- arteries by the catheter method. *Dtsch Med Wochenschr* 1978;50:1994-7.
- 70 Pineo GF, Kaegi A, Hirsh J, Gent M. Platelets, drugs and thrombosis of arteriovenous shunts. In: *Platelets, drugs and thrombosis. Symposium. Hamilton* 1972. Basle: Karger, 1975:276-83.
 - 71 Kaegi A, Pineo GF, Shimizu A, Trivedi H, Hirsh J, Gent M. Arteriovenous-shunt thrombosis. Prevention by sulphinpyrazone. *N Engl J Med* 1974;290:304-6.
 - 72 Kaegi A, Pineo GF, Shimizu A, Trivedi H, Hirsh J, Gent M. The role of sulphinpyrazone in the prevention of arterio-venous shunt thrombosis. *Circulation* 1975;52:497-9.
 - 73 Harter H, Burch J, Majerus P, Stanford N, Delmez J, Anderson CF, et al. Prevention of thrombosis in patients on hemodialysis by low-dose aspirin. *N Engl J Med* 1979;301:577-9.
 - 74 Andrassy K, Malluche H, Barnefeld H, Comberg M, Ritz E, Jesdinsky H, et al. Prevention of po clotting of av Cimino fistulae with acetylsalicyl acid. *Klin Wochenschr* 1974;52:348-9.
 - 75 Ell S, Mihindukulasuriya JCL, O'Brien JR, Polak A, Vernham G. Ticlopidine in the prevention of blockage of fistulae and shunts. *Haemostasis* 1982;12:180 (abstract 332).
 - 76 Fiskerstrand CE, Thompson IW, Burnet ME, Williams P, Anderton JL. Double-blind randomized trial of the effect of ticlopidine in arteriovenous fistulas for haemodialysis. *Artif Organs* 1985;9:61-3.
 - 77 Dodd NJ, Turney JH, Weston MJ. Ticlopidine preserves vascular access for haemodialysis. In: *Proceedings of VI international congress of Mediterranean League Against Thrombosis*. Monte Carlo: 1980. (Abstract 326F.)
 - 78 Grontoft K, Mulec H, Gutierrez A, Olander R. Thromboprophylactic effect of ticlopidine in arteriovenous fistulas. *Scand J Urol Nephrol* 1985;19:55-7.
 - 79 Schnitker J, Koch HF. *Multizentrische studie ticlopidin thromboseprophylaxe in der hämodialyse*. Munich: LABAZ, 1983. (LABAZ internal report.)
 - 80 Michie DD, Womboldt DG. Use of sulphinpyrazone to prevent thrombus formation in arteriovenous fistulas and bovine grafts of patients on haemodialysis. *Current Therapeutic Research* 1977;22:196-204.
 - 81 Albert FW, Schmidt U, Harzer R. Postoperative thromboseprophylaxe der Cimino-fistel mit sulfinpyrazon im vergleich zu azetylsalizylsäure. *Krankenhausarzt* 1978;51:712-8.
 - 82 Schnitker J, Koch H-F. *Multizentrische studie ticlopidin rethrombosierungsprophylaxe nach revision arteriovenöser fisteln oder shunts bei patienten mit terminaler niereninsuffizienz*. Munich: LABAZ, 1983. (LABAZ internal report LAB 0103-02.)
 - 83 Serruys PW, Luijten HE, Beatt KJ, Geuskens R, de Feyter PJ, van den Brand M, et al. Incidence of restenosis after successful coronary angioplasty: a time-related phenomenon. *Circulation* 1988;77:361-71.
 - 84 Mantel N, Haenszel W. Statistical aspects of the analysis of data from retrospective studies of disease. *J Natl Cancer Inst* 1959;22:719-48.
 - 85 Early Breast Cancer Trialists' Collaborative Group. *Treatment of early breast cancer. Vol 1. Worldwide evidence 1985-1990*. Oxford: Oxford Medical Publications, 1990.
 - 86 Efron B, Morris C. Stein's paradox in statistics. *Sci Am* 1977;236:119-27.
 - 87 UK TIA Study Group. United Kingdom transient ischaemic attack (UK-TIA) aspirin trial: interim results. *BMJ* 1988;296:316-20.
 - 88 UK-TIA Study Group. United Kingdom transient ischaemic attack (UK-TIA) aspirin trial: final results. *J Neurol Neurosurg Psychiatry* 1991;54:1044-54.
 - 89 Holden MP. Dangers of aspirin before cardiac surgery. *BMJ* 1992;305:365-6.
 - 90 Sarin S, Shami SK, Cheate TR, Bearn P, Scurr JH, Coleridge Smith PD. When do vascular surgeons prescribe antiplatelet therapy? Current attitudes. *Eur J Vasc Surg* 1993;7:6-13.
 - 91 Goldman S, Copeland J, Moritz T, Henderson W, Zadina K, Ovitt T, et al. Starting aspirin therapy after operation: effects on early graft patency. *Circulation* 1991;84:520-6.
 - 92 van der Meer J, Hillege HL, Kootstra GJ, Ascoop CAPL, Pfisterer M, van Gilst WH, et al. Prevention of one-year vein-graft occlusion after aorto-coronary-bypass surgery: a comparison of low-dose aspirin, low-dose aspirin plus dipyridamole, and oral anticoagulants. *Lancet* 1993;342:257-64.
 - 93 Olivier JP, pour la Groupe EPPAC. Étude de la perméabilité des pontages aortocoronaires à 6 mois. Étude multicentrique Française. *Arch Mal Coeur* 1991;84:537-42.
 - 94 Ekström SA, Gunnes SA, Broden UB. Effect of dipyridamole (Persantin) on blood flow and patency of aortocoronary vein bypass grafts. *Scand J Thorac Cardiovasc Surg* 1990;24:191-6.
 - 95 Taylor RR, Gibbons FA, Cope GD, Cumpston GN, Mews GC, Luke P. Effects of low-dose aspirin on restenosis after coronary angioplasty. *Am J Cardiol* 1991;68:874-8.

(Accepted 29 November 1993)

Management of breast cancer in southeast England

A M Chouillet, C M J Bell, J G Hiscox

Abstract

Objective—To examine the extent to which management of invasive breast cancer reflected consensus guidelines in the Thames regions in 1990.

Design—Population based study of case notes.

Setting—Thames Cancer Registry.

Subjects—All women with breast cancer diagnosed in early 1990 (417 cases) resident in the four Thames regions. Hospital records were traced for 346 cases, of which 12 were ineligible because of misclassification in initial registration and were excluded from the analysis. 334 cases were analysed.

Main outcome measures—Investigations and treatment in the six months after diagnosis, stage of disease.

Results—Of the 334 women identified, 86 were aged under 50. Three years after diagnosis, 74 were dead, seven (8%) aged under 50 and 67 (27%) aged 50 or over. Axillary surgery was used to stage cancer in only 155 cases (46%), although this is recommended in the guidelines. Only 79 (24%) case notes had any information recorded on stage. Stage could be determined reliably for only half of the sample. Treatment varied widely within the same age group and stage of disease. In particular, chemotherapy was not routinely given to patients under 50 with stage II disease. Only 17 records showed evidence that the patient was participating in a clinical trial.

Conclusions—There was a lack of consensus on the management of breast cancer among clinicians in 1990. More patients should be included in clinical trials.

Introduction

Wide variations in the management of breast cancer patients in London hospitals were found by two studies during 1982-6.^{1,2} In 1986, the King's Fund consensus conference published guidelines for treatment of breast

cancer, providing a standard against which care can be audited.³ The guidelines recommended that axillary lymph nodes should be sampled at surgery to enable staging of disease and that combination chemotherapy should be used to reduce the risk of death in women younger than 50, particularly in those with lymph node disease at diagnosis. Tamoxifen was recommended to reduce mortality in women aged over 50. Additional evidence of the value of tamoxifen and chemotherapy has recently been found in the overview of trials of treatment of early breast cancer.⁴

We examined the extent to which the management of breast cancer in southeast England in 1990 reflected the consensus guidelines. Monitoring the management of breast cancer is important, both for the evaluation of the national screening programme and for the British government's Health of the Nation target of reducing breast cancer mortality by 25% in women aged 50-65 by the year 2000.⁵⁻⁷

Methods

We studied the hospital records of 334 women who had invasive breast cancer diagnosed in early 1990 and who were registered in the Thames Cancer Registry, a population based registry covering about 14 million people living in the four Thames regional health authorities in southeast England.^{8,9} Over 7500 cases of breast cancer in women are registered among this population every year. The annual incidence rates (world standardised) are 61 to 65 per 100 000. The five year relative survival for women aged 15-74 years diagnosed during 1980-4 was 63% to 67%.⁸

We included in the study all 249 primary malignant neoplasms of the breast (second contralateral breast cancers were excluded) diagnosed during 15-31 January 1990. These cases are being contributed to the Eurocare study of patterns of survival and cancer care across the European Community. In addition, North

Thames Cancer Registry,
Sutton, Surrey SM2 5PY
A M Chouillet, epidemiologist
C M J Bell, deputy director
J G Hiscox, statistician

Correspondence to:
Dr Chouillet.

BMJ 1994;308:168-71

East Thames Regional Health Authority provided funding to examine records of patients resident in their area diagnosed during 1-14 January and 1-28 February. This produced another 168 cases, giving a total of 417.

Data were collected from hospital case notes between October 1992 and May 1993. Information was abstracted by experienced registry staff and included details of diagnostic investigations, oestrogen receptor status, clinical or pathological stage, and treatment given within the first six months after diagnosis. The date of treatment, but not that of investigations, was recorded. Registry officers routinely abstract data on diagnosis, stage, and treatment given in the first six months after diagnosis, but details of diagnostic tests are not collected routinely. We therefore provided additional training on the special requirements of data collection for this study. When no evidence was found of a diagnostic test having been performed or of a treatment having been given it was classified as not done.

One of us (AMC) used copies of pathology reports, surgical reports, and relevant sections of the case notes to attempt to assign a stage to all records. Staging was based on the TNM system.¹⁰ If there was no information on disease of lymph nodes, no stage was assigned unless a pathology report of a tumour larger than 5 cm (T3) enabled the case to be classified as stage III or the presence of metastases had been confirmed, in which case stage IV was assigned. Evidence of metastases was sought from clinical notes and referral letters, particularly letters from the surgeon to the radiotherapist. In a few cases the results of diagnostic investigations were used as evidence of metastatic disease, but these were not always available. When metastases were not mentioned it was assumed that none was present.

Treatment was categorised as surgery (either conservative or extensive), radiotherapy, chemotherapy, or endocrine treatment (including tamoxifen). Patients were categorised as under 50 or 50 and over as a surrogate for premenopausal and postmenopausal state. For the overall analyses, the postmenopausal group was subdivided into ages 50-69 and 70 and over. Evidence of variation by age in diagnostic examinations or treatment was tested with a χ^2 test for trend. The analysis does not identify treatment centres, consultants, or patients.

Results

We traced the records for 346 (83%) of the 417 cases diagnosed in the study period. Twelve cases were ineligible because of misclassification at initial registra-

tion. The 334 eligible cases were distributed across all 56 district health authorities in southeast England (50% of the women lived in North East Thames) and were treated in 81 hospitals. The women were aged 28-95 years, 86 (26%) being under 50. By May 1993, three years after diagnosis, 74 (22%) women were known to have died, seven (8%) women aged under 50 years and 67 (27%) aged 50 or over.

Evidence that the woman had been entered into a trial was found in only 17 sets of hospital notes. Evidence was also found for one woman refusing to participate.

Table I shows the number of women receiving each type of diagnostic investigation. There was a small but significant fall in the use of liver scanning, bone scanning or skeletal radiography, and axillary surgery with age, but no difference in the frequency of use of chest radiography. Tests to assess oestrogen receptors were mentioned in only nine case notes and results were recorded in only two of these.

STAGE

Three quarters of the case notes had no information on stage recorded. Complete or partial staging of disease at diagnosis was explicitly stated in only 81 (24%) of the case notes, but even these sometimes contained no pathological evidence to support the clinical stage. These 81 cases included five cases in which stage I to IV was specified without recording the TNM stage, 46 cases with an incomplete TNM stage (usually defining only T stage), and 30 with a complete TNM stage.

Reconstruction of stage based on pathology reports of both the tumour and the nodes (pTNM) was attempted for all cases. Copies of pathology reports describing tumour size and nodal status were available for 94 cases, all of which could be assigned a stage. In addition, 91 cases which were either T4 M0 or had metastases, were classified automatically to stage III or stage IV respectively even if nodal status was unknown. In 50 cases, copies of the pathology reports were not available but pathological information on tumour and nodes (pT and pN) was clearly identified in the notes. In a further three cases the reconstructed stage differed from the stage recorded in the medical record and in 168 insufficient information was available to determine stage. In total, therefore, stage could be reliably reconstructed for 163 of the 334 cases.

TREATMENT

A total of 278 (83%) of women had surgery. The use of conservative surgery, tamoxifen, radiotherapy, and chemotherapy was strongly dependent on age but there was no significant difference in the proportion of patients having extensive surgery (mastectomy) across the three age groups (table II).

Most of the 334 women received more than one type of treatment within six months of diagnosis. Among women aged 50 or older, the non-surgical treatments in use were tamoxifen plus radiotherapy in 141 (57%); tamoxifen alone in 67 (27%); tamoxifen plus radiotherapy plus chemotherapy in 15 (6%); radiotherapy alone in 12 (5%); and other combinations, including no adjuvant therapy, in 12 (75%). For the group of 86 patients aged under 50, non-surgical treatments were tamoxifen plus radiotherapy in 25 (29%); radiotherapy in 25 (26%); radiotherapy plus chemotherapy plus tamoxifen in 17 (20%); radiotherapy plus chemotherapy in 13 (15%); and other combinations in six (7%) including one case with no adjuvant therapy.

STAGED CASES

Table III gives the treatment in the 163 cases which could be reliably staged. Surgery was used in all early

TABLE I—Number (percentage) of patients receiving each type of diagnostic investigation by age*

Age	Chest radiography	Liver scanning	Bone scanning skeletal radiography	Axillary surgery
<50 (n=86)	65 (76)	48 (56)	54 (63)	43 (50)
50-69 (n=181)	142 (78)	70 (39)	106 (59)	90 (50)
≥70 (n=67)	50 (74)	19 (28)	31 (46)	22 (33)
All ages (n=334)	257 (77)	137 (41)	191 (57)	155 (46)
P value for trend	0.9417	0.0005	0.0469	0.0478

*Many patients received more than one investigation.

TABLE II—Number (percentage) of patients receiving each type of treatment by age*

Age	Lumpectomy	Mastectomy	Tamoxifen	Radiotherapy	Chemotherapy
<50 (n=86)	60 (71)	17 (20)	45 (52)	75 (87)	32 (37)
50-69 (n=181)	109 (60)	44 (24)	163 (90)	143 (79)	20 (11)
≥70 (n=67)	30 (45)	18 (27)	64 (96)	28 (42)	4 (6)
All ages (n=334)	199 (60)	79 (24)	272 (81)	246 (74)	56 (17)
P value for trend	0.0012	0.2949	0.0000	0.0000	0.0000

*Lumpectomy and mastectomy are mutually exclusive, but many women received more than one type of treatment.

stage cases (stage I and II). Tamoxifen was given to a high proportion of patients with early stage cancers, in particular, those aged 50 and over. For more advanced cancer (stage III and IV), all older patients received tamoxifen. In this sample radiotherapy was given to 89% of patients who had received conservative surgery (81/91) and to 54% who had a mastectomy (26/48). Chemotherapy was almost never used for stage I (one case), but for stage II cancer it was used in 63% (10) of those aged under 50 and in 11% (six) of those aged 50 or over. Adjuvant therapy combinations varied widely within each stage in both age groups (Table IV).

Discussion

This sample of cases provides a profile of management of breast cancer in 1990. Management may have changed since then, but at that time there was considerable deviation from the guidelines.

Among women that we could stage, a low proportion of those under 50 received chemotherapy (46% of all, 63% of those with stage II), though our sample of staged cases was small. Tamoxifen was used in 51% of women aged under 50, although in 1990 there was no conclusive evidence of its effect on survival. Tamoxifen was given to most (98%) of the women aged 50 or over. The use of surgery and radiotherapy was broadly consistent with the guidelines. The ratio of conservative surgery to mastectomies (2.5 to 1) was somewhat lower than that reported by McCarthy and Bore for 1986 in two urban districts¹; mastectomy may be done more often in some of our 56 health districts.

The inability to reconstruct stage from the case notes in half of the sample is a serious obstacle to the interpretation of this study. The unstaged cases are likely to be biased with respect to treatment, making the staged cases unrepresentative of management as a whole. The inability to reconstruct stage in a substantial proportion of cases is consistent with other studies.¹¹

TABLE III—Number of women receiving each treatment for breast cancer by age and stage of cancer

Treatment	Stage I	Stage II	Stage III	Stage IV	Total (%)
Women <50	15	16	8	2	41 (100)
Surgery	15	16	8	1	40 (98)
Tamoxifen	5	9	5	2	21 (51)
Radiotherapy	14	12	7	2	35 (85)
Chemotherapy	1	10	6	2	19 (46)
Women ≥50	21	56	18	27	122 (100)
Surgery	21	56	16	11	104 (85)
Tamoxifen	20	54	18	27	119 (98)
Radiotherapy	15	41	13	21	90 (74)
Chemotherapy	0	6	3	9	18 (15)
All women	36	72	26	29	163

TABLE IV—Treatment combinations received by 163 women with breast cancer according to age and stage of cancer

Adjuvant therapy	Stage I	Stage II	Stage III	Stage IV	Total (%)
Women <50	15	16	8	2	41
Radiotherapy	10	2			12 (29)
Tamoxifen	1	1	1		3 (7)
Tamoxifen plus radiotherapy	3	3	1		7 (17)
Radiotherapy plus chemotherapy		3	3	2*	6 (15)
Tamoxifen plus radiotherapy plus chemotherapy	1	4	3		10 (24)
Chemotherapy		2			2 (5)
Tamoxifen plus chemotherapy		1			1 (2)
Women ≥50	21	56	18	27	122
Radiotherapy		2			2 (2)
Tamoxifen	5	15	4	6†	30 (25)
Tamoxifen plus radiotherapy	15	33	11‡	12§	71 (58)
Tamoxifen plus radiotherapy plus chemotherapy		6	2	9	17 (14)
Tamoxifen plus chemotherapy			1		1 (1)
None	1				1 (1)
All women	36	72	26	29	163

*One woman had no surgery.

†Four women had no surgery. ‡Two women had no surgery. § Five women had no surgery. ||Six women had no surgery.

Clinical implications

- Breast cancer is the most common cancer in women and more women in Britain die of it than of any other cancer
- Published guidelines on the management of breast cancer have been available for some years
- In this study no stage was recorded in the medical records of three quarters of the patients studied, and reconstruction of stage was possible for only half
- Only about half the women had axillary surgery to stage the disease
- A lack of consensus among clinicians in 1990 in the management of breast cancer

STAGING OF CANCER

We could assess deviation from the published guidelines on treatment only in cases that could be staged. The results suggest that liver and bone scanning and skeletal radiography are carried out as often as axillary surgery. This is surprising, since the guidelines advised against the routine use of such investigations but strongly recommended axillary sampling to stage the disease. The frequency of use of axillary surgery was low (46% overall and 50% in women under 50). Underascertainment of axillary surgery was unlikely since in 80% of the cases surgery or pathology reports were available, but other investigations and recorded stage may have been missed, particularly if care was shared between several hospitals. It is possible, however, that some of the scans were given more than six months after diagnosis, as the date of investigations was not recorded. There was no evidence that other investigations, such as hormonal receptor studies, were used routinely to assess the need for adjuvant therapy in early stage cancers.

The wide variation in management suggests that there is no consensus among clinicians on the optimal treatment, and that perhaps some clinicians may not be aware of the recommendations on diagnostic investigations and treatment options. It was surprising, therefore, that so few patients were entered into clinical trials. The 5% participation in trials seems low but is consistent with recent information from the Cancer Research Campaign clinical trials unit about patients participating in trials in the Thames regions (D Riley, personal communication). Mersey region, which is also contributing to the Eurocare study, reported similar findings (J Youngson, personal communication).

Audit of the care of breast cancer patients is likely to be an important component of the strategy to meet the Health of the Nation target for reduction in breast cancer mortality. Cancer registries can play an important part in this activity by providing a profile of current practice regionwide. However, the difficulty in establishing the stage of the disease from the case notes poses a serious obstacle to this type of evaluation.

We acknowledge the initiative provided for this study by Eurocare study coordinators Dr Franco Berrino and Dr Milena Sant of the Varese Cancer Registry, Italy. We thank Mrs Joyce Nicholas and Mrs Shirley Bell and all staff of the Thames Cancer Registry, especially the registration officers, for collecting the data; and Dr Jean-Michel Lutz for advice on the analysis. The Eurocare study is funded by the Europe Against Cancer programme of the European Community.

1 McCarthy M, Bore J. Treatment of breast cancer in two teaching hospitals: a comparison with consensus guidelines. *Eur J Cancer* 1991;27:579-82.

2 Basnett I, Gill M, Tobias J. Variations in breast cancer management between a teaching and a non-teaching district. *Eur J Cancer* 1992;28:1945-59.

- 3 King's Fund. Consensus development conference: treatment of primary breast cancer. *BMJ* 1986;293:946-7.
- 4 Early Breast Cancer Trialists' Collaborative Group. Systemic treatment of early breast cancer by hormonal, cytotoxic or immune therapy. *Lancet* 1992;339:1-15, 71-84.
- 5 Department of Health and Social Security. *Breast cancer screening: report to health ministers of England, Wales, Scotland and Northern Ireland*. London: HMSO, 1986. (Forrest report.)
- 6 Department of Health. *The Health of the Nation key area handbook: cancer*. London: DoH, 1993.
- 7 Day NE, Williams DRR, Khaw KT. Breast cancer screening programmes: the

- development of a monitoring and evaluation system. *Br J Cancer* 1989;59:954-8.
- 8 Thames Cancer Registry. *Cancer in South West Thames 1987-89*. Sutton: Thames Cancer Registry, 1992.
- 9 Thames Cancer Registry. *Lancet* 1993;341:171.
- 10 International Union Against Cancer. *TNM classification of malignant tumours*. Geneva: UICC, 1987.
- 11 Gulliford MC, Bell J, Bourne HM, Petrukevitch A. The reliability of cancer registry records. *Br J Cancer* 1993;67:819-21.

(Accepted 28 October 1993)

Incidence of HIV-1 infection in a rural region of Uganda

Maria J Wawer, Nelson K Sewankambo, Seth Berkley, David Serwadda, Stanley D Musgrave, Ronald H Gray, Maako Musagara, Rebecca Y Stallings, Joseph K Konde-Lule

Abstract

Objective—To determine the incidence of infection with HIV-1 and the risk factors associated with seroconversion in three geographical strata of a rural Ugandan district.

Design—Serological, sociodemographic, and behavioural surveys of everyone aged 13 or more in 21 randomly selected communities at baseline and one year later.

Setting—Rural population of Rakai district, south-western Uganda, residing in main road trading centres, secondary trading villages, and agricultural villages.

Subjects—In 1989, 1292 adults provided a blood sample and interview data; one year later, 778 survivors (77%) who had been seronegative at baseline provided follow up data.

Main outcome measures—Incidence of HIV infection in relation to individual characteristics and risk factors, including place of residence.

Results—Incidence of HIV infection in all adults was 2.1/100 person years of observation (SE 0.5 (95% confidence interval 1.1 to 3.1)); in people aged 15-39 the incidence was 3.2/100 person years. Incidence was highest in men and women aged 20-24 (9.2/100 person years (3.9) and 6.8/100 person years (2.9) respectively). Risk factors significantly associated with seroconversion were age 24 and under and two or more sexual partners. Between the surveys the proportion of all respondents reporting high risk behaviour (two or more partners) significantly increased from 8.9% to 12.3%.

Conclusions—Despite preventive programmes and substantial knowledge about AIDS the incidence of HIV infection remains high in this rural population. Prevention aimed at vulnerable rural communities is urgently needed to contain the HIV epidemic.

Introduction

We previously reported a high seroprevalence of HIV-1 infection in Rakai district, southwestern Uganda, the prevalence among adults ranging from 38.5% in trading centres on roads servicing international traffic to 8.6% in agricultural villages off main and secondary roads.^{1,2} The first national AIDS control programme in Africa was implemented in Uganda, and the Rakai project was initiated in 1989; the project included health rallies, community education through village health workers, access to serological screening and counselling, and distribution of condoms. HIV is transmitted almost exclusively through heterosexual exposure in Rakai,² and the degree of knowledge about the virus is high. In 1989, 94% of responding adults knew about AIDS (S D Musgrave *et al*, sixth international conference on

AIDS, San Francisco, 1990), and 86% correctly identified sexual intercourse as a risk factor (M Musagara *et al*, sixth international conference on AIDS, San Francisco, 1990). We report the incidence of HIV-1 infection in 1990 in the district.

Subjects and methods

In 1989 we established the study cohort using two stage stratified cluster sampling.^{1,2} The population consisted of all consenting people aged 13 and over residing in 21 randomly selected clusters, each of 40 contiguous households. Trading centres on main roads were oversampled to ensure adequate representation of villages with a high prevalence of HIV infection. The distribution of age and sex in the cohort population was typical for rural Africa, with the exception of males aged 15 to 34, who were underrepresented by roughly a quarter. The absent men resided primarily in trading centres and were away from home to work.

Baseline data on sociodemographic variables, knowledge of AIDS and risk behaviours, and health status, as well as a whole blood sample, were collected from all consenting subjects; 1292 adults aged 13 and over (85.6% of those present at the time of the survey) responded, and 1037 were negative for HIV infection.^{1,2} Serum specimens were screened at the Uganda Virus Research Institute, a World Health Organisation HIV reference laboratory, with a commercial enzyme linked immunosorbent assay (ELISA) (Recombigen EIS, Cambridge Biosciences, Worcester, Massachusetts). All positive samples were confirmed by western blotting (Biorad, Hercules, California). In 1990 we resurveyed all respondents of the 1989 survey. The mean follow up time was 15 months.

STATISTICAL ANALYSIS

The incidence of HIV infection per 100 person years of observation was estimated from the number of seroconversions and the person months of follow up. Rate ratios of seroconversion and 95% confidence intervals were estimated to assess associations, and Mantel-Haenszel stratified χ^2 tests for trend were used to determine significance. Multivariate logistic regression by SAS³ was used to estimate the odds ratios for seroconversion after adjustment for potential confounding.⁴

Results

Twenty one of the 1037 subjects (2.0%) who were seronegative at baseline had died by the time of follow up. We obtained follow up data and samples for 778 of the 1016 survivors (76.6%). There were 234 subjects without full follow up data. Of these, 73 completed the follow up questionnaire but declined to provide a blood sample, eight refused both to be interviewed and

Center for Population and Family Health, Columbia University School of Public Health, 60 Haven Avenue, New York, NY 10032, USA

Maria J Wawer, associate professor
Stanley D Musgrave, assistant professor

Department of Medicine and Institute of Public Health, Makerere University, Kampala, Uganda

Nelson K Sewankambo, senior lecturer
David Serwadda, senior lecturer
Joseph K Konde-Lule, senior lecturer

Health Sciences Division, Rockefeller Foundation, New York
Seth Berkley, associate director

Rakai Project—Columbia University Office, Uganda
Virus Research Institute, Entebbe, Uganda
Maako Musagara, field coordinator

Departments of Population Dynamics and International Health, Johns Hopkins University School of Public Health, Baltimore, Maryland, USA
Ronald H Gray, professor
Rebecca Y Stallings, research associate

Correspondence to: Dr Wawer.

BMJ 1994;308:171-3