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Drugs of Today 2005, Vol. 41, Suppl. ?

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**An integrated approach  
to the understanding of  
*Chlamydia trachomatis* infection**



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*Amsterdam, December 17, 2004*



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# **CHLAMYDIA TRACHOMATIS INFECTIONS IN NICARAGUA: PRELIMINARY RESULTS FROM A COMPETITIVE VOUCHER SCHEME TO PREVENT AND TREAT SEXUALLY TRANSMITTED INFECTIONS AND HIV/AIDS AMONG SEX WORKERS**

*A.C. Gorter<sup>1</sup>, Z.E. Segura<sup>1</sup>, P.H.M. Savelkoul<sup>2</sup> and S.A. Morré<sup>3</sup>*

<sup>1</sup>Instituto CentroAmericano de la Salud ICAS, Managua, Nicaragua, <sup>2</sup>Medical Microbiology and Infection Prevention and <sup>3</sup>Laboratory of Immunogenetics, VU University Medical Center, Amsterdam, The Netherlands

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## **Summary**

A donor-supported competitive voucher scheme in Nicaragua provides prevention and treatment services for sexually transmitted infections (STIs) and HIV/AIDS to high-risk populations such as sex workers and their partners and clients. Beyond detecting and treating STIs, HIV and AIDS, these

health services can also raise awareness of risks and promote safer behavior, leading to widespread benefits. This review describes the voucher scheme, summarizes published data on *Chlamydia trachomatis* infection in Nicaragua and provides preliminary prevalence data on *C. trachomatis* obtained in 2003 through the voucher scheme. © 2005 Prous Science. All rights reserved.

Correspondence: Anna C. Gorter, Instituto Centro-Americano de la Salud ICAS, P.O. Box 2234, Managua, Nicaragua. Website: [www.icas.net](http://www.icas.net). E-mail: [agorter@ibw.com.ni](mailto:agorter@ibw.com.ni).

## **Introduction**

Reaching population groups at high risk of sexually transmitted infections (STIs) and

HIV with STI/HIV care is difficult but essential in detaining an HIV epidemic. These core groups are also the ones that facilitate the entry and spread of HIV in the general population, especially in low-prevalence countries such as Nicaragua, which has an adult HIV rate of 0.2% (1). Thus, small interventions targeting such groups can have a large impact on the spread of STIs and HIV (2).

STIs increase the transmission of HIV by a factor of three to five or greater (3). While it may be difficult to achieve immediate changes in sexual behavior, it may be easier to persuade individuals to make use of improved STI/HIV services. More STIs, including those that are asymptomatic, will be detected and treated, concurrently increasing awareness about risks, promoting safer sexual behavior and facilitating early detection of HIV and appropriate follow-up. However, gaining access to high-risk groups, such as sex workers, their partners and clients, drug addicts, men who have sex with men (MSM) and mobile populations (army personnel, truck drivers) tends to be difficult. In developing countries, because of decreased humanity (stigmatization, discourteous treatment, lack of confidentiality) and/or costs, the use of sexual health services among these groups is low, and due to low technical quality it is usually ineffective and inefficient (4). What these groups need is subsidized access to convenient, courteous, confidential services of high technical quality that identify their sexual health needs in a non-stigmatizing manner and provide appropriate counseling, diagnostic information and treatment.

However, as quality STI/HIV care is expensive, limited resources should be targeted. Competitive voucher schemes have proved to be an effective method of targeting resources to high-priority populations for the provision of clearly defined packages of cost-effective services. In Nicaragua such a scheme was developed in 1995 with the aim of providing populations at high risk for STI/HIV/AIDS with access to quality STI/HIV care.

### **How the voucher scheme works**

In Nicaragua, both prostitution and homosexual relations are forbidden by law but condoned in practice, which makes a comprehensive STI/HIV program feasible. Originally the scheme started as a research project to improve STI services for sex workers, as well as for solvent-abusing street youth, in the capital city, Managua. Its success in reducing STIs (5) led researchers to turn the scheme into an operational program. New groups (partners/clients of sex workers, MSM, prison inmates, army personnel, and truck drivers) were included; services for HIV/AIDS diagnosis, care and follow-up were added; and the program expanded to other regions, and now covers most of the Pacific Coast, including the Pan-American Highway.

The Instituto CentroAmericano de la Salud (ICAS) acts as the voucher agency by distributing vouchers; contracting clinical and laboratory services (from the public, NGO and private sector); training clinic staff; defining service packages; analyzing data; and monitoring quality. Annually, over 10,000 vouchers are distributed to approximately 20,000 field contacts to promote safe sex, use of condoms and health services, and approximately 4,500 medical consultations are performed. Vouchers are distributed every 4 months by ICAS staff, through community-based organizations in close contact with these groups, or by sex workers to their partners/clients (Fig. 1). The vouchers serve as a stimulus to attend STI services and to guide the target population to the available services. They remain valid for 3 months and entitle the bearer to a predefined package of "best practice" STI/HIV services free of charge at any one of 20 contracted clinics. Clinics compete for contracts on the basis of price, quality and location. The contracts require staff to follow a specified protocol and to participate in training sessions. Services are paid at a fixed fee per voucher. Quality is monitored and only the best providers are retained in the scheme.

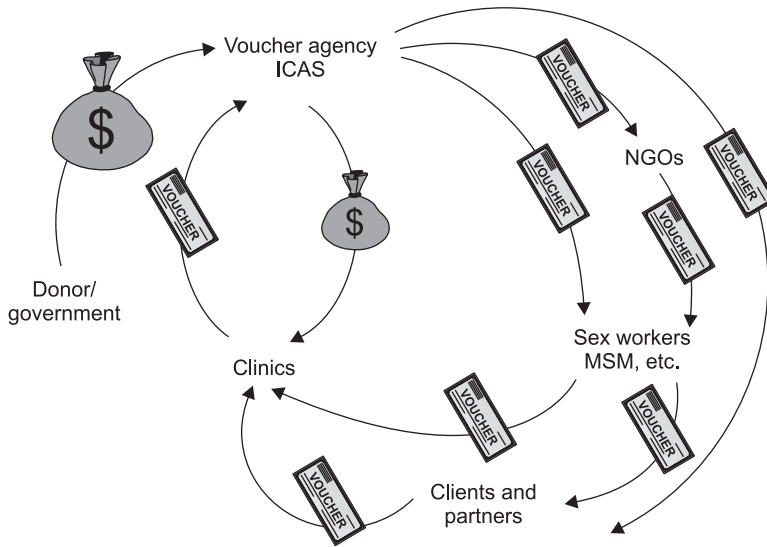


Fig. 1. Distribution of vouchers and funds in the competitive voucher scheme.

### STI/HIV service package

Specific STI treatment strategies used in sex worker populations in developing countries include (6):

- i) Diagnosis and treatment of symptomatic patients on clinical, etiologic or syndromic grounds. This strategy is constrained by reliance on symptoms, while most women and many men with STIs are asymptomatic.
- ii) Regular screening and treatment, which is limited by the lack of affordable screening tests and/or poor performance of available tests in developing countries.
- iii) Presumptive treatment regardless of symptoms. This strategy does address problems of asymptomatic infections and screening tests, but experience to date is limited.

Often combinations of strategies are used, as in the case of the voucher scheme. Since 1997 azithromycin 1 g (single dose) has been offered to all voucher redeemers as presumptive treatment against *Chlamydia trachomatis*, because establishing reli-

able chlamydia testing in Nicaragua failed. *Neisseria gonorrhoeae* testing (culture) was only performed during the first 4 years of research and was abandoned due to costs and the fact that azithromycin cures most of the cases. Now the service package consists of a practical combination of presumptive treatment for *C. trachomatis* and *N. gonorrhoeae*, cheap screening tests for syphilis, *Trichomonas*, *Candida*, *Gardnerella*, cervical cancer and clinical diagnosis of condylomata acuminatum, herpes simplex, chancroid, lymphogranuloma venereum and other STIs. In addition counseling on safe sex and prevention of STIs and HIV is offered along with condoms and educational material specific to each high-risk group. Furthermore, all redeemers are offered a second voucher for voluntary counseling and testing for HIV, and pregnant sex workers are encouraged to take the test. Persons diagnosed with HIV are assigned a health promoter as care coordinator, who then assures that he/she receives the care needed. Through the efforts of the Global Fund for AIDS, TB and Malaria, HIV/AIDS treatment is being introduced in Nicaragua.

### Overall results of the voucher scheme

From 1996 to the end of 2004 the scheme distributed over 50,000 vouchers, provided more than 18,000 consultations, and treated over 5,000 cases of STIs. Of the approximately 1,500 sex workers who are active at any time in the program area, all are reached through field work, but turnover is high at up to 40% every 6 months. Almost 50% of the women redeem their voucher, while for men redemption rates are 20–30%. There is high use of vouchers by sex workers with the highest STI prevalence levels for *N. gonorrhoeae*, *Trichomonas* and syphilis, who are also the poorest, earning the least per client. The scheme succeeded in reducing the STI prevalence in sex workers redeeming their voucher (average annual reduction of prevalence of gonorrhoea 7%, *Trichomonas* 9% and syphilis 16%) and in increasing condom use and uptake of HIV counseling and testing (5, 7, 8). Although prevalence levels are not 0%, sex workers remain free of STIs much longer, which considerably reduces the risk of being infected with HIV or infecting their clients. HIV prevalence in sex workers in Managua remained between 0% and 2% (1991: 0.8%; 1997: 1.3%; 1999: 2%; 2000: 0.9%; 2002: 0%; 2003: 2%), a rate well below that observed in the sex worker populations of other major cities in Central America (1, 8).

### Chlamydia and gonorrhoea study within the context of the voucher scheme

To validate the soundness of the treatment protocol as described above and to obtain data about the current prevalence levels of *C. trachomatis* and *N. gonorrhoeae* among high-risk groups in Nicaragua, a study was undertaken with a sample of sex workers and men redeeming their voucher at one of the nine clinics in Managua. Each woman or man using a voucher between August and November 2003 was asked to participate. All patients agreed, and urine was collected and transported to the central laboratory to be centrifuged. The pellet was saved at –20 °C and sent to the Netherlands for further *C. trachomatis* and *N. gonorrhoeae* testing based on DNA amplification assays.

### *C. trachomatis* infections in Nicaragua

The number of studies assessing the *C. trachomatis* prevalence in different study populations in Nicaragua is still very limited. Two studies have been published, both of which will be discussed below, as well as the preliminary results of the voucher scheme study.

#### Published studies

Claeys *et al.* (9) determined prevalence and risk factors of STIs, HIV, and cervical neoplasia in women attending women's health clinics in Nicaragua to assess the potential impact of screening for these diseases. They interviewed 1,185 consecutive attendees at women's health clinics in different regions in Nicaragua. Nearly one in five women had an STI, one in 13 a precancerous lesion of the cervix and none had HIV. *C. trachomatis* was diagnosed in 4.1% (Table I); young age (<30 years) and being employed were risk factors. Fifty per cent of the cases were found in the group of symptomatic, employed women under the age of 30. In this group, the *C. trachomatis* prevalence was much higher, 11.3%, possibly due to more liberal sexual practices, or having more promiscuous partners. The authors concluded that simple measures such as inquiring about STI symptoms, especially in young women, and offering cervical cancer screening to casual attendees, would improve the reproductive care provided by the women's clinics.

Herrmann *et al.* (10) validated the performance of a direct fluorescence antibody (DFA) test and determined the prevalence, risk factors and clinical manifestations of *C. trachomatis* infection in different groups of women in Nicaragua. A total of 926 women, comprising 863 routine clinic attendees (mean age 27 years) and 63 sex workers (mean age 26 years) from health clinics in Leon, Corinto, Matagalpa and Bluefields, were included in the study. The prevalence of *C. trachomatis* infection (Table I), based on positive DFA test and/or polymerase chain reaction (PCR) ranged from 2% among routine clinic attendees aged 35

Table 1: *C. trachomatis* (CT) prevalence in Nicaragua based on published studies.

Study	CT prevalence		Comments
	%	(n/total)	
Claeys <i>et al.</i> (9) 1999/2000	4.1	(40/969)	Total study population
	5.5	(16/292)	STI-related symptoms
	4.6	(21/461)	Symptoms after probing
	1.4	(3/216)	Asymptomatic
Herrmann <i>et al.</i> (10) 1992/1993	4.3	(37/863)	Study population (routine clinic attendees)
	8.0	(10/125)	Age <20 years (routine clinic attendees)
	6.7	(16/239)	Age 20-24 years (routine clinic attendees)
	2.2	(11/499)	age >24 years (routine clinic attendees)
	14.3	(9/63)	Study population sex workers

years or older, to 8% among adolescent clinic attendees, and 14% among sex workers. Among routine clinic attendees, young age (15–19 years) compared with women 25 years of age or older (OR 3.6) and use of oral contraceptives (OR 4.0) were the only statistically significant risk factors identified in multivariate logistic regression analysis. Presence of mucopurulent cervical discharge (OR 5.9) and presence of ectropion (OR 2.6) were the only clinical signs independently associated with infection. They concluded that genital *C. trachomatis* infection is a common health problem among women in Nicaragua, but that its importance was not yet widely appreciated. While screening programs would be justified, they proposed that due to limited resources, syndrome-based treatment algorithms adapted to the Nicaraguan context be implemented.

#### *Preliminary results for C. trachomatis prevalence within the voucher program*

In the voucher program, 338 sex workers from Managua and 133 of their clients and partners were screened for *C. trachomatis* infection using a real time PCR technique (TaqMan) to diagnose *C. trachomatis* infection in a urine specimen after DNA was isolated (HPPTP Kit, Roche Diagnostics).

The sex workers came from the approximately 60 prostitution sites in Managua,

which can be stratified into different socio-economic groups based on the price paid for vaginal intercourse:

1. Solvent abusers: girls and women who live at markets or in shacks and exchange sex for the lowest price (\$0.50–1 US). Their clients are among the least paid workers at markets, such as porters.
2. Markets: women working during the day at different markets, at low prices ranging from \$1–3 US. Clients are mainly men who work at or around the market, such as vendors, taxi drivers as well as some business people.
3. Lower income bars/streets: women in working-class bars and streets who offer services for \$4–7 US. Clients are mainly from the skilled manual class, such as construction workers.
4. Middle-income bars/streets: women working in middle-class bars, brothels and some streets in “better” locations, who are paid \$8–10 US by clients with a higher socioeconomic status, such as students, professionals or business people.
5. Red light district: women working in night-clubs and massage parlors earning \$10–15 US or more per client. Clients are generally high-status professionals and business people, including foreigners.

Thirteen percent of women were positive for the presence of *C. trachomatis* DNA. Remarkably, the *C. trachomatis* prevalence was highest among the highest socioeconomic level, the red light district (25%) and statistically significantly higher compared to levels 1 through 4 ( $p=0.0025$ ) (Fig. 2). For clients and partners of sex workers we found a *C. trachomatis* prevalence of 6% with also the highest prevalence level in the red light district (22%).

As expected, the prevalence of *C. trachomatis* was significantly higher in younger women ( $p<0.0001$ ; Fig. 3). When the data for young age and socioeconomic level were combined, the most prominent differences in *C. trachomatis* prevalence were observed: while in level 1 the solvent-abusing girls aged 14–19 years had a *C. trachomatis* prevalence of 6%, in young girls of the same age in the red light district this prevalence was 60%.

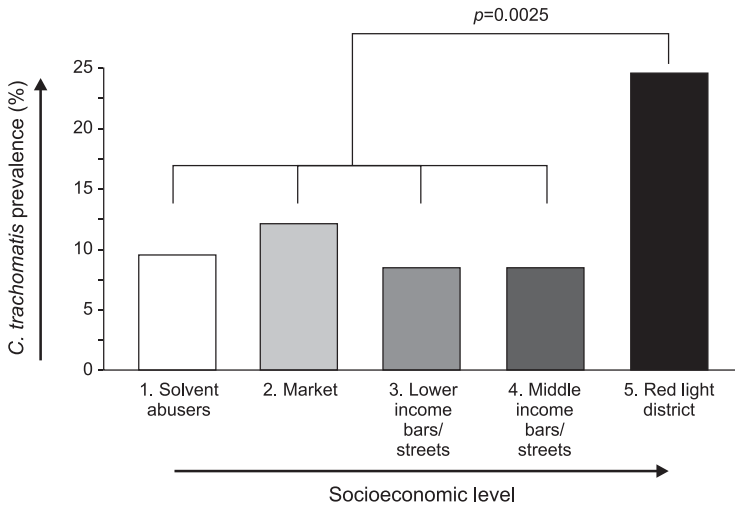


Fig. 2. *C. trachomatis* prevalence in relation to the socioeconomic level.

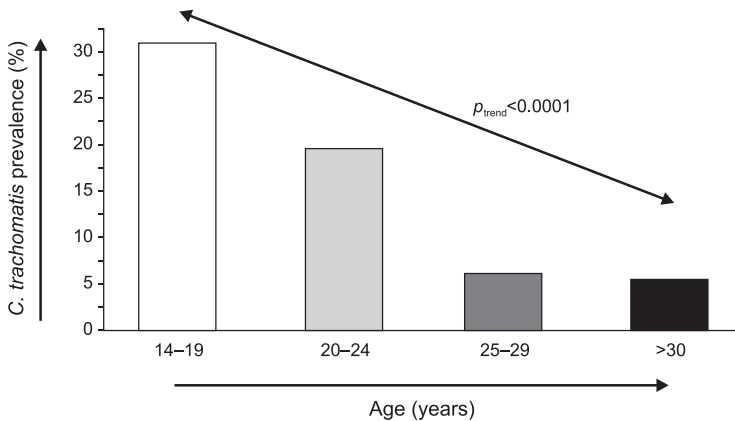


Fig. 3. Age-related prevalence of *C. trachomatis* infection.



We are currently involved in assessing potential risk factors and confounding factors associated with *C. trachomatis* positivity using multivariate logistic regression analysis. We are also assessing *C. trachomatis* serovars not only to identify the *C. trachomatis* serovars found in the population, but also to determine whether clusters of *C. trachomatis* serovars exist in specific socio-economic levels and locations (*i.e.*, specific streets, bars, nightclubs).

## Discussion

Herrmann *et al.* (11) found a similar overall incidence of *C. trachomatis* infection among sex workers (14%) to that found in our voucher-based study (13%), and young age was also a significant risk factor. Our study showed the highest *C. trachomatis* prevalence in the highest socioeconomic level. This is in sharp contrast with the results for the other STIs, *Trichomonas*, *N. gonorrhoeae* and syphilis, for which prevalence levels increase with lower prices for vaginal intercourse and the highest prevalence levels are seen among the lowest socioeconomic groups. Clients in the red light district, compared to the other prostitution sites, have higher levels of education and income and better access to quality STI services, all of which may explain their lower prevalence of the other STIs but not the higher *C. trachomatis* prevalence. Also, condom use at last contact increases with higher prices and is greatest in the red light district. Further analysis to explain this finding is underway. However, in the 1980s the prevalence of *C. trachomatis* infection in the United States was reported to be greater than that for *N. gonorrhoeae*, among whites, the young, and individuals of higher socioeconomic status (11). An extensive literature review of risk factors for *C. trachomatis* infection in developed countries by Navarro *et al.* (12) concluded that chlamydia was detected in a diverse group of people. Unlike gonorrhoea, chlamydia was not concentrated in low income, minority core groups with high rates of partner change, although communities with well-established control programs were

beginning to demonstrate this pattern. This is in accordance with Wasserheit and Aral (13), who described the STI epidemics as dynamic interactions among the pathogen, behavior and prevention efforts, which evolve through four predictable phases: from growth (I), hyperendemic (II) and declining prevalence (III), and finally to phase IV, in which remaining infections move into high-risk populations where control measures are less effective.

Nicaragua still seems to be in phase II; the few scientific studies conducted have shown high levels, especially among youths, but control efforts are implemented on an incidental basis and modes of diagnosis and control still have to be defined by the corresponding authorities. Even though resources are limited and no reliable *C. trachomatis* testing is available on site in Nicaragua, measures such as those proposed or used in the different studies (*i.e.*, inquiring about STI symptoms, especially in younger routine clinic attendees; development of a contextual syndromic management algorithm; and targeted presumptive treatment) could assist Nicaragua in moving into phase III of the epidemic.

## Acknowledgments

We would like to thank Jolein Pleijster for her excellent technical assistance in *C. trachomatis* diagnostics. We also wish to thank all members of the ICAS team (Rene Ramirez, Tomas Danaire, Esteban Zuñiga, Joel Medina) as well as the groups whose donations have made the development of the voucher scheme and this study possible: DfID (UK), Elton John AIDS Foundation, USAID (through NicaSalud), NOVIB and the Dutch Government which currently finances the program (Act. no. 2016).

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