Canada, during routine public health measures of infectious disease control between April and August, 2009. In addition to standard contact tracing information, participants were asked to list all venues attended in the last 6 months where sexual partnering may have occurred. We constructed a sexual affiliation network by linking together persons infected with syphilis, and their named sexual contacts, to sex partner meeting venues. By transposing the sexual affiliation matrix and applying matrix multiplication we created two separate networks; a network of persons connected by venues and a dual network of venues connected by persons. Hierarchal clustering was performed to model patterns of individual patronage of venues, and network algebraic measures of centrality and permutation statistical methods were used to determine what type of venue connected the most individuals infected with syphilis. **Results** 77% of participants reported meeting a sex partner at a social venue in the last 6 months. We identified a densely connected sexual affiliation network of 94 men who have sex with men (MSM), comprised of 18 cases of infectious syphilis and 76 named sexual contacts connected by 21 venues. In the network of sex partner meeting venues, Internet venues had higher degree centrality than non-internet venues (p<0.05). In the network of men connected by venues, hierarchal clustering detected a cluster of 35 men linked together by their patronage of three Internet venues see Abstract P1-S4.10 Figure 1. These three Internet venues had the highest degree centrality in the network of sex partner meeting venues and connected two thirds of all infectious syphilis cases.
Conclusions To our knowledge, this is the first study to use SNA of a sexual affiliation network to quantify the importance of places in an outbreak of infectious syphilis. Network analysis allowed identification of three key venues that connected individuals who were infected with syphilis. These venues could provide public health officials with an epidemiologic target for primary and secondary prevention strategies to prevent further dissemination of disease.

Epidemiology poster session 4: Methodological aspects: Outbreak evaluation

P1-S4.11 **THE USE OF THE HISTORICAL LIMITS METHOD OF OUTBREAK SURVEILLANCE TO RETROSPECTIVELY DETECT A SYPHILIS OUTBREAK AMONG AMERICAN INDIANS IN ARIZONA**

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Background In April 2007, an Indian Nation located in Southern Arizona declared an outbreak of syphilis among its tribe members. The Arizona Department of Health Services Sexually Transmitted Diseases Control Program (ADHS STDCP) was first alerted by the tribe about the increase in syphilis cases during January 2007, 6 months after the occurrence of the first case in the outbreak. At the time, the ADHS STDCP did not have a method in place to monitor surveillance data for the detection of an outbreak of any sexually transmitted disease occurring within the state.
Methods In January 2009, the Arizona Department of Health Services STD Control Program developed a syphilis outbreak detection system based upon a Historical Limits Comparison Method (HLCM) to monitor reported syphilis-related labs. The Southern Arizona Indian Nation outbreak was then retrospectively evaluated using the state surveillance database and the HLCM outbreak detection system.
Results Retrospective analysis of the HLCM system of the syphilis outbreak in Arizona indicates that, had this system been in place at the outset of the outbreak, the ADHS STDCP would have been

alerted to the increase in syphilis-related labs reported from the tribal Indian Health Service centers between 10 and 12 weeks earlier.
Conclusions The use of the HLCM system of syphilis outbreak detection in Arizona would have alerted the state health department earlier to an increase in syphilis cases occurring on the tribal lands in Southern Arizona. Earlier awareness of the increase in cases would have allowed for earlier intervention and collaboration with the tribe to control the outbreak. The ADHS STDCP has since instituted this method of outbreak detection among identified high morbidity or high risk surveillance sites for both syphilis and gonorrhoea.

Epidemiology poster session 4: Methodological aspects: Neighbouring

P1-S4.12 **USING NEIGHBOURHOOD-LEVEL POPULATION DATA TO GUIDE GONORRHOEA INTERVENTION, MONTRÉAL, QUÉBEC, CANADA, 2002−2009**

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Background The reported incidence rate of gonorrhoea has more than doubled between 2000 and 2010 in Montréal, increasing in both genders and all age groups; however, it was particularly high in females aged 15 to 24. As the reasons for the increases among young women are not fully understood, we wanted to determine whether neighbourhood-level population characteristics were associated with incidence rates among them, to help target intervention strategies.
Methods Incident gonorrhoea cases were female residents of Montréal, aged 15 to 24, who met Québec's provincial gonorrhoea surveillance definition, with a notification date between 2002 and 2009. The unit of analysis was neighbourhoods—111 non-administrative boundaries defined by the Montréal Public Health Department, by grouping census tracts to maximise homogeneity of population characteristics. The dependent variable was the neighbourhood gonorrhoea incidence rate based on all reported cases and the neighbourhood population, for females aged 15 to 24; the independent variables included material and social deprivation indices, their combination and components, and ethnic origin. Adjusted incidence rate ratios (IRR) were estimated by negative binomial regression after exponentiation of the regression coefficients and show the change in the incidence of gonorrhoea for each unit increase in the independent variable. In the final model, independent variables were normalised to facilitate comparison of their IRR which represents the change in gonorrhoea incidence rate associated with an increase of one SD in the percentage of residents of a given ethnic origin.
Results A total of 837 cases were reported (cumulative incidence rate 5.6 per 100 000). Higher proportions of three ethnic origin groups were associated with higher neighbourhood gonorrhoea rates, even when deprivation indices were considered (Abstract P1-S4.12 table 1).

Abstract P1-S4.12 Table 1   Population characteristics associated with gonorrhoea rates among female residents of Montréal aged 15−24, 2002−2009

Independent variable	Incidence Rate Ratio (95% CI)	p value
% of the population whose origin is African	1.34 (1.20 to 1.49)	0.000
% of the population whose origin is Aboriginal	1.32 (1.19 to 1.46)	0.000
% of the population whose origin is Caribbean	1.19 (1.07 to 1.33)	0.001

Conclusions Customary methods for gonorrhoea surveillance consider individual characteristics of cases as risk factors for disease. However, gonorrhoea is clustered in neighbourhoods that have high

proportions of African, Aboriginal and Caribbean populations. The ecological approach used in this study suggests that certain phenomena exist at the population level that may not exist at the individual level, which can be used to target population-level prevention programs.

Epidemiology poster session 4: Methodological aspects: Neighbouring / mapping

P1-S4.13 **MAPPING HIGH RISK ACTIVITIES OF HIV/AIDS IN GAOXIN AND YANTAN DISTRICT OF ZIGONG CITY**

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Background Zigong is located in the south of Sichuan Province of China. As a key area with a large number of migrants, Zigong has long been confronting the danger of HIV/AIDS. The goal of "Zigong geographic mapping on HIV/AIDS high-risk population" research project is to provide information on the location, type and volume of the female sex workers (FSWs) in Gaoxin (urban) and Yantan District (rural) to provide baseline information for HIV/AIDS prevention policy and programs in future.

Methods This study adopted a "geographical approach" to map the location and spots of the activities of sex trade and estimated the number of FSWs involved in the activities. This included two sequential steps: 1) Systematic information gathering from key informants (KI) suggested the locations ("hot spots") where FSWs congregate. 2) The "hot spots" were validated through site visit and insiders; the information about the number and characteristics of FSWs in each spot were collected.

Results In Gaoxin District: 59 high-risk spots were confirmed and 16 clusters were marked in 10 zones. The most common type of sex trade spots was hair salon/massage room/foot massage room. 72.9% of the spots were both "seeking risk" and "taking risk", while 22.0% and 3.4% were only "seeking risk" and "taking risk" respectively. 39.0% of the spots had more than three clients per FSW per day. The estimated number of total FSWs in this urban area was 303. 38.5% of FSWs were in hotel/small lodge, while 29.3% and 27.3% were in small tea house/bar/KTV and hair salon/massage room/foot massage room respectively. The peak season, peak date and peak time of the most spots was summer, the whole week, afternoon and night. In Yantan District: 12 high-risk spots were confirmed and half were concentrated in Yantan Town. The most common type was small tea house/bar/KTV. Nine spots were both "seeking risk" and "taking risk", while three were "taking risk" only. Five spots had more than three clients per day for each FSW. The estimated number of FSWs was 42, and 74.4% worked in the small tea house/bar/KTV. The peak season, peak date and peak time of the most spots was spring and summer, the whole week, and night, respectively.

Conclusions The mapping approach provided direct and visible geographic distribution information, which enables a quick mastery of the distribution of high risk spots and the number of high risk population, for public health intervention planning and program implementation.

P1-S4.14 **DOES CORE THEORY APPLY IN RURAL ENVIRONMENTS?**

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Background The expansion of core theory to include geographically defined core areas of elevated infection has been based primarily on spatial investigations into sexually transmitted infections (STIs) in large urban areas. It is uncertain whether core theory is applicable for rural environments. Our objective was to evaluate the concept of geographical core areas for gonorrhoea and syphilis in North Carolina, a rural state with urban pockets.

Methods We analysed geomasked gonorrhoea and syphilis cases reported to the North Carolina State Health Department's sexually transmitted disease surveillance program from 1 January 2005 to 31 December 2007 for gonorrhoea and from 1 January 2000 to 31 December 2007 for syphilis. Incident gonorrhoea and syphilis rates were estimated using census tract level population estimates for the total North Carolina population from the US census. Rates were mapped by census tract and quarter. Rurality was measured at the census tract using two different definitions: percent rural and rural-urban commuting area (RUCA). RUCAs were used to classify North Carolina census tracts into rural, small town, micropolitan, or urban. SatScan was used to identify spatiotemporal clusters of significantly elevated rates of infection. Clusters were classified as outbreak or core based on duration. Clusters lasting the entire study period were considered potential core areas, while clusters of shorter duration were considered outbreak areas. Clusters were overlaid on maps of rurality and qualitatively assessed for correlation.

Results On average, gonorrhoea rates are low in the western mountains and higher in the eastern coastal part of the state. Most of the clusters were located in urban RUCAs or very low percent rural. Clusters for rural and small town RUCAs were of short duration and usually covered several census tracts and sometimes more than one county. Consequently, they were considered outbreak areas rather than core areas. Similar results were found for syphilis.

Conclusions We found that core areas of elevated STIs were limited to the urban centers in rural environments. Significant clusters of infection in rural environments appear to be due to outbreaks. Rural environments may have core areas but not enough infection to sustain ongoing transmission. Bridge contacts may be more important for STI transmission in rural environments.

Epidemiology poster session 4: Modelling

P1-S4.15 **REVISITING HIV EPIDEMIC APPRAISALS FOR ASSISTING IN THE DESIGN OF EFFECTIVE HIV PREVENTION PROGRAMS**

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Background There is substantial heterogeneity in the size and trajectory of HIV, driven largely by differences in the population sexual structure, which determines overall HIV transmission dynamics. Two standard methods have been developed to appraise epidemics and guide prevention strategies. The numerical proxy method classifies epidemics based on HIV prevalence thresholds. The Modes of Transmission (MOT) model estimates the distribution of incidence over 1 year among subgroups. Neither approach explicitly captures the drivers of the epidemic and can therefore lead to misguided prevention priorities. Using data from India, we explored the limitations of current methods and propose an alternative approach.

Methods We compared outputs of the traditional methods in five countries with published results, and applied the numeric and MOT model to India, and to six districts within India. We developed an alternative approach based on a qualitative understanding of local