Only 2% of patients were deemed treatment failures, with a 14% lost to follow-up rate. The high therapeutic success and low treatment failure rates aptly underscore the clinic's delivery of high-quality, effective care for soft tissue infections on an

outpatient basis. The predominant concern regarding conversion to an outpatient-based model of care delivery was that many of our patients would be lost to follow-up and suffer from incompletely treated infections. In essence, this concern is rooted in the assumption that patients who use injection drugs are irresponsible and incapable of exercising good judgment when it comes to their own medical care. This fundamental, albeit paternalistic, attitude toward substance-abusing patients imbued our previous practice of admitting most patients with serious soft tissue infections to the hospital. Once patients were admitted, we could assume responsibility for them and ensure that they received antibiotics and timely care. To render care on an outpatient basis eliminated the clinical safety net that hospital admission represented. Consequently, monitoring patient follow-up was a critical component of the ISIS Clinic's initial and continuing evaluation.

Few patients (14%) did not return for their scheduled wound clinic appointment or interface with the county-sponsored health care system within 6 months of being treated in the clinic. This lost to follow-up rate is comparable to that observed for other clinics throughout the San Francisco Community Health Network. Interestingly, patients who admitted to substance abuse were no more irresponsible for follow-up treatment than other patients. In fact, injection drug users were equally as compliant with their medical care plan as nonusers. These data not only contradict the assumption that injection drug users are inherently irresponsible when it comes to their health care, but also suggest that patients battling drug addiction, like all patients, will readily utilize services provided in a user-friendly, nonjudgmental environment.

Nowhere in the country are the consequences of managed care and its attendant effects on health care finances more evident than in the San Francisco Bay Area. Thus, the need to redesign health care systems with an eye toward increased efficiency and cost-effectiveness played a prominent role in the design and implementa-

Editor's Note

The ISIS Clinic at SFGH is another in a long list of contributions from the Department of Surgery. The use of illicit drugs in Northern California, and particularly in the San Francisco/Oakland area, is an enormous burden, particularly to public hospitals. Drs Harris and Young have used their creative and clinical abilities to organize and staff a functional unit to treat the nagging but geometrically increasing infections inundating our hospitals. The Clinic has been operative for several years and represents the cooperative efforts of the SFGH Department of Surgery and Administration, as well as the dedicated support of the nursing staff. The hospital administration realized that this investment would be cost-effective. The functional simplicity of the ISIS Clinic is a tribute to the authors and is verified by strong patient support. It has many secondary benefits, the most significant of which is the reduction in operating room use to treat these persistent infections.

Claude H. Organ, Jr, MD

tion of the ISIS Clinic. After 1 year the clinic is estimated to have yielded net total savings of almost \$9 million, representing a 45% reduction in the costs of treating soft tissue infections. Because we are unaware of data that document the incidence and magnitude of injection drug use-related soft tissue infections throughout the United States, we can only assume that other communities are similarly confronted with this medical and public health problem. Therefore, we believe that the ISIS Clinic could serve as a model intervention and thus have a significant impact on the treatment of this prevalent but often overlooked challenge.

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REFERENCES

1. Substance Abuse and Mental Health Services Administration. *Prevalence of Substance Abuse Report: Summary of Findings From the 2000 National Household Survey on Drug Abuse*. Washington, DC: US Dept of Health and Human Services; 2001.
2. Bangsberg DR, Rosen JI, Aragon T, Campbell A, Weir L, Perdreau-Remington F. Clostridial myonecrosis cluster among injection drug users: a molecular epidemiology investigation. *Arch Intern Med*. 2002;162:517-522.
3. Centers for Disease Control and Prevention. Soft tissue infections among injection drug users—San Francisco, California, 1996-2000. *JAMA*. 2001;285:2707-2709.
4. Murphy EL, DeVita D, Liu H, et al. Risk factors for skin and soft-tissue abscesses among injection drug users: a case-control study. *Clin Infect Dis*. 2001; 33:35-40.
5. Schroeder JR, Latkin CA, Hoover DR, Curry AD, Knowlton AR, Celentano DD. Illicit drug use in one's social network and in one's neighborhood predicts individual heroin and cocaine use. *Ann Epidemiol*. 2001;11:389-394.
6. McCoy CB, Metsch LR, Chitwood DD, Miles C. Drug use and barriers to use of health care services. *Subst Use Misuse*. 2001;36:789-806.
7. French MT, McGeary KA, Chitwood DD, McCoy CB. Chronic illicit drug use, health services utilization, and the cost of medical care. *Soc Sci Med*. 2000;50:1703-1713.
8. Torassa U. Abscesses plague addicts, ravage city's health budget. *San Francisco Examiner*. January 3, 2000:A1.
9. Gomez D. *Task Force on Management of Patients With Abscess and IVDU Report*. San Francisco, Calif: San Francisco General Hospital; 2000.
10. Substance Abuse and Mental Health Services Administration. *Year-End 2000 Emergency Department Data From the Drug Abuse Warning Network*. Washington, DC: US Dept of Health and Human Services; 2000:27.