

Loss to Follow-Up Among Adults Attending Human Immunodeficiency Virus Services in England, Wales, and Northern Ireland

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Aim: To assess the extent to which human immunodeficiency virus (HIV)-diagnosed adults attending HIV-services in England, Wales, and Northern Ireland are lost to follow-up or attend services intermittently.

Methods: A cohort of HIV-diagnosed adults was created by linking records across the 1998 to 2007 national annual Survey of Prevalent HIV Infections Diagnosed. The records were also linked to the national HIV and acquired immune deficiency syndrome New Diagnoses Database (n = 61,495) and to Office for National Statistics death records. Patterns of HIV-service attendance were analyzed.

Results: On average, 90% of adults attending HIV-services in any one year attended the following year. Nearly 5% of adults attending services in any one year were lost to follow-up, a further 4% subsequently attended services intermittently, whereas less than 2% died. Cumulatively, 19% of adults seen for HIV care between 1998 and 2006 were lost to follow-up by the end of 2007. Factors associated with loss to follow-up included being the following: female; aged 15 to 34 years; black-African or "other" ethnicity; not on antiretroviral therapy; recently diagnosed; and infected outside the United Kingdom.

Conclusions: Although the majority of HIV-diagnosed adults in England, Wales, and Northern Ireland attended HIV-services regularly, cumulatively nearly 1 in 5 adults were lost to follow-up between 1998 and 2007. Innovative strategies focusing on those most likely to drop out of regular care should be developed to maintain regular service engagement and to ensure optimal care.

The risk of human immunodeficiency virus (HIV)-related morbidity and mortality among persons living with HIV, as well as the risk of HIV transmission, can be reduced by not only encouraging earlier and more frequent testing for HIV but also through the provision of optimal care and regular clinical review.^{1,2} The British HIV Association guidelines state that diagnosed persons should be encouraged to regularly attend HIV-related health services (referred to here as "HIV-services") to monitor their CD4 count and HIV viral load as well as providing drug-adherence support services for those receiv-

ing antiretroviral therapy (ART).^{3,4} The guidelines also recommend a sexual health assessment at first presentation and at 6 monthly intervals thereafter, and ongoing high-quality counseling and support.⁴

National HIV surveillance data for England, Wales, and Northern Ireland (E, W, and NI) suggest that people may be leaving the HIV-diagnosed prevalence pool for reasons other than death.^{5,6} Up to the end of 2007, 87,972 adults (aged 15 years or over) had been newly diagnosed with HIV. Of these, 15,833 were reported to have died by the end of 2006. Subtracting the number of reported deaths from the cumulative number of new HIV diagnoses suggests that 72,140 diagnosed adults were living in E, W, and NI in 2007. This number greatly exceeds the 52,603 adults reported as attending HIV-services in E, W, and NI in 2007. This article explores annual patterns of attendance at HIV-services among HIV-diagnosed adults seen for care for the period 1998 to 2007. We assess the extent to which HIV-diagnosed persons are lost to follow-up or attend services intermittently across the whole of E, W, and NI and determine predictors of loss to follow-up.

MATERIALS AND METHODS

Data Sources

Survey of Prevalent HIV Infections Diagnosed. The cross-sectional annual Survey of Prevalent HIV Infections Diagnosed (SOPHID) was introduced in 1995 and collects reports of all persons within a calendar year attending National Health Service (NHS) sites offering HIV-services in E, W, and NI, including all transfers.⁶⁻⁹ Data from the 1998 to 2007 surveys were included in the analyses (sex, age, use of ART, probable route of infection, ethnicity, and whether the person had died).

New-Diagnoses. The HIV and acquired immune deficiency syndrome new Diagnoses and Deaths system (referred to as New-Diagnoses) has operated since 1982, and collects information relating to new HIV diagnoses, first acquired immune deficiency syndrome diagnoses, and deaths among HIV-infected adults across the whole of E, W, and NI on an ongoing basis through voluntary laboratory and clinician reports.^{5,10} Information on year of first HIV diagnosis, probable country of infection (assigned by clinicians or during follow-up interviews with patients), and vital status (alive or dead) was abstracted from the New-Diagnoses system and linked to the SOPHID records. Data are as reported to the end of June 2008.

Both the SOPHID and New-Diagnoses surveillance systems are held at the Health Protection Agency (HPA),¹¹ and strict attention to confidentiality is maintained at every stage of data collection, analysis, and storage. No names are collected or

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held on either database. Instead, a soundex code (a 4-character coding of the surname),¹² together with sex and date of birth, provide a unique identifier in each system. To reduce underreporting, both systems identify and subsequently contact reporting sites that either have not reported, or have reported fewer patients than might be expected based on previous reports. Death notifications are reported directly to both systems by clinics and are supplemented by death notifications from the Office of National Statistics.

Record Linkage and Removal of Duplicate Records

We created a cohort of persons attending HIV-services by linking records across the 1998 to 2007 annual SOPHID surveys on full and part-linked identifiers (sex, date of birth, soundex code, and postcode of residence). Duplicate reports were first identified and removed. A soundex code is not provided for most children and the analyses were therefore restricted to adults aged 15 years and older. Because of improved data collection in later years, some analyses were restricted to the period 2002 to 2007.

Loss to Follow-Up

We allocated a year of last attendance to any person who was reported to at least 1 SOPHID between 1998 and 2006, for whom no record could be identified in subsequent surveys and for whom no death had been reported. These individuals were defined as being lost to follow-up from that point on.

We calculated the percentage of adults attending services each year who were lost to follow-up from that point on (i.e., they were classified as last attending services during that year). We did this for the overall cohort and for different subgroups (for example, according to sex, age, or ethnicity). We then conducted a univariate analysis to determine the likelihood of being lost to follow-up within each subgroup by comparing, for example, men and women or younger people and older people. In each subgroup, the reference category was the one that was most frequently reported, and the comparison of percentages was expressed as a ratio. In addition, we conducted logistic regression to identify factors associated with loss to follow-up cumulatively for the period 2002 to 2006 (restricted to these years due to better variable completion).

Loss to Follow-Up Adjusted for Intermittent Attendance

We adjusted the percentage of adults who were lost to follow-up each year to take account of people intermittently attending services who may return to care after 2007 (Table 1). The adjustment allows for an interval of nonattendance of up to 8 years. To make the adjustment, we extrapolated observed patterns of intermittent attendance between 1998 and 2007 to subsequent years. For example, the number of adults lost to follow-up (i.e., last attending services) in 2000 was adjusted for adults estimated to reattend in 2008 or 2009 (i.e., after a gap of 7 or 8 years), whereas the number for 2006 was adjusted for adults estimated to attend services again at some point between 2008 and 2015 (i.e., after a gap of 1 to 8 years). The adjusted figures represent best estimates of loss to follow-up.

Finally, we calculated cumulative loss of follow-up between 1998 and 2006. In the numerator, we added the final estimates of loss to follow-up for each year between 1998 and 2006 (Table 1, bottom row). In the denominator, we included the number of all adults attending HIV-services for 1 year or more between 1998 and 2006 ($n = 65,040$). Pearson χ^2 values

and all confidence intervals presented are at the 95% level. STATA 9.0 (Stata Corp., College Station, TX) was used for analyses.

RESULTS

A cumulative number of 72,218 adults attended HIV-services in at least 1 year in E, W, and NI between 1998 and 2007. These adults comprised the cohort for the analysis. Complete data were available as follows: soundex, date of birth and sex, 100% ($n = 72,218$); ethnicity, 98.2% (70,928); probable route of infection, 96.3% (69,537); use of ART, 95.7% (69,129); year of diagnosis, 85.2% (61,495); and probable region of infection, 59.6% (43,077).

Overall Patterns of Attendance

On average, between 1998 and 2006, 89.8% of adults attending services in a given year attended services the following year, 2.1% skipped 1 year of care, 1.2% skipped 2 or more years, and 1.7% died (decreasing from 2.9% [466] in 1998 to 0.7% [340] in 2006) (Table 1). On an average, 5.7% of adults attending services in a given year were not reported again to SOPHID at any time up to and including 2007, i.e., they were lost to follow-up (before adjusting for intermittent attendance). This percentage ranged from 5.0% in 2001 to 7.4% in 2006.

Loss to Follow-Up

Table 2 presents the likelihood of being lost to follow-up for the different subgroups for 2002, 2004, and 2006 (data for other years available from authors on request). In all years, men infected through sex between men were less likely to be lost to follow-up compared to adults infected through other routes ($P < 0.05$). The following groups were the most likely to be lost to follow-up: people of black-African ethnicity; females; people aged 15 to 34; those not on ART at last report; people with a recent diagnosis in E, W, and NI; and people infected in Africa (all $P < 0.05$) (Table 2).

Combining data for the years 2002 to 2006, multivariate logistic regression identified these same factors to be associated with loss to follow-up as well as being of "other" ethnicity, and being infected in Europe (all $P < 0.05$). In terms of probable route of infection, in multivariate logistic regression, heterosexual contact was associated with loss to follow-up ($P < 0.05$).

Loss to Follow-Up Adjusted for Intermittent Attendance

After adjusting for adults who may return to care following a period of up to 8 years nonattendance, it was found that, on average, 4.9% of adults attending services in any given year between 1998 and 2006 were lost to follow-up (Table 1), 4.2% attended intermittently (2.1% + 1.2% + 0.9%), and 1.7% died. The adjusted percentage of adults lost to follow-up fell over time, from 6.3% (1012/16,126) in 1998 to 3.7% (1776/48,103) in 2006 ($P < 0.05$) (Table 1, bottom row).

Overall, we estimated that 12,467 people were lost to follow-up between 1998 and 2006 (Table 1, bottom row). This represents 1 in 5 adults (19.2%; 12,467/65,040) attending HIV-services for 1 or more years between 1998 and 2006.

Adjusting National Estimates of Diagnosed HIV for Loss to Follow-Up and Intermittent Attendance

Subtracting the number of reported deaths from the cumulative number of new HIV diagnoses suggests that

TABLE 1. HIV-Service Attendance 1998–2006

	Year of HIV-Service Attendance														Average Across All Years (%)				
	1998		1999		2000		2001		2002		2003		2004			2005		2006	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%		n	%	n	%
No. adults attending HIV-services in that year	16,126	100.0	18,146	100.0	20,549	100.0	23,903	100.0	28,489	100.0	33,392	100.0	38,253	100.0	43,318	100.0	48,103	100.0	—
No. (%) adults who attended HIV-services the next year	13,983	86.7	16,014	88.3	18,344	89.3	21,439	89.7	25,433	89.3	30,161	90.3	34,885	91.2	39,691	91.6	44,207	91.9	89.8
No. (%) adults who did not attend HIV-services the next year, but did so the year after that	368	2.3	388	2.1	410	2.0	548	2.3	650	2.3	652	2.0	739	1.9	753	1.7	—	—	2.1
No. (%) adults who did not attend HIV-services for the next 2 yr but did so at some time after that	297	1.8	275	1.5	285	1.4	286	1.2	344	1.2	295	0.9	217	0.6	—	—	—	—	1.2
No. (%) adults who died in a given year	466	2.9	457	2.5	423	2.1	427	1.8	437	1.5	493	1.5	383	1.0	439	1.0	340	0.7	1.7
No. (%) adults who were not reported to SOPHID again during the study period	1012	6.3	1012	5.6	1087	5.3	1203	5.0	1625	5.7	1791	5.4	2029	5.3	2435	5.6	3556	7.4	5.7
No. (%) adults not reported to SOPHID again during the study period who may attend HIV-services after 2007	0	0	0	0	41	0.2	72	0.3	114	0.4	200	0.6	383	1.0	693	1.6	1780	3.7	0.9
No. (%) adults lost to follow-up in a given year (final estimate)	1012	6.3	1012	5.6	1046	5.1	1131	4.7	1511	5.3	1591	4.8	1646	4.3	1742	4.0	1776	3.7	4.9

All percentages are based on the annual number of adults attending HIV-services (top row of table). HIV indicates human immunodeficiency virus; SOPHID, Survey of Prevalent HIV Infections Diagnosed.

TABLE 2. Factors Associated With Loss to Follow-Up

	Year the Patient Was Lost to Follow-Up					
	2002		2004		2006	
	Ratio*	95% CI	Ratio*	95% CI	Ratio*	95% CI
Probable route of infection [†]						
Sex between men [‡]	1.0		1.0	—	1.0	—
Injecting drug users	2.3	(1.8, 3.0)	1.8	(1.4, 2.4)	2.4	(2.0, 2.9)
Sex between men and women	2.5	(2.3, 2.8)	2.4	(2.1, 2.6)	2.1	(1.9, 2.2)
Other [§]	4.7	(3.7, 5.9)	3.0	(2.3, 3.9)	2.0	(1.6, 2.5)
Ethnicity [†]						
White [‡]	1.0	—	1.0	—	1.0	—
Black-African	2.5	(2.2, 2.7)	2.4	(2.1, 2.6)	2.1	(2.0, 2.3)
Other [¶]	1.7	(1.4, 2.0)	1.0	(0.9, 1.2)	0.8	(0.6, 0.9)
Sex [†]						
Male [‡]	1.0	—	1.0	—	1.0	—
Female	1.7	(1.6, 1.9)	1.5	(1.4, 1.6)	1.5	(1.4, 1.5)
Age group [†]						
15–24	3.2	(2.7, 3.7)	2.7	(2.3, 3.1)	2.3	(2.0, 2.5)
25–34	1.4	(1.3, 1.6)	1.8	(1.7, 2.0)	1.7	(1.6, 1.8)
35–44 [‡]	1.0	—	1.0	—	1.0	—
45+	0.9	(0.8, 1.1)	1.0	(0.9, 1.1)	0.7	(0.7, 0.8)
ART at year of last report [†]						
On ART [‡]	1.0	—	1.0	—	1.0	—
Not on ART	4.9	(4.5, 5.5)	5.3	(4.8, 5.7)	3.9	(3.6, 4.2)
Year of diagnosis						
2001 or before [‡]	1.0	—	1.0	—	1.0	—
2002	2.9	(2.6, 3.3)	2.0	(1.7, 2.4)	1.5	(1.3, 1.7)
2003	—	—	2.9	(2.5, 3.3)	1.7	(1.5, 2.0)
2004	—	—	3.7	(3.2, 4.1)	1.9	(1.7, 2.2)
2005	—	—	—	—	2.5	(2.2, 2.8)
2006	—	—	—	—	3.5	(3.1, 3.8)
Probable world region of infection						
Africa [‡]	1.0	—	1.0	—	1.0	—
United Kingdom	0.3	(0.3, 0.4)	0.4	(0.3, 0.4)	0.5	(0.5, 0.6)
Europe (not United Kingdom)	1.0	(0.7, 1.3)	0.9	(0.7, 1.2)	0.8	(0.7, 1.0)
Elsewhere	1.2	(1.0, 1.5)	0.9	(0.8, 1.1)	0.8	(0.7, 0.9)

*Ratio of percentages: the percentage of adults lost to follow up in that category divided by the percentage lost to follow-up in the reference category. For example, the female ratio of 1.7 equals the percentage of women lost to follow up in 2002 divided by the percentage of men lost to follow up in 2002.

[†]On the basis of the following number of SOPHID records: 2002, 1625; 2004, 2029; 2006, 3556.

[‡]Reference group.

[§]Includes mother-to-child transmission and blood or blood products recipients.

[¶]Includes black-Caribbean, black-other, black-unspecified, Indian, Pakistani, Bangladeshi, other, mixed, Oriental.

^{||}On the basis of the following number of SOPHID records: 2002, 943; 2004, 1522; 2006, 2841.

CI indicates confidence interval; ART, antiretroviral therapy; SOPHID, surveys of prevalent HIV infections diagnosed.

72,140 diagnosed adults were living in E, W, and NI in 2007. This number greatly exceeds the 52,603 adults reported as attending HIV-services in E, W, and NI in 2007 on the basis of SOPHID. The disparity between these 2 estimates (72,140 – 52,603 = 19,537) is greatly reduced when loss to follow-up and intermittent attendance are taken into account.

Adjusting for cumulative loss to follow-up between 1998 and 2006 (19.2%) reduces the new-diagnoses-minus-deaths figure from 72,140 to 58,300. The SOPHID figure increases from 52,603 to 54,550 when we take into account the adults who did not attend services in 2007 but may do so subsequently (the 2006 intermittent attendance estimate of 3.7% in Table 1 was applied). The disparity between the 2 estimates then becomes 3750 (58,300 – 54,550) compared with 19,357 before adjustment.

DISCUSSION

Our findings indicate that the majority of adults with diagnosed HIV living in E, W, and NI are regularly seen for HIV-care after diagnosis. Overall, 9 of 10 adults attending HIV-services in any one year attended for care the following year. On average, nearly 5% of adults attending services in any one year were lost to follow-up, although there was a significant decline over the study period from 6.3% in 1998 to 3.7% in 2006. Also, 4% of patients subsequently attended services intermittently, whereas less than 2% died, on average. Cumulatively, 1 in 5 (or an estimated 12,500) adults attending HIV-related services in E, W, and NI between 1998 to 2006 were lost to follow-up by the end of 2007.

How can we explain loss to follow-up among people diagnosed with HIV in E, W, and NI? One possible explanation is that some adults diagnosed with HIV in E, W, and NI

subsequently emigrate. New HIV diagnoses among adults of black-African ethnicity, many of whom have recently arrived in the United Kingdom, have increased since 1999.^{1,5,13-15} It is possible that the association between loss to follow-up and black-African ethnicity, acquiring HIV-infection abroad, and having a recent diagnosis can be explained by migrants moving to the United Kingdom leaving shortly after receiving an HIV diagnosis. Their emigration may be voluntary or involuntary, temporary or permanent. Although these associations provide some evidence of emigration contributing to loss to follow-up, we are unable to judge the extent to which an HIV diagnosis or HIV-related morbidity would influence this.

Another possible explanation for loss to follow-up is diagnosed adults withdrawing from HIV-related treatment and care. Discrimination and HIV-related stigma, within and outside the health care system, are major barriers to healthcare-service usage. Discrimination has been reported among persons of black-African ethnicity living with HIV in the United Kingdom,^{16,17} a group for whom an elevated risk of loss to follow-up was found. It is possible that some people withdraw from HIV treatment and care once they are diagnosed, only to present again some years later when they are symptomatic. This is consistent with the association between loss to follow-up and not being on ART at last report and having a recent HIV diagnosis.

It is unlikely that loss to follow-up is due to diagnosed adults attending non-NHS (i.e., private) services. In the United Kingdom, it is recommended that people diagnosed with HIV regularly attend specialist NHS outpatient clinics which are free at the point of access and which are encouraged to offer clinically effective HIV care that matches local population needs.^{3,4} A study of HIV-diagnosed persons attending 2 London NHS clinics found that only 15 out of 225 respondents had private health insurance.¹⁸ It is therefore unlikely that loss to follow-up is a result of adults attending private HIV-services once they stop going to an NHS clinic.

There are some limitations to our analyses. It is possible that our estimates of loss to follow-up and intermittent attendance are inflated due to problems with data linkage across surveys. For example, unfamiliar African surnames may result in soundex codes being reported differently over time,¹⁹ making record linkage difficult. This could result in loss to follow-up estimates being inflated among black-Africans. To reduce this potential bias, we increased the likelihood of matching records by using an algorithm that included variations in soundex and date of birth.

It is also possible that our estimates may be inflated due to the under reporting of adults over time to SOPHID. However, we believe this is unlikely. The SOPHID collects data from all NHS sites throughout the United Kingdom, which offer open and free access to HIV-related care and treatment. In addition to the active follow-up of all nonreporting and underreporting sites by the HPA, annual survey outputs are linked to the local commissioning of HIV-services. For underreporting to SOPHID to contribute to loss to follow-up, it would require adults attending HIV-related services to be omitted from clinic reports in all years subsequent to the year of last report. As this could result in the underfunding of services in subsequent years, it is unlikely that this is common.

It is also unlikely that underreported deaths among HIV-diagnosed persons in E, W, and NI have a major impact as overall numbers are relatively small.⁵ Also, the likelihood of underreporting is reduced by the supplementation of HIV- and non-HIV-related death reports from clinics with information from the Office of National Statistics.²⁰

Our estimates of loss to follow-up and intermittent attendance help to explain the disparity between our 2 estimates of diagnosed HIV prevalence, one based on reports to SOPHID, the other based on new HIV diagnoses minus deaths. After taking loss to follow-up and intermittent attendance into account, the disparity was greatly reduced. Our cumulative estimate of adults lost to follow-up during our study period is the same as that reported from a London clinic-based study where 1 in 5 patients registered between 1997 and 2005 were lost to follow-up by the end of 2006.²¹

The HPA has recently developed measures to evaluate the quality of care received by people accessing HIV-services, including timely access to care following an HIV diagnosis.²² In 2008, 80% of people newly diagnosed with HIV were seen for care within 1 month of their diagnosis with almost 95% seen within 3 months.²² The HPA will also provide annual estimates of loss of follow-up among HIV diagnosed adults as an additional indicator of quality of care.

In conclusion, the majority of adults with diagnosed HIV living in E, W, and NI are regularly seen for HIV-care after diagnosis, in line with guidelines recommending regular patient contact with HIV-services.⁴ Nevertheless, we identified a significant proportion of HIV-infected adults either permanently lost to follow-up or intermittently attending services. Innovative strategies should be developed to maintain regular service engagement among those groups found to be at increased risk of dropping out of regular care.

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