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DIAGNOSTICS

What is the impact of change in diagnostic test method on surveillance data trends in *Chlamydia trachomatis* infection?

F Burckhardt, P Warner, H Young

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See end of article for authors' affiliations

Correspondence to:
Florian Burckhardt, MSc, Bavarian Health and Food Safety Authority (Public Health), Veterinaerstr. 2, 85764 Oberschleissheim, Germany; florian@burckhardt.de

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Objective: To describe the impact of change from culture to more sensitive nucleic acid amplification testing (NAAT) tests on the detection of *Chlamydia trachomatis* in a genitourinary medicine (GUM) clinic population.
Methods: Data were collected between January 1992 and December 2003 on results of *C trachomatis* tests on male and female attenders at the Lothian GUM clinic (n = 81 590). Routine diagnosis switched from culture to NAAT methods in September 1998. Association of test result with age, sex, year of test, and test type was analysed using logistic regression.
Results: 6.1% (95% CI: 5.7% to 6.5%) of women and 7.1% of men (95% CI: 6.7% to 7.5%) tested positive with culture and 9.9% of women (95% CI: 9.4% to 10.3%) and 11.1% of men (95% CI: 10.7% to 11.5%) tested positive with NAATs. This corresponds to a 56% increase for men (95% CI: 47% to 66%) and 62% for women (95% CI: 50% to 67%). Logistic regression showed that a positive test result was strongly associated with test type with or without adjustment for year of test, sex, and young age.
Conclusions: The significant increase in chlamydial infections detected following a change from culture to NAATs has important implications for interpretation of trends ascertained from surveillance data. Not all of this can be a direct effect of enhanced sensitivity and there may be indirect effects that improve ascertainment of existing infections. As more laboratories switch to NAATs similar patterns of stepwise increases in positive results are expected and trend analysis based on such surveillance data might thus show an artefactual rise in chlamydia infection rates. Accumulated surveillance data should therefore include timing of introduction of NAAT, so as to take account of under-ascertainment by previous methods.

Infection by *Chlamydia trachomatis* is still the most common bacterial sexually transmitted disease (STD) in the United Kingdom[1] and other developed countries, although efficient diagnostic tests and treatment have been available for years. The infection is asymptomatic in about 50% of men and 70% of women[2] and is thus transmitted quite readily before preventive or curative measures. Chlamydial infections have major medical, social, and economic consequences. Pelvic inflammatory disease, ectopic pregnancy, tubal factor infertility and epididymitis, proctitis, and arthritis[3] are costly sequelae to the healthcare system with conservative calculations being estimated at £50 million per year for the United Kingdom.[1]

Recent UK data show a considerable increase in the prevalence of chlamydial infection.[4 5] However, an observed increase may be artefactual if the yearly number of people tested increases while the reference population (denominator) stays constant. This effect can be exacerbated if more people with a higher risk of being positive are included, such as contacts of cases. Similarly, introducing a test with enhanced sensitivity would automatically increase prevalence even if true prevalence remained constant.

Several studies have reported increased detection after change to nucleic acid amplification testing (NAAT),[6–10] but interpretations of trends in incidence seldom take account of the increasing use of more sensitive NAAT methodology. For public health surveillance and intervention policies it is important to know the true extent of increase in prevalence of chlamydia, independent of changes in laboratory practice.

This study covers 12 years of routine surveillance data of the Lothian Health Board and is one of the largest such studies on *Chlamydiae*. Our aim was to describe the impact of switching diagnostic tests from culture to NAAT methods on rates of positive test results for *C trachomatis* in a genitourinary medicine (GUM) clinic population.

METHODS

Study population

The study comprises all patients who attended the Lothian GUM clinic between January 1992 and December 2003. This is the only clinic within Lothian Health Board and serves a population of 778 000.[11] However, some patients test for STDs at their GP or family planning or gynaecology clinics. Within Scotland, Lothian accounts for over a quarter of all *C trachomatis* cases seen at STD clinics.[4]

Clinical data

Data were extracted from the Medical Microbiology Laboratory of the Royal Infirmary Edinburgh. Records range from January 1992 until December 2003, comprising 82 540 tests in total, and contain sex, date of birth, date of attendance, specimen type, type of laboratory test and test result. Including clinic code would give seven out of 13 data items of the core data set of the National Chlamydia Screening Programme.[12] Names or addresses of patients were neither stored in the original database nor retrieved through other means. A total of 950 tests (1.2%) were excluded from analysis, 727 because of not being routine method, 202 had

Abbreviations: DFA, direct fluorescence assay; EIA, enzyme immunoassay; FP, family planning; FVU, first voided urine; GUM, genitourinary medicine; GP, general practitioner; LCR, ligase chain reaction; NAAT, nucleic acid amplification testing; PCR, polymerase chain reaction; STD, sexually transmitted diseases

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equivocal results, and 21 had data errors. That left 33 695 culture tests (January 1992–September 1998) and 47 895 NAATs (September 1998–December 2003) available for analysis.

Laboratory testing

From January 1992 until 2 September 1998 *C trachomatis* was routinely diagnosed by culture and from then onwards by a NAAT, the ligase chain reaction (LCR) (Abbott Diagnostics LCx assay) until mid-March 2003, and by polymerase chain reaction (PCR) (Roche Cobas Amplicor) thereafter. For culture, urethral swabs from men and endocervical swabs from women were placed in 2SP medium. Swabs were stored at −20℃ for up to 3 hours immediately after taking the specimen and at −70℃ in the laboratory for up to 3 days. Specimens were thawed and vortexed before culture in cycloheximide treated McCoy cells[13] and detection of chlamydia was done by iodine staining: *C trachomatis* was considered to be present if characteristic intracytoplasmic inclusions were seen.[14]

For LCR and PCR, endocervical swabs were collected using the Abbott LCR sexually transmitted disease swab collection kit and MicroTest M4-RT transport medium respectively. The swabs were stored at 4℃ before processing. A first voided urine (FVU) was collected from men and sent to the laboratory within 4 hours where it was frozen overnight when LCR testing was performed. FVU was not frozen before testing with Cobas Amplicor PCR because an internal amplification control to detect inhibitors was included in the assay. All specimens were processed according to the respective manufacturer's protocol. All reactive specimens were rechecked and were only reported as positive if they were reactive on the repeat test. Treatment followed the national guideline for chlamydial management.[15]

Statistical analysis

Data cleaning and descriptive analysis were done using SPSS and SQL database queries. We used logistic regression modelling to examine the association of positive test result with the binary variables test type, sex, and young age (<20 years, ⩾20 years), and with year of test. Univariable (crude) and multivariable (adjusted) associations were calculated. Year was tested both as a linear and a categorical variable. The models were also checked for influence of season (quarter) and interactions of test type with young age and with sex.

Clustering in the data (repeat visits by same patient) means robust logistic regression estimation is preferable, leaving regression coefficients unchanged but giving more conservative (wider) confidence intervals.[16] However, patient numeric code was available only for data up to May 2000,[17] so for the overall model robust method would not be possible. On available data, average cluster size was found to be 1.378, a low degree of clustering. A sensitivity analysis was undertaken, calculating effects on confidence intervals of utilisation of robust standard errors[16] for two scenarios: assuming intracluster correlation of 1.0 (''perfect''), the maximum impact possible, but very unlikely, and also 0.75, more realistic but still ''higher'' than is likely. These reassured us that in this case, with low clustering, the failure to use robust estimation has had minimal effect on width of confidence intervals, as will be highlighted in a footnote to table 3.

Logistic regressions, χ^2 tests and confidence intervals were calculated with SPSS version 10.

RESULTS

Over the study period the total number of tests undertaken per year increased for men and women, more markedly from 1998 (table 1). Overall, there were more tests among males, but in those aged under 20 years fewer males than females were tested. From 1992 to 1998 among those under 20 years only about a third of those tested were men. Whereas age and sex composition of the population served by GUM clinics has remained fairly constant from 1992 to 1999, the male:female ratio increased from 2001 to 2004, both overall and in those under 20 years.

Table 2 shows that between 1992 and 1998, 6.1% (95% CI: 5.7% to 6.5%) of women and 7.1% of men (95% CI: 6.7% to 7.5%) tested positive with culture. After the change to a NAAT, 9.9% of women (95% CI: 9.4% to 10.3%) and 11.1% of men (95% CI: 10.7% to 11.5%) tested positive. This corresponds to a 56% relative increase for men (95% CI: 47% to 66%), 62% for women (95% CI: 50% to 74%).

Across the 6 months around test change the positivity rate rose profoundly with an overall increase of 1.9 (95% CI 1.5 to 2.4): for men it increased from 7.2% for culture (3 June to 2 September 1998, n = 846) to 10.8% for NAAT (3 September to November 1998, n = 832) yielding an increase by a factor of 1.5 (95% CI 1.1 to 2.1). For women, culture positivity was 4.0% (n = 743) and NAAT positivity (n = 704) 10.8%, yielding an increase by a factor of 2.7 (95% CI 1.8 to 3.9).

Table 1 Numbers of tests included in initial study (1992 to May 2000) and additional data (June 2000 to 2003), separately by sex, total number of tests per year, and number among those aged under 20 years, plus sex ratio for tests included in study, overall and under 20 years of age

	Male		Female		Male:female ratio	
Year	Total	Aged <20 years	Total	Aged <20 years	Total	Aged <20 years
1992	2316	135	2188	364	1.06	0.37
1993	2328	121	1998	340	1.17	0.36
1994	2692	109	2282	366	1.18	0.30
1995	2602	128	2313	439	1.12	0.29
1996	2896	152	2483	478	1.17	0.32
1997	2895	164	2687	487	1.08	0.34
1998	3238	186	2811	513	1.15	0.36
1999	4118	249	3678	692	1.12	0.36
2000*	4408	284	3754	746	1.17	0.38
2001	5360	355	3911	740	1.37	0.48
2002	5891	445	4045	868	1.46	0.51
2003	6496	546	4200	842	1.55	0.65

*Data for first 5 months of the year were in initial study, remainder in additional data obtained.

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Table 2 Increase after change to NAAT in proportion of positive tests, separately by sex and overall

	Positive	Total	% Positive (95% CI)
Men			
Culture	1270	17 855	7.1 (6.7 to 7.5)
NAAT	3038	27 385	11.1 (10.7 to 11.5)
Overall increase culture to NAAT (percentage points)			4.0 (3.5 to 4.5)
χ^2 = 198.3, df 1, p<0.001			
Relative increase 1.56, 95% CI 1.47 to 1.66			
Women			
Culture	964	15 840	6.1 (5.7 to 6.5)
NAAT	2021	20 510	9.9 (9.4 to 10.3)
Overall increase culture to NAAT (percentage points)			3.8 (3.2 to 4.3)
χ^2 = 167,8, df 1, p<0.001			
Relative increase 1.62, 95% CI 1.50 to 1.74			
Overall men and women combined			
Culture	2234	33 695	6.6 (6.4 to 6.9)
NAAT	5059	47 895	10.6 (10.3 to10.8)
Overall increase culture to NAAT (percentage points)			4.0 (3.6 to 4.3)
χ^2 = 375,3 df 1, p<0.001			
Relative increase 1.59, 95% CI 1.52 to 1.67			

Figure 1 presents the rate of positive results by quarter within year for men and women. There is substantial quarter to quarter variation but from 1993 until second quarter of 1998 (switch to NAATs was in the last month of third quarter 1998) rates fluctuate around an apparently flat trend. After a change to NAATs the positivity rate increases by 3–4 percentage points, as summarised in table 3. The fluctuations do not follow a seasonal pattern and inclusion of quarter in the model made no significant improvement to fit so the variable was dropped (results not reported).

In logistic regression analysis, the form of the year variable (linear *v* categorical) made no difference to the associations with test type, sex, or age variables. However, the categorical variable gave a significantly better fitting model (change in model χ^2: 16.8, df 6, p = 0.01), so this form was used in the final model. Univariable (crude) associations of positive test results with the independent variables were calculated (see first section of table 3). The first multivariable model (model A, table 3), shows associations of positive result with sex, age, and year, all adjusted for each other. The adjusted associations for year are very little changed from the unadjusted, which suggests no confounding by sex or age of the effect of year on positivity rate. However, the associations for age and sex increased, so in the univariable analyses the association of each variable separately with positive result must have been confounded by the other. Model B (table 3) included

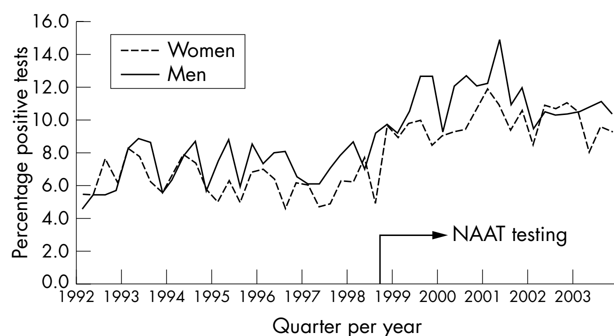

Figure 1 Percentage positive chlamydia tests per yearly quarter in the Royal Infirmary Edinburgh GUM dataset for 1992 to 2003, separately for males and females: date of change from culture to NAAT for routine tests was 3 September 1998 (this being the final month of the third quarter on the X-axis the year given precedes (is to the left of) the plots for the four quarters (in turn) of that year).

test type and resulted in a significant improvement in model fit (change in model χ^2: 23.8, df 1, p<0.001). Even after adjustment for all the other variables there is a strong association of test type with positive result (OR 1.6, 95% CI 1.3 to 1.9), very little changed from the univariable estimate. This suggests the absence of confounding of demographic variables on the effect of test type, which is further supported by the fact that the associations in this model for sex and age are unchanged from model A. However, the associations for the post-NAAT years, 1998–2003 were markedly diminished after adjustment for test type. The effect of year that remains after adjustment is of notably higher positivity, relative to 1992, only in the early years (1993–1994), with the odds of a positive result from 1995 to 2003 being on the whole similar to 1992. Sensitivity analysis reassures that this interpretation would be unchanged by the use of robust estimation. Inclusion of interaction terms ''test type by sex'' and ''test type by young age'' was tested but made no significant improvement to model fit (results not shown).

DISCUSSION

This study has examined chlamydial positivity rates in Lothian before and after the switch from culture to NAAT methods. With 12 years of data corresponding to over 82 000 tests this is one of the largest retrospective, laboratory based studies on genital chlamydia. The observed overall relative increase in positive results after change in test was 59% (95% CI 52% to 67%, table 2) and this was confirmed by multivariable logistic regression which estimated a 61% increase in odds of positive result after adjusting for sex, young age, and year of test (table 3). The change in positivity was similar for women and men.

Our study uses a sequential design. The challenge with this type of design is to establish the effect of the factor of interest, in our case change to NAAT testing, free of the potentially confounding effects of the various other factors that may be at play, such as true secular increase in prevalence, temporally related changes as a result of immigration, or to increase/decrease in risk behaviours such as unprotected sexual intercourse and having multiple sexual partners, or to more effective treatment and testing strategies including better contact tracing.

As in all observational studies, a factor must have been measured in order to be identified as a confounder. We examined the background trend in chlamydia infection by means of the year variable in the multivariable logistic

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Table 3 Logistic regression modelling of positive test outcome for the years 1992–2000: univariable associations and multivariable models with and without test type included

			Multivariable models			
	Univariable analyses		A: Test type NOT in model		B: Including test type	
Variable*	Odds ratios (crude) (95% CI)	p Value	Adjusted OR (95% CI)	p Value	Adjusted OR (95% CI)§	p Value
Male†	1.18 (1.12 to 1.24)	<0.001	1.28 (1.21 to 1.34)	<0.001	1.28 (1.21 to 1.34)	<0.001
Young age‡	1.79 (1.68 to 1.91)	<0.001	1.91 (1.79 to 2.04)	<0.001	1.91 (1.79 to 2.04)	<0.001
Year§		<0.001		<0.001		<0.001
1993	1.33 (1.12 to 1.58)	0.0010	1.33 (1.12 to 1.58)	0.001	1.33 (1.12 to 1.58)	0.001
1994	1.26 (1.07 to 1.49)	0.0058	1.27 (1.08 to 1.50)	0.005	1.27 (1.08 to 1.50)	0.005
1995	1.21 (1.02 to 1.43)	0.0290	1.20 (1.01 to 1.42)	0.034	1.20 (1.01 to 1.42)	0.034
1996	1.21 (1.02 to 1.43)	0.0244	1.20 (1.02 to 1.41)	0.032	1.20 (1.02 to 1.41)	0.032
1997	1.09 (0.92 to 1.29)	0.3088	1.09 (0.92 to 1.28)	0.337	1.09 (0.92 to 1.28)	0.337
1998	1.44 (1.23 to 1.68)	<0.001	1.43 (1.22 to 1.67)	<0.001	1.19 (1.00 to 1.42)	0.057
1999	1.92 (1.66 to 2.22)	<0.001	1.91 (1.65 to 2.20)	<0.001	1.19 (0.94 to 1.51)	0.158
2000	1.97 (1.71 to 2.28)	<0.001	1.95 (1.68 to 2.25)	<0.001	1.21 (0.96 to 1.54)	0.114
2001	2.20 (1.91 to 2.53)	<0.001	2.16 (1.87 to 2.49)	<0.001	1.34 (1.06 to 1.70)	0.014
2002	1.89 (1.64 to 2.18)	<0.001	1.83 (1.59 to 2.11)	<0.001	1.14 (0.90 to 1.44)	0.277
2003	1.88 (1.63 to 2.16)	<0.001	1.81 (1.57 to 2.09)	<0.001	1.13 (0.89 to 1.43)	0.310
Test type: NAAT¶	1.66 (1.58 to 1.75)	<0.001	not included	not included	1.61 (1.33 to 1.94)	<0.001

*Reference categories: †female; ‡age 20 years or older; §year 1992; ¶culture test.
§Sensitivity analysis was undertaken of the likely impact of utilisation of robust standard errors (see methods). Assuming intracluster correlation of 0.75, robust standard errors would have widened the confidence intervals for the estimates minimally, by up to 0.008 lower for the lower limits, and by up to 0.013 higher for the upper limits. Interpretations of the coefficients for sex, young age, and test type, in particular, and for years would have been unchanged.

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Table 4 Studies comparing NAAT and non-NAAT tests for genital *C trachomatis*

Study	Setting/location	Time	% positive non-NAAT	% positive NAAT	% increase in positive results
Ridgway[6]	concurrent, London (GUM)†	–	9.5% (culture)*	12.0% (LCR)*	26%
Puolakkainen[25]	concurrent, Helsinki, Finland	May 1996–Oct 1996	6.0% (culture)	7.0% (LCR)	17%
Scoular[7]	sequential, Glasgow (GP, GUM, FP)	April 1996–March 2000	4.8% (EIA, 1996–97)	7.8% (LCR, 1997–2000)	63%
Braverman[8]	concurrent, Philadelphia, US†	–	10.6 % (culture)	13.0 % (LCR)	23%
Forward[9]	sequential, Nova Scotia, Canada†	April 1998–Dec 2001	3.3% (EIA, preApril 2001)	4.8% (PCR, post 4/01)	46%
This study	sequential, Edinburgh (GUM)	Jan 1992–May 2000	6.6% (culture)	10.6% (LCR,PCR)	59%

Concurrent, diagnostic methods are tested at the same time, sequential, diagnostic methods are tested sequentially
*Cervical and urethral combined, culture without blind passage, †women only, GP, general practitioner; GUM, genitourinary medicine; FP, family planning; EIA, enzyme immunoassay; DFA, direct fluorescence assay.

regression model. The model without test type showed relatively high odds of positive results for the NAAT time periods, 1998 and, particularly, 1999 to 2003 (table 3, model A and fig 1), but once there was adjustment for test type the odds ratios for 1998–2003 dropped markedly (model B). If there was any background trend in rate of positive results post-NAAT it appears to have been a stable or slightly declining rate.

This is in contrast with what would have been expected if the increase between 1990 and 2000 in sexual behaviour conducive to contracting the infection[18–20] had had a concomitant and gradual impact on chlamydia infection prevalence. Taken together these findings suggest that the observed increases in positivity in the years immediately after the switch to a NAAT were not a reflection of an underlying temporal trend of increasing prevalence in the Lothian population.

One alternative explanation for the greater than expected increase in positivity could be a change in the case mix, or selection of patients attending the GUM clinic. Scotland has a low migration rate,[11] so profound or sudden changes in the composition of the GUM population are unlikely. However, change in case mix because of NAAT testing cannot be excluded. For men, urine testing rather than the (uncomfortable) urethral sampling required for culture might have encouraged more asymptomatic men to come forward. Table 1 shows that the relative numbers of men tested, in particular young men, increased markedly from 2001 onwards. However, the odds ratios for age and sex remained constant in the multivariable models whether or not test type was included, and there were no significant interactions of test type with sex or with age, which together indicate that the change in positivity after switching to NAATs was to a similar extent in young and old, male and female. This reassures us that the observed effect for test switch is unconfounded by changes in the age or sex structure of the tested population.

If NAATs had lower specificity relative to culture, it would result in more false positives. However, both NAATs and culture are of comparable specificity.[21] Another potential source of bias could have been the change in specimen sampling for men, but sensitivity and specificity for NAATs does not change according to specimen type.[22] We retested only positive samples, which could result in partial verification bias[23] except that sensitivity of NAATs is very high[21] so false negatives are very unlikely. Also, by not retesting NAAT negatives we would if anything have underestimated post-NAAT rates.

GUM clinic patients have different sociobehavioural characteristics from patients attending other clinical settings for chlamydia testing, such as family doctor or family planning clinics. However, factors such as the performance of diagnostic tests are largely independent of socioeconomic or psychosocial characteristics of the underlying study population.

Although our findings differ from national trend data[4 5] the latter are already subject to the effects of increased testing rates and piecemeal shifts to NAAT methodology. Furthermore, these national data do not adjust for test type, sex, and age structure of the tested population. Our use of annual number of tests as the denominator means our increased positivity is not an artefactual consequence of increasing numbers being tested, relative to a stable denominator population, as may be the case with other reports.[5 24]

Table 4 shows the increases in positive results in our study and five published studies, classifying studies according to design—concurrent (paired design) or sequential testing. Our observed increase of 59% is consistent with other laboratories that switched sequentially to NAATs (table 4), especially that of nearby Glasgow.[7]

Concurrent studies typically employ multiple specimens and resolve equivocal results for different specimens taken from one patient, which improves sensitivity, particularly of inferior tests. Therefore, these studies would be expected to show lower differences between test types, in rates of positive results, than would be expected if the same tests were compared by routine GUM clinic single specimen testing.[6] The three concurrent studies in table 4 reported increases in positive results of 17% to 26%.[6 8 25] Higher increases were found in the studies with sequential design (46–63%), and our study (59%).

Not included in table 4 is a Swedish study with a quasi-sequential design lacking test by test identification of test type.[26] However, it is noteworthy that for the two periods examined (from 1996 to 1998, and 1998 to 1999) the overall extent of increase in positivity was, respectively, 42% and 71% greater for laboratories which had ‘‘changed to NAAT’’ (as per the imprecise study definition) than those which had not.[26] Also excluded is a paper from Finland,[24] which concluded that less than half their observed rise in rates of chlamydia from 1995 to 2000 was due to the change to NAATs. The authors have not included test type as a variable so their assertion was not based on analyses of the data of that study, but on an estimated increase, that in addition seems to be erroneous (7%,[24] rather than the 17% quoted in the source cited[25]).

We do not believe that all our observed increase is directly due to change to NAAT test, not least because the upper limit of change would be the actual improvement in sensitivity. However, in sequential studies differences in positivity rates are reflecting more than merely the direct effect of improved sensitivity of the new test. It is possible that the ease of specimen provision might lead to more determined and successful contact tracing which would lead to an increase in the proportion of test subjects with a higher likelihood of

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infection. This would not reflect a true increase in prevalence of infection in the population served, but merely increased detection of established infection that had previously remained untested and hidden.

As such, the difference in positivity rates pre-NAAT and post-NAAT would validly reflect the total impact of test change on rates of positive results, in part direct, because of increased sensitivity, in part indirect, because of greater readiness of clinic staff to pursue contacts or of contacts themselves to come forward for testing. Concurrent studies would fail to pick up the latter part, so this might explain some of the differences in findings between such studies and sequential studies.

Public health management and control of *C trachomatis* remains a very important issue in infectious disease control and needs quality surveillance data to monitor trends and plan public health initiatives. Accurate trend analysis for chlamydial infection requires populations to be tested over several years by methods of consistent sensitivity, yet in a recent survey by the HPA Chlamydia Diagnosis Forum, 55 laboratories were using EIA as the routine test and 34 NAAT.[27] This complicates the compilation of regional and national trend data, since a piecemeal shift in practice by regional laboratories will lead to ever more infections being diagnosed giving an overestimate of the increase in prevalence and, perhaps of more concern, may be erroneously interpreted as indicating failure of public health initiatives in chlamydia control.

Assessing population infection rates over time together with relevant concurrent explanatory factors in a large enough prospective cohort, would be prohibitively expensive. Instead, available surveillance data from GUM clinics are used to monitor and understand the burden of disease. Our study has shown what can be achieved when available surveillance data from a GUM clinic are analysed in conjunction with readily available temporal and demographic variables, and, even more importantly, has highlighted the value of inclusion of test type (culture/NAAT) in summary analyses, in order to avoid confounding of trends by test method. We recommend that accumulation of surveillance data should be upgraded to include a richer mix of explanatory variables, to ensure demographic shifts in infection patterns can be monitored accurately.

With their higher sensitivity for detecting *C trachomatis* NAATs significantly reduce the number of false negatives and thus increase the identification and proper treatment of infected individuals, especially asymptomatic carriers. Urine sampling adds the possibility of home sampling and could be the strategic element for a greater involvement of men[28] and high risk groups in targeted screening programmes.[29 30] Combined with a balanced strategy of screening and contact tracing, the technological advances in diagnostic tests have the potential to translate into large health gains for the individual and public health, provided surveillance data are accumulated informatively and interpreted appropriately.

Key messages

- After switching to NAAT from culture methods, the number of infections detected increased by a factor of 1.6 (95% CI: 1.5 to 1.7). Multivariable logistic regression showed a strong association of test type with a positive result
- The observed increase in positivity is more than would be expected solely on the basis of gain in test sensitivity. Part of the increase may be indirectly the result of test change, given that NAAT's more acceptable urine sampling method may result in a change in case mix through more successful contact tracing (thus recruiting patients with higher likelihood of testing positive)
- Part of the recently seen increase in *Chlamydia trachomatis* prevalence in the United Kingdom is likely to be directly and/or indirectly caused by the gradual shift of laboratories to more sensitive NAAT diagnostics.
- Accumulation of surveillance data should be upgraded to include a richer mix of explanatory variables including test type

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CONTRIBUTORS

FB had the overall study idea, liaised with clinic staff to obtain data, undertook literature review, data management and statistical analysis, and took the lead in drafting and revising the paper; PW was involved with the original study, contributed to analysis and interpretation, and contributed substantially to revisions. HY had the idea for and formulated the relevant questions of the paper, contributed laboratory methodology, gave historical and technical background, summarised and provided additional data, and revised the paper.

Authors' affiliations

F Burckhardt, Bavarian Health and Food Safety Authority (Public Health), Veterinaerstrasse 2, 85764 Oberschleissheim, Germany
P Warner, Division of Community Health Sciences, (Public Health Sciences), University of Edinburgh, Teviot Place, Edinburgh EH8 9AG, UK
H Young, Department of Laboratory Medicine (Microbiology), Royal Infirmary of Edinburgh, 51 Little France Crescent, Edinburgh EH16 4SA, UK

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ECHO

Introduction of HIV post-exposure prophylaxis for sexually abused children in Malawi

J C Ellis, S Ahmad, E M Molyneux

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Aims: To improve the care of children who are victims of child sexual abuse (CSA) by routinely assessing eligibility for HIV post-exposure prophylaxis (PEP) and to investigate the feasibility, safety, and efficacy of such treatment started in a paediatric emergency department in Malawi.
Methods: Children presenting to the Queen Elizabeth Central Hospital, Blantyre between 1 January 2004 and 31 December 2004 with a history of alleged CSA were assessed for eligibility for HIV PEP and followed prospectively for six months.
Results: A total of 64 children presented with a history of alleged CSA in the 12 month period; 17 were offered PEP. The remainder were not offered PEP because of absence of physical signs of abuse (n = 20), delay in presentation beyond 72 hours from assault (n = 11), repeated sexual abuse in the preceding six months (n = 15), and HIV infection found on initial testing (n = 1). No family refused an HIV test. No side effects due to antiretroviral therapy were reported. Of the 17 children commenced on PEP, 11 returned for review after one month, seven returned at three months, and two of 15 returned at six months post-assault. None have seroconverted.
Conclusions: In a resource-poor setting with a high HIV prevalence, HIV PEP following CSA is acceptable, safe, and feasible. HIV PEP should be incorporated in to national guidelines in countries with a high community prevalence of HIV infection.

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