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The social ecology of syphilis

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Abstract

Factors affecting the transmission of syphilis can be categorized into those acting at the level of individuals (e.g., number of sex partners) and others at the level of the sociophysical environment (e.g., availability of treatment services for curable infections). In a prior study, we identified several sociophysical factors correlated with the ten-year mean syphilis rate in a regression analysis of United States counties. In the present study we used qualitative methods to investigate additional aspects of some factors in the regression, as well as to identify entirely new factors. Twelve counties with populations less than 100,000 and ten-year mean syphilis rates that were greater or less than expected by the regression model were selected for a three to five day visit. The case study protocol included observations, unstructured interviews with care providers and county residents, and a standardized questionnaire completed by state and local sexually transmitted disease control personnel pertaining to characteristics and practices of the local health department. Comparisons of the field notes and questionnaires revealed patterns of factors of the sociophysical environment that potentially affect county syphilis rates. These included access to the health department STD clinic, race relations, employment opportunities for minorities, interagency coordination, STD outreach activities, the social acceptability of discussing STDs, and intercommunity dynamics. In addition we noted the disproportionate influence of particular individuals on these factors. Some of the factors identified are readily quantifiable and could enhance the predictive power of multivariable models of county syphilis rates. The hypotheses generated by this study may also lead to a better measurement and understanding of potentially important environmental determinants of community syphilis rates, and the development of new or enhanced prevention strategies. © 1999 Elsevier Science Ltd. All rights reserved.

Introduction

Epidemiologists studying sexually transmitted diseases (STDs) have demonstrated in recent years a growing awareness of factors other than characteristics of individuals that affect disease rates (Aral, 1996).

Included is a renewed appreciation for dependent happenings, in which the risk of a new infection in an individual depends in part on the current prevalence of infection in a population (Halloran and Struchiner, 1991; Shiboski and Padian, 1996), and the dynamics of spread within sexual networks (Garnett and Anderson, 1993; Morris and Kretzschmar, 1997). These perspectives clearly represent advances in our understanding of the spread of infection within a population. Charles Poole (1994) has suggested further that epidemiology is inherently “not so much the study of disease and health *in* human populations as the study of disease and health *of* human populations”. The contradistinction of healthy communities from healthy individuals

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Table 1
Examples of factors in the three categories of the sociophysical environment demonstrated or hypothesized to be positively associated (unless otherwise noted) with community rates of sexually transmitted diseases

Category of sociophysical environment	Actual (demonstrated empirically)	Potential (hypothesized)
Geographic	urban areas (Rice et al., 1991; Kilmarx et al., 1997) rural areas in North Carolina (Thomas et al., 1995) southern region of the US (Kilmarx et al., 1997) proximity to an interstate highway (Cook et al., in press) increased availability of treatment services (lowered rates) (Grosskurth et al., 1995) comprehensive chlamydia prevention program (lowered rates) (Hillis et al., 1995) needle exchange programs among injection drug users (lowered rates) (Des Jarlais et al., 1994) lack of anonymous testing for HIV (Hertz-Picciotto et al., 1996) high number of physicians per 100,000 population (Kilmarx et al., 1997) social marketing and condom distribution (lowered rates) (Hananberg et al., 1994; Nelson et al., 1996) gender subordination (Schoepf, 1993)	
Architectural and technological		inadequate STD screening policies (Rothenberg, 1981) physically inaccessible care (Wasserheit and Aral, 1996) curtailed city services (Wallace, 1990)
Sociocultural	low mean income (Aral et al., 1996) high rate of violent crime (Kilmarx et al., 1997) high percent of births to women <20 (Kilmarx et al., 1997) high percent of female-headed households (Kilmarx et al., 1997) high percent non-Hispanic black population (Kilmarx et al., 1997) high percent Hispanic population (Kilmarx et al., 1997) low local per capita expenditures for education (Kilmarx et al., 1997) low percent of adults with less than a ninth grade education (Kilmarx et al., 1997) low unemployment rate (Kilmarx et al., 1997)	availability of illegal drugs (Rofis et al., 1990; Thomas et al., 1995; O'Reilly and Piot, 1996) distrust of Public Health Service (Thomas and Quinn, 1991) perceived lack of confidentiality (Thomas et al., 1995) cultural differences between care providers and patients (Schuster et al., 1995) high income disparity (Kaplan et al., 1996; Kennedy et al., 1996) non-segmentation of social networks (Rothenberg et al., 1996) social disruption of war (Miles and McBride, 1997) high prevalence of concordance in sexual relationships (Morris, 1995) loan programs for poor women (O'Reilly and Piot, 1996)

Table 2
Counties included in the analysis, with values rounded to conceal their identity

State	Demographics		Ten-year mean syphilis rate ^a (cases/100,000 person-years)	
	population	%black	actual	expected ^b
<i>Rate greater than expected</i>				
Georgia	20,000	40	110	37.6
Louisiana	90,000	30	70	14.8
Florida	70,000	20	35	5.7
California	90,000	5	20	0.8
Georgia	100,000	10	20	2.4
Missouri	30,000	10	15	1.3
New York	100,000	5	5	0.5
<i>Rate less than expected</i>				
South Carolina	80,000	10	2	3.2
Kentucky	70,000	25	5	20.3
Alabama	30,000	40	5	36.1
Alabama	20,000	80	35	207.2

^a 1984–1993. ^bBased on the regression equation described in Kilmarx et al. (1997).

within a community highlights the importance of the social environment in which individuals live.

Stokols (1992) elaborated on the differences and interrelationships between individuals and their environments in his model of social ecology. His categories of individual-level factors affecting health are: biogenic (e.g., immunologic competence); psychological (e.g., self-esteem); and behavioral (e.g., seeking health care). Categories of environmental (i.e., 'sociophysical environment') factors are geographic (e.g., rurality); architectural and technological (e.g., availability of a vaccine or cure); and sociocultural (e.g., social support)³. Factors of the sociophysical environment both influence and are influenced by individual-level factors. Research on the epidemiology of STDs has dealt predominantly with individual-level factors. Factors of the sociophysical environment that have been demonstrated or hypothesized to influence community STD rates are summarized in Table 1.

Epidemiologic studies in which populations are compared with one another with the aim of identifying aspects of communities that affect their health are also referred to as 'ecologic'. Ironically, the optimal appli-

cation of ecologic studies has been hindered by a bias towards individualism, resulting in their being used often as an expedient means of studying risk factors among individuals (a misappropriation of the study design known as the ecologic fallacy). Moreover, because of the expense of empirical data collection on multiple populations, the vast majority of ecologic studies have used archival data (e.g., census, economic data, and national surveys). Perhaps, again, because of an individualistic orientation very few data are collected nationwide that can characterize the sociophysical environment. Epidemiologists thus have an impoverished vocabulary and repertoire of tools for talking about and studying environmental-level phenomena. In turn, a diminished capacity to measure the sociophysical environment has often been mistaken to mean that there is nothing to measure or nothing of importance to consider.

The study on which we report here was the second phase of a two-phase exploration of environmental-level factors affecting endemic syphilis rates conducted from October 1994 through April 1996. In the first phase, an ecologic analysis of 3,085 counties in the 48 contiguous United States yielded a regression equation in which ten sociodemographic variables accounted for 71% of the variation between ten-year mean county syphilis rates for the period 1984 to 1993 (Kilmarx et al., 1997). This 10 year period was one during which syphilis rates throughout the United States (US) rose to a peak and then began to decline (Division of STD Prevention, 1996). The variables, in order of their strength of association with mean syphilis rates over this period were: percent non-Hispanic black popu-

³ Stokols's categories were designed primarily for noninfectious phenomena. The ecology of an infectious process would include a separate category related to factors of the infectious organism (e.g., its infectivity). In addition, the sociophysical environment would include a fourth category for the prevalence of infection, since an individual's risk of infection depends in part on the prevalence of disease in the population.

lation; Southern region of the US; percent urban population; percent Hispanic population; percent of births to mothers less than 20 years of age; percent of adults with less than a ninth grade education (negative association); number of physicians per 100,000 population; violent crime rate; female family head householders per 1000 population; and the unemployment rate (negative association).

In the second phase we sought additional factors that might explain why some communities had substantially higher or lower rates of syphilis than predicted by this model. Our findings might lead to an even more highly predictive model of county syphilis rates and to a better understanding of how the socio-physical determinants of syphilis transmission and persistence might actually be overcome in some communities, while opportunities are lost in others. In addition to identifying potential factors for which we had no preconceptions, we had an *a priori* interest in exploring potential refinements of a number of factors in the regression model. These included: race; unemployment; and provision of STD-related health services, in particular by health departments. The interest in health department STD services also stemmed from the fact that changes in this factor may be relatively easy to effect.

Methods

Sample selection

Of the 3085 counties, 34 had rates that were more than two standard deviations above or below the rate predicted for them by the regression equation from the first phase of the study; 25 had a population of less than 100,000. Because our limited budget could have been consumed by studying one or two of the large cities (e.g., New York), we selected sites from among the smaller counties, enabling us to visit a greater number and variety of counties. Twelve counties were selected for visits.

Our interest was primarily in the South since counties with high syphilis rates are heavily concentrated in that region (Division of STD Prevention, 1996). We weighted our sample accordingly with eight Southern counties and four non-Southern counties. None of the non-Southern county outliers had a rate markedly lower than expected. Thus, four non-Southern, regionally diverse counties with rates higher than expected were selected. The county selected from the southwest was eventually dropped from the study due to a review process for research among Native Americans on a reservation that potentially exceeded the duration of our study. The demographics and syphilis rates of the

counties visited are listed in Table 2 with rounded numbers to conceal the identity of each county.

The regression analysis of the first study phase had indicated that the proportion of a population that was African-American was strongly predictive of endemic syphilis rates. In the second study phase we anticipated that the number and proportion of African-Americans in a county might influence the dynamics within the African-American community and between African-Americans and others in the county. In the interest of being able to investigate the role of African-American population size and proportion both in counties with syphilis rates higher and lower than expected, we selected counties with a lower than expected rate that had about the same population size and percent African-American population as counties with a higher than expected rate.

Data collection

We followed a qualitative case study approach in which diverse types of data are gathered for each case and the cases are compared systematically to reveal patterns and dominant themes among them (Patton, 1990; Yin, 1994; Stake, 1995).

A large proportion of clinical care for people with syphilis is provided by local health departments. Standardized information on individual health departments was collected through a questionnaire sent to the Centers for Disease Control and Prevention (CDC) STD Manager working in each state that included a study county. The questionnaire collected information on the facilities, staffing, patient population, and procedures of the local health department for diagnosing and treating STDs from 1984 through 1993. The questionnaires were completed with the assistance of personnel from the designated local health department.

The CDC state manager also identified an appropriate contact person in the local health department to facilitate a three to five day site visit. Prior to the visit we collected census, historical, and cultural information on the county available in the library at the University of North Carolina at Chapel Hill (UNC). Four people from UNC with training and experience in qualitative data collection conducted the site visits. Budgetary constraints allowed for only one visitor per site, with the exception of two sites where an Atlanta-based CDC co-investigator also participated. Each site visit consisted of:

- Tours of the county: the initial one self-directed; followed by another guided by someone knowledgeable about the county and the population most affected by STDs.
- Face-to-face interviews with the local health department STD personnel (including a Disease

Intervention Specialist, DIS), a representative from the sheriff's office and/or police, and a representative from at least one community-based organization.

- A review of stories in the local newspaper from the year of peak syphilis incidence for the county in the period 1984–1993, and two other six-month periods – one before and the other after the peak.
- An examination of materials such as a local phone book, map of the county, and descriptions of local businesses and resources.
- Photographs of the site to facilitate discussion among the co-investigators.

When possible, interviews were also conducted with an elderly minority person who was knowledgeable about the history of the county, a recognized minority leader or spokesperson, and representatives from a county school, municipal housing authority, and the Department of Social Services. Most site visits included attendance at an African–American or Hispanic church and discussion with one of the clergy. The study procedures were approved by the University of North Carolina School of Public Health Institutional Review Board.

Data management and analysis

Handwritten notes taken during interviews and while making observations or reading local materials were transcribed into a word-processing program by the site visitor while still at the site or immediately after returning to Chapel Hill. The field notes were organized into a standardized format (e.g., observations during tours, interview notes) to facilitate comparison across sites and were reviewed by the principal investigator for clarity and completeness. Following each visit, the four site visitors discussed the observations, the procedures followed, and helpful hints for the remaining visits.

Through ongoing discussions and a preliminary reading of the questionnaires and field notes, a number of factors playing prominent roles in the vast majority of counties became evident. A number of these were related to our *a priori* interests. A key factor related to race was race relations, and our interest in employment became more narrowly focused on employment opportunities as they related to African–Americans and Hispanics in the county. Emergent issues pertaining to the provision of clinical services were access to STD services at the public health clinic, interactions between local institutions, and STD-related outreach efforts. Additional factors of the sociophysical environment emerging from the data were the social acceptability of discussing STD- and sex-related issues, and interactions with neighboring cities.

Ecologies are characterized by interdependencies among their component parts. As environmental factors influence individuals and their health, so do individuals affect the sociophysical environment. Thus, another category emerging from our data was key individuals in the county who had a noticeable effect on the sociophysical environment.

Each site visitor coded his or her field notes for these issues. The site summaries and category codes assigned therein were each reviewed by at least one of the other three site visitors before being finalized. A given topic, such as race relations, was read for all of the counties with higher than expected rates and factors that were consistent or dominant across the sites were noted. The site summaries for the counties with lower than expected rates were then read in the same fashion. Similarly, the questionnaire data regarding the health department characteristics and activities were tallied and compared by county types.

Unless otherwise noted, we report findings that were more (or less) common in counties with higher than expected rates of syphilis than in counties with lower than expected rates. Quantification beyond a simple ranking is unwarranted because: the factors identified are complexly interdependent and our small sample is inadequate for teasing apart the confounding relationships; variables were not measured in a quantifiably standardized manner; and because of the progressive nature of this exploratory study, in which the observations in counties visited later were influenced by observations in the counties first visited. We provide detail on some factors with anecdotal illustrations, but these are not intended to indicate the normative situation in the sample.

Results

County commonalities

Each of the counties had a number of characteristics in common by virtue of their size and experience of nationwide phenomena (e.g., trends in agricultural policy). None of the counties had public transportation. Each had experienced increases in illicit drug use and drug-related crime in the latter half of the 1980s. Each had a local health department, none of which offered hours for STD care outside of 8–5 Monday through Friday. Each health department had a DIS assigned (some from outside the county) to conduct partner notification of syphilis cases. Other community-based outreach programs in the counties were directed principally towards drugs and crime with little attention, if any, to prevention of STDs (although curtailing drug use in a community may have a salutary effect on some STDs as well).

Each county was affected by at least one larger, neighboring city. People who grew up in the county and who had become highly educated (e.g., as physicians, teachers, or lawyers) often moved to the larger city where there were more career opportunities. The counties studied often served as ‘bedroom communities’ to the larger cities; there were also people working in the study counties who commuted in from a neighboring city. The private physicians working in the county often lived in a neighboring county. Most were reported to rarely interact with the broader community and evidenced little interest in collaborating with other agencies. Many of the physicians in these smaller counties were foreign born.

In the following sections, factors that were differentially distributed among counties with syphilis rates that were endemically higher or lower than expected are presented in the categories empirically identified in the analysis. These are summarized in Table 3.

Race relations

Compared to counties with lower than expected syphilis rates, the sharing of power among different races appeared on the surface to be less equitable in counties with higher than expected rates. Although the distribution of power and influence in a community is complex and sometimes hidden, the evidence we could see during our relatively brief visits included the exclusion of local minorities from positions of influence and prestige, such as the board of health or the county commission in counties with higher than expected rates. Conversely, in a county with a rate lower than expected, the position of health director was shared between an African–American female and a white male. This health department also had a reputation of having earned the trust of African–American residents.

In one county with a large Hispanic population, the Hispanics interviewed could not identify any local Hispanic leader or spokesperson for their interests. There was no Spanish language newspaper or newsletter in the county, and Hispanics were marginalized through negative stereotypes in the paper serving the white population (e.g., featuring almost exclusively those associated with crime). The minority population in this county did not appear to be organized to make its collective voice heard or to effect change. This apparent lack of collective action was not observed in the minority communities of counties with lower than expected rates. Rather, in some of these counties, African–Americans had organized to: advance job opportunities for African–Americans; recruit more African–American teachers; and improve housing in African–American neighborhoods. In one such county the African–American residents spoke of a sense of

optimism and hope that they could improve their neighborhoods and lives.

A prominent theme underlying race relations was trust. One African–American county commissioner commented on the lack of African–Americans on local boards, saying “There is a lot of the good ole’ boy network going on in the county. The local level government has violated the trust of those they were meant to serve. Trust is a big issue – it isn’t there”. To protect the trust he had developed, a white DIS in a county with lower than expected rates asked us not to take a picture of an African–American neighborhood. He explained, “Most of the people recognize me. My job is based on a lot of trust and connections in this area. I don’t want to give people a reason not to trust me”. An STD clinic nurse in the same county spoke of the importance of developing trusting relationships with patients and described how, to this end, she visited an HIV-positive mother in a migrant camp and brought her fruit.

Employment

In most instances where syphilis rates were higher than expected there was a notable lack of employment opportunities for the minority population and an absence of minority-owned businesses. In one such community a respondent stated “A lot of the minority-owned businesses have gone belly-up. There are no job opportunities for African–Americans”. In contrast, most of the counties with lower than expected rates had several local businesses owned by African–Americans.

Hispanic migrant agricultural workers and seasonal workers in a county with higher than expected rates faced a number of economic disadvantages. Wages for agricultural jobs in this county were low because the farm owners resisted the formation of a farm worker organization that could bargain for the migrants for better wages. Also, in years past, the farmers interacted directly with the migrant farm workers; hiring them, providing housing, and often getting to know them personally. In recent years farmers have contracted with professional intermediaries to hire farm workers. The intermediaries are given a sum of money and told that they can keep whatever is not used to pay the workers. This system serves to depress wages and benefits for the migrants and to distance the farm owners from the workers financially and emotionally.

Access to the health department STD clinic

Access to the health department STD clinic was affected by physical and cultural barriers as well as inadequate assurances to confidentiality. Physical accessibility included location and the ability to be treated

Table 3
Factors of the sociophysical environment potentially affecting^a syphilis rates identified empirically in the analysis of the site visits

Category of the sociocultural environment	Study category	Individual factors identified
Geographical	intercommunity dynamics	location on an interstate highway
Architectural and technological	access to Health Department STD Clinic	agricultural crops attracting migrant workers
		clinic location
		clinic hours
		clinic architecture
Sociocultural	employment	employment opportunities for minorities
	race relations	minority-owned businesses
	(cultural) access to Health Department STD Clinic	minority representation on governing boards
	interagency coordination	minority community competence
	STD outreach	confidentiality through integrated services and extended hours
		languages spoken reflect the composition of the clinic clientele
		cooperation among agencies, schools, and churches
		individuals adept at forming and maintaining networks
		relationships and trust established between various agencies and groups in the county
	social acceptability of addressing STDs	churches communicating and coordinating with other agencies on a variety of issues affecting the county, including STD prevention
	intercommunity dynamics	service providers from outside the county who are not invested in or knowledgeable about communities within the county they work

^a The factors listed are those which were more common either in counties with higher than expected syphilis rates as determined by the regression equation in Kilmarx et al. (1997).

promptly. Compared to STD clinics in counties with lower than expected rates, a greater proportion in those with higher than expected rates were located remotely from the communities most affected by STDs. In one such county the health department was located on the outskirts of town on the far side of an agricultural field. This inaccessibility is compounded by the absence of public transportation characteristic of counties in our sample.

All but one of the counties with lower than expected rates offered STD care five days a week for at least seven hours a day. The majority of counties with higher than expected rates limited their care to one or two days a week, and often for just a few hours on those days. Compared to counties with lower than expected rates, the clinics in counties with higher than expected rates were: more likely to use an appointment system (as opposed to walk-ins); less able to see patients the same day they requested service; less likely to test for syphilis on-site; and more likely to conduct a confirmatory test before treating the patient, thereby incurring delays in treatment.

Language was a cultural barrier to care in a number of the counties with higher than expected rates. The Hispanic and Vietnamese residents of one such county could find no one who spoke their language at the health department. In another county with a large Hispanic population the clinic had a Spanish translator, but she was often busy, leaving the non-Spanish speaking staff to interact on their own with Spanish speaking STD patients. The absence of STD clinicians who are of the same race as the predominantly minority race clientele also has the potential of acting as a cultural barrier to care. Although some counties with higher than expected rates were in this category, there were too few counties in our sample with minority STD staff to establish a clear pattern across all of the counties visited.

The need for confidentiality is more an aspect of human nature than of culture. Restricted hours of STD care (occurring more often in counties with higher than expected rates) often translated into a lack of confidentiality since it was known that patients showing up at a particular time were in the clinic for a suspected STD. The integrated services of other health departments afforded patients more hours of care to choose from and a greater sense of confidentiality since an observer could not identify the kind of care people in the waiting room were seeking. Confidentiality was also affected by the clinic architecture. One county with higher than expected rates provides an extreme example. Patients requested care for STDs at an open counter, behind which sat several administrative staff within hearing distance. Patients were seen by a clinician in a room with vinyl accordion-type doors through which sound traveled freely

and were left open at times with the clothed patient inside (perhaps because of the effort required to open and close this type of door), even though other patients might walk by and look in.

Interagency coordination

More often than in the other counties, the service providers in counties with higher than expected rates showed concern about protecting their 'turf', usually in terms of funding and public prestige, than about cooperating with other agencies to collectively address county STD rates. For example, one rural health center refrained from advertising its services because local pediatricians accused them of taking away their clients. In another instance of lack of cooperation between agencies, a philanthropist born in one of the counties but no longer living in it made the county a gift of a clinic for low income African-Americans. The clinic building was acquired, renovated, and equipped without establishing communication and trusting relationships with existing health care agencies in the county. Staff in the other agencies knew few details of the new clinic but spoke of it with suspicion, suggesting (incorrectly) that it was a place for 'alternative' care such as herbal treatments.

Although seldom involved in health care delivery themselves, the faith community also enters into the mix of agencies that need to coordinate. The role of a few churches in opposing sex education in the public schools of counties with higher than expected rates is discussed below. The actions of these particular churches also demonstrated a lack of ongoing communication and coordination with other agencies. Health service employees in a county with a higher than expected rate noted that some churches were not active in the community unless in opposition to an issue. Another county provided a hopeful model of coalition building, though focused on preventing teen pregnancy rather than STDs. Members of the coalition included health care providers, school board members, church leaders, and county politicians.

Outreach

Traditionally, the county health department's STD clinic presence is extended into the community through the DIS. There was, however, no noticeable difference in the quantity of DIS per county, nor in the number of years of service of a DIS within a county between those with higher versus lower than expected syphilis rates. There were, however, noticeable patterns in the quality of relationships that DIS and others had formed within the community. Comparatively often in counties with higher than expected rates there was little interaction outside the STD clinic between health

department staff and the members of the community most affected by STDs. Health department staff in these counties, including DIS, did not spend time establishing relationships with community members apart from the express purpose of tracking potentially infected individuals. Many were notably poorly connected with other institutions. An STD supervisor with 15 years of experience in a county with higher than expected rates was unaware of any community-based organizations, including one that we visited. Also, though two white male DIS each had at least 20 years of experience in this Southern county; neither could name any black-owned businesses or churches in the county (here, again, we visited one). (These observations further underscore the importance of race relations.) In one county with a higher than expected rate a health department employee who was frustrated with the lack of outreach beyond the clinic building said the prevailing attitude was that “Outreach is a dirty word”.

This was not the case in every county visited. A white female health educator in a county with lower than expected rates was able to name several African–American community leaders. In another county the white male DIS stressed the importance of dropping into a neighborhood convenience store owned by an African–American woman for a cup of coffee to stay in contact with her. Because he felt that employment was a major concern for many of the people he interacted with, he read the classifieds section of the newspaper every day so he could let people know about any job openings. Through such means he had earned the trust of the community. He reported: “I’ll reach a lot of the young black males through their grandmothers ... the grandmother will bring him to me in person”.

Social acceptability of discussing STDs

Patterns among the counties in the social acceptability of publicly discussing STDs were most evident in the activities of churches. The school boards in most of the counties we visited were against discussion of pregnancy and STD prevention other than abstinence in the schools. This result had been achieved in some of the counties with higher than expected rates through active lobbying against sex education by one or more local churches. In one such county a respondent reported that several churches in the main town were trying to eliminate a committee that oversees the ‘family life’ curriculum in the schools which includes sex education, even though students could already opt out of the curriculum. The health educators in this county were not allowed to advise students, even individually, about STDs or pregnancy prevention.

In contrast, in several communities in which rates were lower than expected, African–American churches were active in AIDS and STD prevention. In one such county, the pastor of the African–American church we visited invited the site visitor to talk to the congregation about STDs.

Intercommunity dynamics

Being located on an interstate highway and having a sizable migrant farm worker population both appeared to be related to having higher than expected syphilis rates. During its recent syphilis epidemic, one county closed down interstate truck stops known to be frequented by prostitutes. Two counties that had been bypassed by an interstate had lower than expected rates of syphilis but appeared to have suffered from the loss of economic opportunity afforded by the traffic.

In counties with higher than expected rates, the DIS were more likely to commute in from a neighboring county. In two of these counties the DIS showed little awareness of the community in which they worked, perhaps in part because they were residents elsewhere. During a conversation that took place across the street from an African–American nursing home, one DIS could not suggest to us where to find an elderly African–American who might relate to us the history of the community. Another, who had worked in the county for many years, knew essentially nothing of a community-based clinic in the county that the site visitor had observed during the initial drive through the county. In contrast, a nurse who oversaw the STD care in one county but lived in another was apparently not hindered by the handicaps of this physical and emotional distance. She evidenced a strong sense of commitment to the county in which she worked, playing a key role in establishing communication and trust between the various organizations working in the county.

Individuals affecting the sociophysical environment

In a number of counties there were individuals who had a disproportionately negative influence on the community. Cooperation between agencies was at times preempted by the corruption or incompetence of one individual. In three of the counties visited a public official, such as the sheriff or mayor, had been arrested or was widely suspected of graft. Although coordination between the non-corrupted agencies in these counties occurred, it could not reach optimal levels because of the need to work around the corrupt official and his or her agency. In a county with higher than expected rates the DIS left his job because of a regional STD supervisor who had a widespread repu-

tation for poor supervisory and interpersonal skills. At least two DIS had left their jobs because of this person.

Just as there were individuals in some communities who had a disproportionately negative influence, there were also individuals who had a marked positive influence on the sociophysical environment. These people were skilled at developing and maintaining relationships within and between agencies. They would defuse agency turf battles and had often established good relationships across racial and economic differences. The critical role these individuals played was often recognized by their peers. In one county we asked the health department director to identify the two or three factors in the county most responsible for keeping syphilis rates lower than they might be otherwise. Without hesitation, she named the STD regional supervisor who lived and worked in the county, and listed the ways in which she was particularly effective (e.g., she was respected and trusted by people in other agencies as well as those most commonly affected by STDs).

Discussion

This study revealed several factors of the sociophysical environment potentially influencing syphilis rates. Although often interrelated and difficult to separate, we discuss these factors by placing them in the geographical, architectural and technological, and sociocultural categories of the environment.

Geographic environment

Geographic factors included proximity to an interstate highway and agricultural crops and related employment opportunities that attract migrant workers. People entering the county because of highway access or to work on crops, if infected and having sex with county residents, represent two of many potential modes of entry of infections into the county. Alternatively, these factors may influence syphilis rates more indirectly by affecting community dynamics. For example, interstate routes may serve as a conduit for illegal drugs which, when they become prevalent in the community, may alter sexual mixing patterns (Cook et al., in press). Location of counties in the South was also an a priori geographic factor of interest to us. However, our sites outside of the South were so few and varied that the only notable difference between the Southern and non-Southern counties was the proportion of the population that was African-American (significantly greater in the Southern sample). We discuss some aspects of race, below, with the sociocultural factors.

Architectural and technological environment

Technological factors include the provision of treatment for syphilis. In the regression equation of the first phase of this study, the influence of the number of physicians per 100,000 population, caused us to look in the second phase for additional aspects of availability of clinical services for STDs. We identified a number of factors, each related to potential delays in receiving treatment from the public health STD clinic. These included a remote location and the likelihood of seeing and treating a person the same day they requested care. Any delays in treatment that these factors incur provide more time for transmission to others, thereby contributing to the continued presence of syphilis in the county. Furthermore, the architecture of a clinic can affect the confidentiality of sensitive conversations, and could influence whether some people seek care at the clinic.

Sociocultural environment

The majority of the environmental factors emerging from our data were sociocultural. We had an a priori interest in exploring how unemployment might affect syphilis rates, as indicated in the regression equation. In the counties we visited the availability of sustainable jobs for the local minority appeared to be associated with lower than expected syphilis rates. What are some potential mechanisms of this association? Stack (1974) described in one urban community complex networks for the exchange of goods and services that people living in poverty entered into with one another as a collective means of survival. These material interdependencies could both result from, and lead to, sexual relationships. In an alternative model, lacking a meaningful job, some people (predominantly men) may turn to obtaining and selling illicit drugs, such as cocaine, to generate an income. Women with little or no income who become addicted to cocaine may exchange sex to obtain drugs. A person's exposure to STDs will increase if the considerations in these models lead to more sexual relations with people likely to be infected.

In the regression analysis the percent unemployed in a county had a weak *inverse* relationship with the syphilis rate (partial $R^2 = 0.002$). In that model, however, the unemployment variable was for the entire county population and was not race-specific. It also did not include underemployment, seasonal employment, lack of benefits, and other important nuances of employment. Furthermore, others have found the overall mortality of a population is more related to income disparity than to unemployment, average income, or the prevalence of poverty (Ben-Shlomo et al., 1996; Kennedy et al., 1996). They argue that a particular

level of income is less important to health than one's relative position in the community. Income disparity may thus relate how resources are distributed in the community. A relatively great disparity suggests sizable social distances, and thus social tensions, in the community. In our study sample, we would expect the social distance evident between farm owners and their Hispanic field workers, for example, to be reflected in a large income disparity in the county. Such a social distance makes it difficult for those lower on the social scale to express a need, such as time from work to seek care for an STD, or the desire for evening clinic hours.

The percentages of the county population that were African-American and Hispanic were both strong predictors of syphilis rates relative to the other regression variables (partial $R^2 = 0.09$ and 0.01 , respectively). This might be expected since nationwide rates among African-Americans, and until recently among Hispanics as well, have been orders of magnitude greater than among whites (Division of STD Prevention, 1996). A larger percentage of these racial and ethnic groups thus weights a county's average rate of syphilis towards a higher value. Although the associations in the regression equation thus reflect, in part, psychological and behavioral factors of African-American and Hispanic individuals, our interest was in the manner in which race might work in the sociocultural environment, and thus reflect a characteristic of the county.

A sociocultural factor pertaining to race that emerged from our qualitative data was the ability of people of a particular race or ethnic group to work collectively towards a common goal. This communal skill has been referred to by others as 'community competence' (Iscoe, 1974; Cotrell, 1976; Eng and Parker, 1994). Components of community competence include: (1) effective collaboration in identifying the problems and needs of a community, (2) achieving a working consensus on goals and priorities, (3) agreeing on means of achieving an agreed upon goal, (4) collaborating effectively in the required actions, and (5) mobilizing resources. A lack of community competence was seen, for example, in the county we visited where the large Hispanic population could not identify any leaders and had few resources available to them. Positive examples were seen in those counties where African-Americans had rallied to increase job opportunities and improve their neighborhoods. In a measure related to community competence, Sampson et al. (1997) found an association between neighborhood 'collective efficacy' and violent crime in the neighborhood. In the first phase of our study, we found that county syphilis rates were also associated with violent crime (Kilmarx et al., 1997). Rather than one causing the other, syphilis rates and violent crime

may be co-morbid events both linked to community competence.

The potential importance of relations *between* races was most evident in the cultural accessibility of STD clinics, in part through the degree to which authority was shared in governing boards. Exclusion of African-Americans or Hispanics from institutional governance not only denies those racial and ethnic groups experiencing the most STDs a voice in how the institution conducts business, but it obviates the sense of ownership of the institution that engenders emotional and material investment. A lack of ownership can degenerate further into a sense of alienation when the institution's staff do not respond with cultural sensitivity to the clientele, possibly not even speaking their language. Analogous to community competence, there is also a literature on cultural competence among institutions (Rogers, 1995; Lavizzo-Mourey and Mackenzie, 1996; Rorie et al., 1996). Cultural competence within an institution goes beyond an awareness and appreciation for cultural diversity, and includes specific skills in effective cross-cultural communication and empowerment. Cultural competence within health institutions treating syphilis might include flexibility in hours of service and providing greater confidentiality through integrated services. Clients might then be less likely to delay seeking treatment. They might also have a greater trust of the institution and its staff and be more receptive to their health education messages.

Trust is a prominent component of the sociocultural environment, touching on all of its factors. In our study the importance of trust was clearly evident in interagency coordination and outreach, two components of accessibility to clinical services. Although the regression analysis indicated that the number of private physicians was associated with syphilis rates, the site visit findings suggested that the relations between private physicians and other agencies in the county are also important. Physicians who are not invested in the community because they are of a different culture or a different county may be less able to establish relationships of trust necessary for effective coordination of services.

STD clinic staff may not develop relationships with the communities most affected by STDs for similar reasons. In such situations outreach, if it exists at all, can become pragmatic and impersonal, limited to the business of locating potentially infected individuals. Staff in a few of the counties visited, including some who commuted in from a neighboring county, provided examples of positive interactions. They interacted with the community and the staff of other institutions in ways that were not just pragmatic, but demonstrated a sincere interest in individuals and led to the development of mutual trust and cooperation.

Individuals affecting the sociophysical environment

Individual and environmental factors in Stokols' model of social ecology each affect each other. We observed that a well placed individual can have a profound effect on the sociophysical environment of the county. With poor relational skills or dishonesty, they can engender distrust and undermine community-wide coordination. Alternatively, an individual with skills at building and maintaining relationships and networks may significantly enhance a county's effectiveness in combating STDs. Although the presence of such individuals may not, itself, be measurable, their influence will be manifest in the other factors of the sociophysical environment.

Study limitations

The nature and scope of this study necessarily incurred some limitations important to the interpretation of the findings. Our sample of eleven counties was relatively small, even though they are relatively homogenous in terms of population size. We were unable to reliably determine the degree to which their outlier status in the regression model was related to relative thoroughness (or underreporting) in syphilis reporting. Variations in gender relations and the social constructs of gender roles within particular cultures was another factor we did not study. This would be an important factor to explore in future community studies of diseases transmitted sexually.

Visits to these counties impressed us with the variety of ways in which counties can be unique while also sharing some characteristics in common with other counties. Individual site visitors also have different perspectives and skills. In only a few instances did more than one person visit a county, thus many of the observations do not have the benefit of a parallax view. The gender, race, and prior experiences of the individual site visitors undoubtedly had some influence on the questions asked and the observations made. Finally, the time we spent in each location was relatively brief. Although an initial impression can be the most objective, and county residents may be more candid with outsiders, obviously we would have learned more had we stayed longer. In spite of these limitations, however, we feel that on-site visits were invaluable and led to the identification of some prominent patterns.

Summary and conclusions

This study demonstrates the complementarity of a quantitative epidemiologic ecologic analysis and a qualitative exploration of components of a model of social ecology. The quantitative research identified

variables statistically associated with county syphilis rates; the qualitative research generated hypotheses regarding additional factors to consider for future research. Most notably, the qualitative research identified relational aspects that were not self-evident in the regression variables. The qualitative study suggested, for example, that the quantitative association between race and STDs may in part reflect relations within and between racial and ethnic groups. Therefore, in addition to asking "What is it about being black or poor that increases one's risk of infection?", one might ask "What is it about the way a community functions that results in many black or poor people being infected?"

While this qualitative study followed a quantitative one, the reverse may now be possible, leading to more fruitful quantitative analyses employing measures of factors suggested by this study. Several of the identified factors already have associated quantitative measures. They include: the number of minority-owned businesses; income disparity; representation of minorities on governing boards; and the distance of a clinic from the community most affected by STDs. Other factors, such as the degree to which care providers, including DIS, have established trusting relationships with the community, will require the development of new measures.

The systematic measurement of these variables in a larger sample that includes metropolitan counties will reveal the degree to which the factors identified in non-metropolitan counties are universally applicable. In addition, factors uniquely relevant to metropolitan counties might be identified through a qualitative study of such counties.

The factors we identified were among counties with ten-year mean syphilis rates that were higher or lower than expected as predicted by the variables in our regression equation. Information obtained from these outliers may lead to a yet more highly predictive model that explains what keeps syphilis endemic at a particular rate. A similar study of communities that were not outliers would clarify the degree to which our findings help explain the outlier status of the communities we studied. Perhaps the greatest challenge to the further study of factors of the sociophysical environment affecting syphilis, however, is the vast array of permutations by which the factors interrelate. A systems analytic technique may be more appropriate than a traditional epidemiologic regression analysis for illuminating these interrelationships.

The exploratory nature of this study is an insufficient basis for definitive recommendations for syphilis prevention. Nonetheless, factors we identified that have a strong construct validity may prove to be fruitful if put into practice. For example, measures to enhance or ensure the perceived anonymity of STD clients through clinic schedules, policies, and architecture

are likely to decrease barriers to seeking care for infections. Some DIS may need to be encouraged or helped to gain a fuller knowledge of the communities in which they work, and to become known by the communities. Moreover, it may be helpful to build on existing strengths in a county by, for example, facilitating the work of those with demonstrated skills at establishing relationships and building networks among different agencies and racial communities.

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