ORIGINAL ARTICLE

Surveillance of HIV in the army of the Republic of Cyprus (SHARC); rationale, design, and implementation of an inexpensive system

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Objectives: To design and implement an HIV surveillance system using periodic cross sectional prevalence surveys in National Guard recruits of the Republic of Cyprus.

Methods: HIV infection surveillance used unlinked anonymous screening (UAS) methodology, which tested residual blood originally collected for other purposes. Residual blood from samples collected for ABO blood group typing at intake and samples from blood collected for hepatitis testing at discharge was used. Screening was unlinked and anonymous.

Results: The system operated for four semiannual recruitment seasons: summer 1998 to the end of winter 2000. No recruits screened at entry into the ranks tested positive.

Conclusions: This was the first large scale HIV surveillance project in Cyprus. Without nationwide HIV surveys, periodic measurements of prevalence could lead to estimates of HIV incidence and provide insights on temporal changes in HIV infection rates. The prevalence data collected provide useful epidemiological information about the status of the HIV epidemic in this segment of the population in Cyprus.

Screening programmes for HIV are established with the premise that early diagnosis of HIV infection is necessary for the protection of both individual and public health, and that a clinical AIDS diagnosis represents a substantial delay from infection.¹ HIV surveillance is a key part of implementing national HIV prevention efforts.

Population level HIV incidence estimates are difficult to determine and incur logistical, reporting, and ethical problems. Therefore, sentinel populations are an attractive alternative. Military recruits are an ideal population for systematic surveillance of HIV infection; their continuous influx into the ranks, the ease of their follow up, and their periodic screening have been shown in previous studies to be very useful in indirectly estimating HIV incidence.^{2–7}

METHODS

In collaboration with the health authorities and the National Guard, a 4 year HIV surveillance system was established. Since an incident case requires documentation of a previous negative test, results from this project could only provide estimates of incidence. This surveillance system could provide valid information about the HIV infection rates among this subset of the male population of Cyprus.

The primary intent of the "Surveillance of HIV in the Army of the Republic of Cyprus" project (SHARC) was to provide timely information in a small subset of the population that is potentially at high risk of exposure to HIV infection.

Population definition

In Cyprus, all males (females do not serve) at the age of 18 are required to serve in the National Guard for 26 consecutive months. The sample is a cross section of the population, as deferments are given only after consideration by a military board and no deferments are given for educational reasons. Recruitment is semiannual, in summer and winter. The two recruit classes differ in their educational and socioeconomic status, factors that might be associated with HIV infection risk.⁸ Males are required to join the ranks at the beginning of the

calendar year in which they turn 18. Individuals who are still in high school are allowed to finish their schooling and then join the ranks in the summer immediately following their graduation; these comprise the summer recruit class. All others (almost exclusively those not in school) join the ranks in the winter. Thus, the educational status of the two recruit classes, and by extension, their socioeconomic status, differ.

To assess HIV prevalence, we designed a system that uses the unlinked anonymous screening (UAS) methodology as described by the World Health Organization.⁹ Our project was initially designed for 4 years, which would allow screening of randomly selected recruits when they join the army as well as when they complete their service. The standard methodology to be used throughout the project would help assess temporal changes in HIV infection rates.¹⁰

Sample size calculations

The number of recruits needed to be screened each year was calculated (based on the formula derived by Kish and Leslie¹¹) using EPI-INFO 6 (Centers for Disease Control and Prevention, Atlanta, GA, USA). Prevalence of HIV infection in this population is assumed to be 0.271% as of the 1996 WHO estimate.^{12–13} Based on sample size calculations we decided to test a total of 1650 recruits annually: 1300 recruits during the summer recruiting period and 350 recruits during the winter one. When combining the estimated population sizes for the two recruitment periods of each year (a total of 1650 recruits) we are able to detect HIV-1 infections (worst acceptable prevalence 0%) with close to 99% confidence.

Specimen collection and HIV testing

Samples were collected at recruitment centres and then shipped to the facilities of the virology laboratory where they were stored and batch tested. We incorporated (fig 1) ABO blood group typing and hepatitis testing as potential sources for residual unlinked sera.

Figure 1 Diagrammatic representation of SHARC.

HIV screening at recruitment

Every new recruit has ABO blood group typing by finger stick. For *every third* (the decision to screen every third patient was made based on the sample size estimates) recruit, an additional two blood drops were placed in two circular spots on filter paper cards (FP, 5 mm × 30 mm, Nobuto filter paper strip, Roshi Kaisha Ltd, Japan), which was dried and processed according to the manufacturer's instructions at the central referral laboratory. Specimens that produced equivocal and reactive results were further tested by an additional ELISA (Genscreen-Pasteur) and a confirmatory western blot format assay (Inno-EIA, Innogenetics). Unused eluate was stored for future use. There was no identifying information on the filter papers where the blood drops were collected.

HIV screening at dismissal

After a 26 month service, recruits are dismissed from active military duty. The military and health authorities intended to establish a hepatitis B education prevention screening (HeBEPS) campaign that would incorporate education, counselling, and voluntary hepatitis testing and would be confidential. A sample of individuals who would attend the hepatitis campaign *and* were due for dismissal from the ranks

in the subsequent 3 or 4 month period would be randomly selected (*every third* eligible recruit) and invited to participate. In an anonymous hepatitis screening study (in the event of refusal to participate the unit physician would proceed to the next eligible recruit and invite him to participate in the hepatitis screening). The HIV surveillance project would use residual blood from the hepatitis screening; HIV screening would once again be *unlinked* and *anonymous*. HeBEPS was intended to be operational in the summer of 2000 in order to screen the recruits of summer 1998 upon exit from the ranks.

Table 1 HIV-1 screening results

	Recruits screened	Positive (%)	Negative (%)	Prevalence
Summer 1998	1300	0 (0)	1300 (100)	0%
Winter 1999	356	0 (0)	356 (100)	0%
Summer 1999	1502	0 (0)	1502 (100)	0%
Winter 2000	265	0 (0)	265 (100)	0%
Total	3423	0 (0)	3423 (100)	0%

RESULTS

The HIV sentinel surveillance project was initiated during the summer of 1998 and continued to the end of winter 2000. A total of 3423 recruits were tested during these four recruitment seasons and all were negative for HIV-1 (table 1).^{14 15}

The second component of SHARC that would allow for HIV screening at exit from the ranks did not materialise for logistical reasons. Owing to a delay in the set up and organisation of the HeBEPS component, it was logistically impossible to screen close to 1600 recruits (who joined in the summer of 1998) upon their exit from the ranks in the summer of 2000.

DISCUSSION

The total number of HIV-1 infections in Cyprus (population ≈ 778 000) is conservatively estimated to be between 500–1000.¹⁶ Heterosexual transmission accounted for 44% of the infections; 45% of the infections were in men who have sex with men; and 2% of the infections were related to injecting drug use. A national AIDS programme must incorporate periodic assessment of HIV infection rates in an attempt to monitor the epidemic's trends over time and across different risk groups and geographic regions. The SHARC programme provides accurate cross sectional prevalence estimates, which at this time are low. The annual cost of the first component of SHARC (at entry HIV screening) was less than £5000 CY (current exchange rate: £1 CY ≈ \$1.5 US). HIV surveillance of selected segments of the population, like the military recruits, can provide cost efficient and timesaving alternatives to large, countrywide HIV infection surveys. Even though such a system might not lend itself to the provision of accurate estimates of true incidence of HIV infection in the general population, it can prove to be useful in indicating the HIV trends in this selected subset of the population.

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CONTRIBUTORS

TCK, project design and supervision, manuscript preparation; LP, project design and supervision; NM, project set up and supervision in the military units; AE, laboratory supervision, HIV assay performance.

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REFERENCES

- 1 **Phillips AN**, Elford J, Sabin C, *et al*. Immunodeficiency and the risk of death in HIV infection. *JAMA* 1992;**268**:2662–6.
- 2 **Brundage JF**, Burke DS, Gardner LI, *et al*. Tracking the spread of the HIV infection epidemic among young adults in the United States: results of the first four years of screening among civilian applicants for US military service. *J Acquir Immune Defic Syndr* 1990;**3**:1168–80.
- 3 **McNeil JG**, Brundage JF, Gardner LI, *et al*. Trends in HIV seroconversion among young adults in the US army, 1985 to 1989. US Army Retrovirus Research Group. *JAMA* 1991;**265**:1709–14.
- 4 **Levin LI**, Peterman TA, Renzullo PO, *et al*. HIV-1 seroconversion and risk behaviors among young men in the US Army. The Seroconversion Risk Factor Study Group. *Am J Pub Health* 1995;**85**:1500–6.
- 5 **Renzullo PO**, McNeil JG, *et al*. Human immunodeficiency virus type-1 seroconversion trends among young adults serving in the US Army 1985–93. US Military Medical Consortium for Applied Retrovirus Research. *J Acquir Immune Defic Syndr Human Retro* 1995;**10**:177–85.
- 6 **Brown AE**, Brundage JF, Tomlinson JP, *et al*. The US Army HIV testing program; the first decade. *Mil Med* 1996;**161**:117–22.
- 7 **Nguyen TH**, Hoang TL, Pham KC, *et al*. HIV monitoring in Vietnam: system, methodology and results of sentinel surveillance. *J Acquir Immune Defic Syndr* 1999;**21**:338–46.
- 8 **Murray M**, Baker T. Investigating the relationship between economic status and HIV risk. *J Health Care for the Poor and Underserved* 1997;**8**:416–23.
- 9 **Global Program on AIDS**. Unlinked anonymous screening for the public health surveillance of HIV infections. In: *Proposed international guidelines*. Document WHO/GPA/SFI/89.3, 1989.
- 10 **WHO Regional Office for the Eastern Mediterranean**. Report on the Second WHO Eastern Mediterranean Regional Workshop on Epidemiological Surveillance for HIV Infection and AIDS. Nicosia, Cyprus, 1–6 July 1991.
- 11 **Kish A**, Leslie Y. *Survey sampling*. New York: John Wiley, 1965.
- 12 **World Health Organization**. Global Programme on AIDS and UN Population Division, Geneva, Switzerland. *Weekly Epidemiological Record* 1995;**70**:353–60 (no 50, 15 December, 1995; updated 2 February 1996).
- 13 **UNAIDS/WHO**. Cyprus—epidemiological fact sheet on HIV/AIDS and sexually transmitted diseases, June 1998.
- 14 **Papantoniou L**. HIV surveillance among military recruits in Cyprus: preliminary results. Second National Conference on AIDS and Sexually Transmitted Diseases. Athens, Greece, 22–25 April 1999.
- 15 **Kyriakides TC**, Eleftheriou A, Michaelides N, *et al*. XIII International AIDS Conference, Durban, South Africa, 2000. Poster Presentation, Poster No MoPeC2335.
- 16 **Papantoniou L**. *HIV/AIDS epidemiological report*. Ministry of Health, Nicosia, Cyprus, April 2000.