Original article

Epidemiological HIV infection surveillance among subjects with risk behaviours in the city of Messina (Sicily) from 1992 to 2015

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Summary

Introduction. *Epidemiological studies are a key element in determining the evolution and spread of HIV infection among the world population. Knowledge of the epidemiological dynamics improves strategies for prevention and monitoring.*

Methods. *We examined 2,272 subjects who voluntarily underwent HIV testing from January 1992 to December 2015. For each subject, an anonymous form was completed to obtain information on personal data, sexual habits and exposure to risk factors.*

Results. *The number of subjects undergoing the screening test has increased over the years and the average age of the tested subjects has decreased over time. The main motivation for undergoing HIV*

testing is unprotected sex. Although heterosexual subjects taking the test were more numerous than homosexuals in this study, an increase in the latter over time should be highlighted.

Conclusions. *Although the number of tests performed has increased over the years, the persistence of unprotected sex shows an inadequate perception of risk. Therefore, it is necessary to implement programmes to increase the general awareness of HIV infection. It is also essential to undertake constant monitoring of behaviour, risk perception and the application of the screening test via surveillance systems in order to implement effective and efficient prevention.*

Introduction

Epidemiological HIV data are the most important element showing the evolution and diffusion of HIV infection among the world population. Moreover, epidemiological studies allow the planning of specific prevention strategies monitoring the spread of this infection [1-4]. The AIDS surveillance systems provide useful information on HIV epidemic dynamics [5-7]. For this reason, since 1988 several Italian provinces and regions (Lazio, Veneto, Friuli Venezia-Giulia, Trento, Modena, Sicilia) have established local surveillance systems for new HIV diagnoses [8, 9]. AIDS surveillance has three complementary objectives in HIV-infected individuals: (1) reducing high-risk sexual behaviours [10-13]; (2) reducing the use of injected and non-injected drugs [10, 14]; (3) improving clinical care [15]. The last objective aims to attain adherence to antiretroviral therapy, the suppression of HIV viral load and the prevention of the development of HIV drug resistance [15, 16]. At the Epidemiological Observatory, the Regional Registry (activated in Sicily in 1985) collects all cases of AIDS occurring among Sicilian residents or diagnosed in Sicily. The register is part of the National Register, which is maintained by the National Institute of Health and it collects all cases of AIDS occurring or diagnosed in all Italian regions. However, the monitoring of new cases of HIV

infection has always been difficult to implement due to the significant problems related to privacy. Subsequently, following the issue of the Ministerial decree of 2008.03.31, a national surveillance system of HIV infection was established which included the notification of new cases; this system is similar to that used for cases of AIDS. For this purpose, the regional representatives of the Infectious Diseases Units have been specially appointed and a regional surveillance system has been implemented since 2010. In addition, since 2009 our laboratory has adhered to the system of regional surveillance, although it was already in place in the province of Messina from 1984. This system offers the screening test to all people who voluntarily request it after engaging in risk behaviours. Therefore, our study is a surveillance survey of the number of subjects who underwent a voluntary HIV test in the city and province of Messina from January 1992 to December 2015, monitoring in the territory risk behaviour, risk perception, HIV infection and the application of the screening test via surveillance systems in order to implement effective and efficient prevention.

Methods

Overall, 2,272 people, 1,554 males and 718 females, voluntarily underwent HIV testing from January 1992 to

December 2015 at the HIV laboratory of the Policlinic G. Martino in Messina, which is one of the reference centres for monitoring HIV infection in Sicily. Messina lies on the north-eastern tip of Sicily and it has around 240,000 inhabitants. Before blood sample collection, the volunteers underwent counselling to ascertain the need for the test considering the risk factor and if the time between exposure and the test was sufficient to detect the presence of antibodies. During counselling, we collected information about gender, age, place of birth, occupation and sexual habits (heterosexual, homosexual or bisexual). We also asked about the motivation for coming and the kinds of risk to which the subjects may have been exposed recently, such as blood transfusion, dental visits, accidental punctures, drugs and/or alcohol use, piercing and/or tattoos and unprotected sex.

Comparisons and correlations were determined using the standard Pearson test and linear regression. Significance was assessed at the p < 0.05 level. All analyses were performed using the Prism 4.0 software.

Results

Table I shows information about gender, age, sexual habits, occupation and exposure to risk factors.

The analysis of the data collected from 1992 to 2015 clearly showed a statistically significant increase (p < 0.0001) in the number of HIV tests performed. The number of subjects undergoing the screening test has increased from 8 to 245 persons/year (Fig. 1).

The data analysed by gender shows a predominance of male subjects who carried out the test (1,554 males vs. 718 females). As confirmed by the regression analysis, from 1992 to 2015, the mean age of the tested subjects steadily decreased from 48 to 32 (p < 0.0001) (Fig. 2).

Analysing the sample according to profession, most of the subjects in the study were students (38.13%), followed by employees (16.54%) and unemployed (15.52%). These categories were prevalent in all the years examined in this study. All categories were uniformly represented over the years under investigation, with the exception of the category "unemployed" and "retired" significantly more

Tab. I. Overview on subjects who voluntarily underwent HIV testing from January 1992 to December 2015.

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
N° test	8	14	37	29	10	5	25	122	100	82	53	105
Male	6	6	28	17	4	4	18	70	63	49	30	63
Female	2	8	9	12	6	1	7	52	37	33	23	42
Mean age	48	50	46	47	44	52	46	43	42	42	42	43
Occupation												
Student	3	7	15	11	7	1	11	51	51	35	25	49
Employee	0	2	7	3	1	0	4	23	17	18	5	18
Freelancer	0	1	0	4	0	0	3	2	2	3	2	6
Workman	0	0	0	4	0	1	3	7	3	5	2	5
Housewife	0	1	1	2	0	0	0	4	6	2	2	3
Physician*	0	0	1	0	0	0	0	12	5	5	5	13
Dealer	2	1	4	2	0	1	2	6	7	2	0	2
Police,army	2	0	4	0	0	0	0	2	1	3	3	2
Retired	0	0	0	0	0	2	0	1	1	1	0	0
Prostitute	0	0	0	0	0	0	1	0	0	0	0	0
Unemployed	1	1	4	1	2	0	0	14	6	7	8	6
Sexual habits												
Heterosexual	7	13	33	29	10	4	21	104	85	69	44	96
Homosexual	1	0	2	0	0	1	3	5	7	3	3	3
Bisexual	0	0	1	0	0	0	1	4	1	3	1	6
Transsexual	0	0	0	0	0	0	0	0	0	0	0	0
Unresponsive	0	1	1	0	0	0	0	9	7	7	5	0
Risk factor												
No risk reported	0	0	1	1	0	0	0	0	1	0	0	1
Unprotected sex	6	9	22	18	5	4	20	85	64	46	28	71
Prevention/control	0	1	10	6	1	1	1	16	8	8	2	13
Accidental injury	1	0	0	1	1	0	1	13	14	21	12	15
Invasive practices$	0	0	0	0	1	0	0	1	4	0	1	0
Drug addicts/ partner drug addicts	1	2	4	2	2	0	1	2	5	4	7	0
Partners of HIV+ subjects	0	1	0	1	0	0	1	4	4	2	3	5
Transfused or dialysis patients	0	0	0	0	0	0	0	0	0	0	0	0
Suspected diagnosis	0	0	0	0	0	0	0	0	0	0	0	0

* physician, paramedic, dentist
$ surgery, dental care, tattoo, piercing

Tab. I. Overview on subjects who voluntarily underwent HIV testing from January 1992 to December 2015.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
N° test	99	90	218	143	89	83	84	193	83	147	208	245
Male	69	62	144	96	65	63	60	124	55	97	164	197
Female	30	28	74	47	24	20	24	69	28	50	44	48
Mean age	41	41	38	36	36	40	34	31	35	32	33	32
Occupation												
Student	28	25	79	63	38	20	36	96	25	60	55	73
Employee	15	20	49	24	13	18	11	23	11	21	26	47
Freelancer	3	9	22	13	10	6	8	14	8	15	23	18
Workman	5	5	6	8	8	5	6	13	3	8	18	17
Housewife	2	2	1	0	2	3	5	4	2	2	5	2
Physician*	13	8	13	7	3	10	6	9	2	8	9	17
Dealer	3	0	10	8	2	2	4	1	2	4	6	2
Police,army	5	2	0	1	0	5	1	5	1	1	4	7
Retired	1	3	7	1	2	2	1	0	4	4	5	4
Prostitute	0	0	0	0	0	0	0	0	0	0	0	0
Unemployed	23	16	30	17	10	11	4	28	24	23	56	58
Sexual habits												
Heterosexual	71	67	191	111	54	72	57	155	56	117	134	128
Homosexual	15	15	13	23	24	10	20	17	23	20	57	75
Bisexual	10	6	9	7	4	1	4	7	2	10	5	25
Transsexual	0	0	0	0	0	0	0	0	0	0	0	0
Unresponsive	3	2	5	2	7	0	3	14	2	0	12	17
Risk factor												
No risk reported	0	0	0	1	0	0	0	6	1	0	2	5
Unprotected sex	68	64	144	115	76	68	69	127	68	106	158	186
Prevention/control	7	5	58	11	5	4	6	31	4	19	25	14
Accidental injury	17	12	13	14	8	9	6	4	10	11	9	10
Invasive practices$	0	0	0	1	0	2	2	25	0	2	1	3
Drug addicts/ partner drug addicts	0	0	3	1	0	0	0	0	0	0	9	1
Partners of HIV+ subjects	7	8	0	0	0	0	0	0	0	4	0	14
Transfused or dialysis patients	0	0	0	0	0	0	0	0	0	1	0	0
Suspected diagnosis	0	0	0	0	0	0	0	0	0	3	4	11

* physician, paramedic, dentist
$ surgery, dental care, tattoo, piercing

present in recent years (p = 0.0078 and p=0.0046 respectively), in contrast to the "dealer" category, most represented in the 1990s (p = 0.0076).

The information collected on sexual habits showed that, on average, 76.06% of the sample comprised heterosexual subjects, 14.96% homosexual subjects and 4.71% bisexual subjects. The statistical analysis showed a significant inverse correlation (p < 0.0001) between the number of heterosexual and homosexual subjects; in particular, the former decreased while the latter increased over the years (Fig. 3a).

The most common reason prompting the subjects to carry out the test was unprotected sex (71.17%). In addition, 9.95% of people were persuaded to take the test for prevention and 10.03% due to contact with potentially contaminated objects. The category of drug users, on average, accounted for 4.36% of the subjects examined. The comparison between the two risk factors most implicated – unprotected sex and the exchange of syringes among drug users – showed that the former increased significantly from 1992 to 2015, while the latter declined significantly over the years (Fig. 3b).

In all, 35 of 1,554 tested males (2.25%) were HIV positive and their average age was 35 ± 11.73. Only 4 female subjects out of 718 were HIV positive (0.5 %); they were on average 45 ± 11.21 years old. As shown in Figure 4a, the number of positive HIV tests increased over the years, especially from 2013 onwards, reaching 5.7 new cases of HIV infection per 100,000 residents in 2015. Furthermore, the number of positive HIV tests increases significantly with an increase in the number of tests performed (Fig.4b). Of the subjects who were positive on the test, 48% were heterosexual, 41% were homosexual and 11% were bisexual. Analysing the reasons that led the subjects to carry out the test, it was found that 56% of them did so because of occasional unprotected sex, 19% because of sexual contact with an HIV-positive partner, 18% because of apparent symptoms related to HIV and only 7% due to being drug users (Fig. 5a-b).

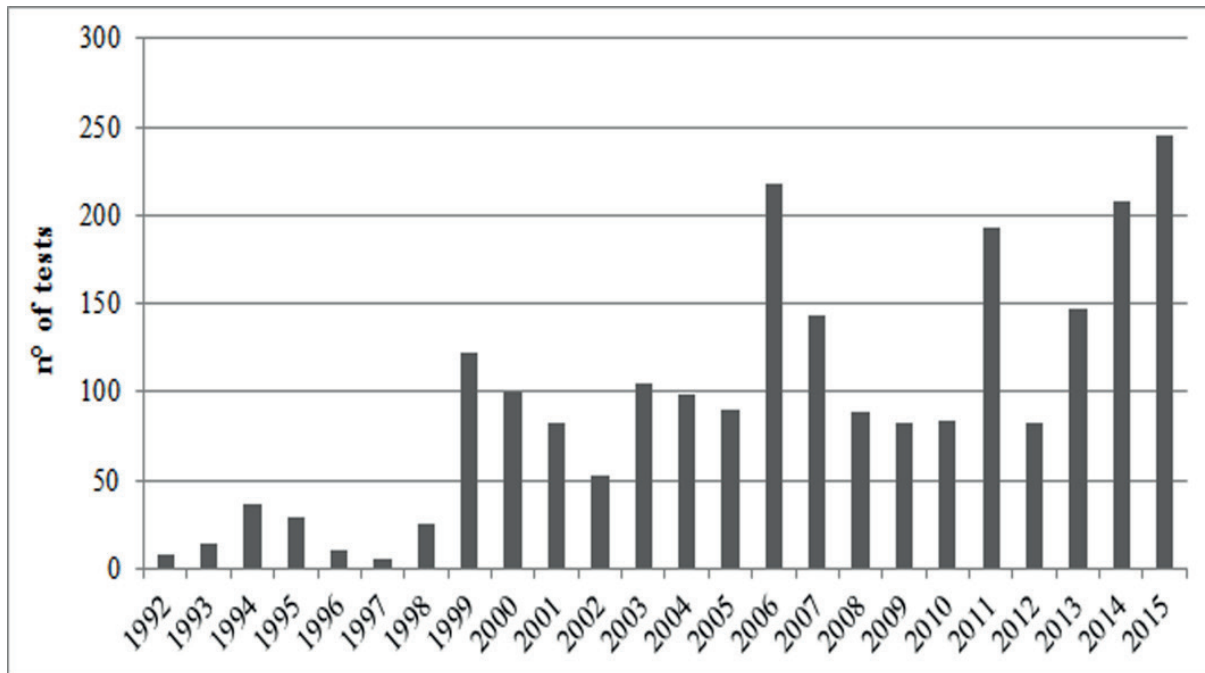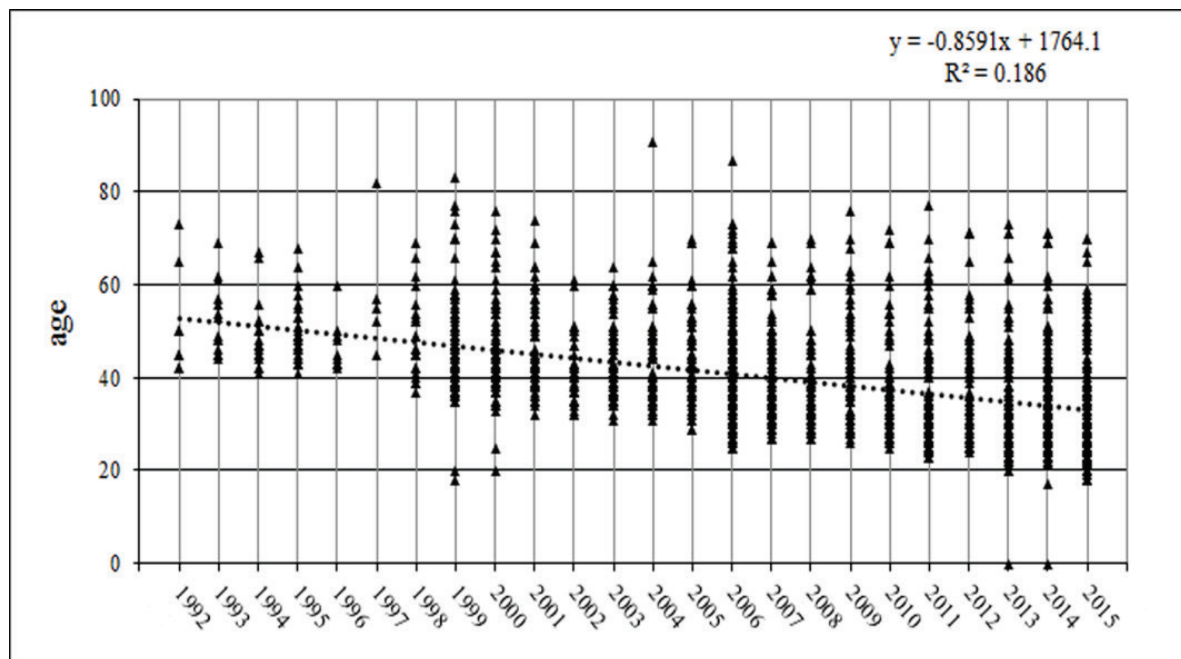**Fig. 1.** Number of 2 screened for HIV from 1992 to 2015.

Fig. 2. Regression analysis shows the distribution of subjects undergoing screening for HIV by age in the period 1992-2015.

$$y = -0.8591x + 1764.1$$
$$R^2 = 0.186$$

Discussion

Our study is an observational survey that drew on epidemiological surveillance carried out in our laboratory from 1992 to 2015 among subjects who underwent a voluntary test. The Joint United Nations Programme on HIV/AIDS (UNAIDS)/World Health Organization (WHO) has defined second generation surveillance (SGS) [17, 18] as the "regular, systematic collection, analysis and interpretation of information for use in tracking and describing changes in the HIV/AIDS epidemic over time". This kind of surveillance provides an

Fig. 3. Comparison between heterosexuals and homosexuals categories, (a) and the most involved risk factors (b).
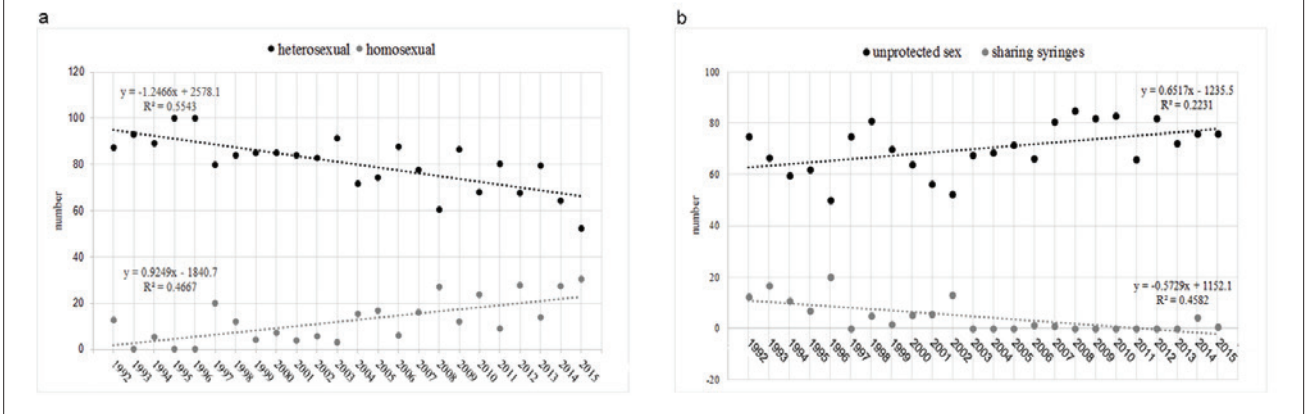
Fig. 4. The scatterplots show the results of regression analysis to assess the increase in the number of tests during the years examined (a) and the relationship with the number of HIV tests performed in the same period (b) (1992–2015).
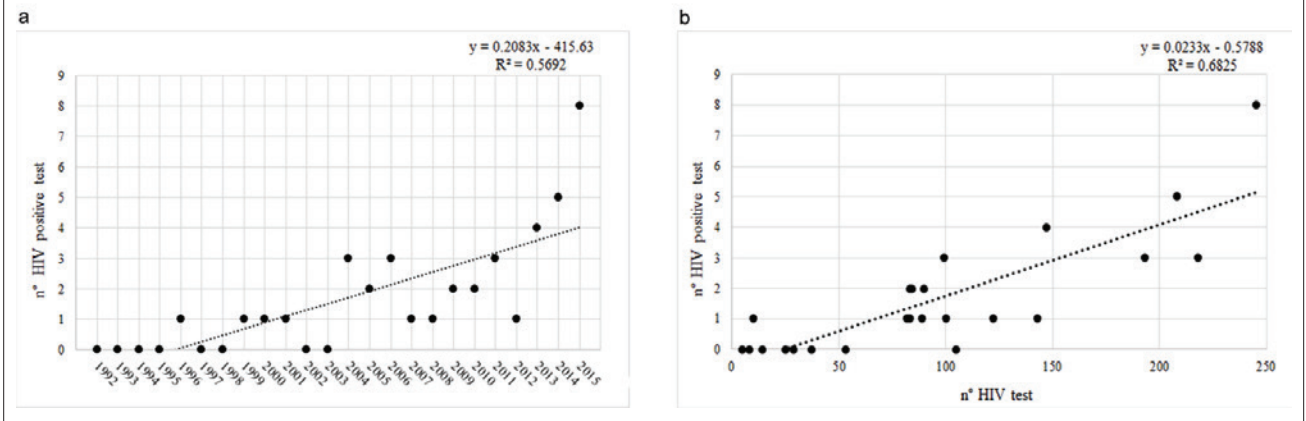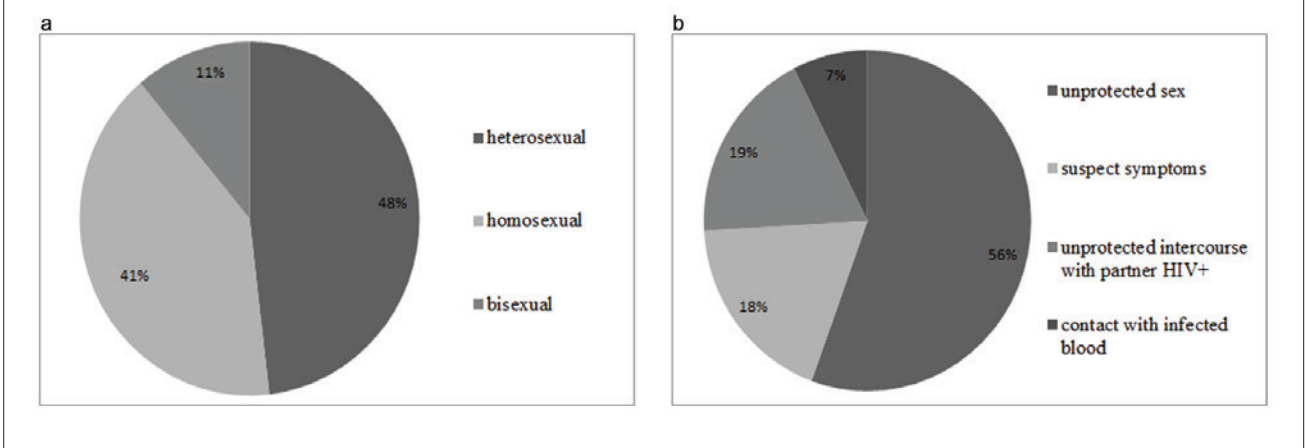

Fig. 5 Sexual habits (a) and main cause of transmission (b) of the subjects who tested HIV positive.

understanding of local epidemics, including sources of new infections over time, as well as the behavioural and biological factors driving epidemic spread. Most new transmission is still attributed to those with higher risk behaviours and their immediate sexual partners. The monitoring of risks related to the transmission of HIV provides a key source of information, not only to understand the drivers of epidemics, but also for advocacy and the planning and evaluation of preventive interventions [19, 20].

From the data described above, the greater presence of males than females could be attributed to the fact that men pay less attention to prevention than women and therefore their behaviours are less cautious. Alternatively, it could reflect a heightened perception of risk among men. The results showed that during the entire period of observation, the average age of the tested subjects consistently decreased, whereas the number of individuals who voluntarily took the test increased over time. This is an unequivocal sign that information has become more effective over the years. During the period observed, we highlight the increase in the number of those undergoing voluntary testing in the years 2006 and 2011. In these years, our laboratory, in collaboration with the Red Cross of Messina, organized prevention campaigns, with information points distributed in the main squares of the city, offering the chance to do an on-site test.

The results obtained show that from 1992 to 2015 individuals who requested testing and those who tested positive were predominantly subjects with at-risk sexual behaviours. Despite the fact that heterosexuals remain the category most represented, our results show that in recent years the number of heterosexuals voluntarily taking the test has decreased, while the number of homosexuals has increased. This can be attributed to greater awareness among the latter of the greater risk of transmission of HIV through anal intercourse [21], or perhaps finding it easier to declare their sexual orientation because the homosexuality taboo is greatly reduced in society. Some associations, particularly active in our city, help us in the field of sexual health and the prevention of HIV and sexually transmitted infections (STIs) to increase the promotion of testing in this group given the increased vulnerability of gay and bisexual men.

Only a few subjects belonged to the category of drug addicts, in contrast to the 1980s in Italy, when they were the predominant category in the spread of the virus [22, 23]. In addition, the prevalence of people who reported that they practised unprotected sex denotes a lack of knowledge of the risk, in particular evidence of inadequate risk perception, condom use and HIV testing, suggesting the need to implement programmes aimed at increasing the general awareness of HIV infection according to the guidelines issued at the European level [24].

Regarding the subjects who tested positive for HIV, our data show a lower incidence of HIV infection in women, in line with the latest data from the AIDS Operating Center (COA) of the National Institute of Health. Unlike women, only the age group of affected men is in line with the national figure, at 39 years for males and 36 for females.

The increase in the number of positive HIV tests could suggest an increase in the incidence of new diagnoses, but this would not be in line with current Italian data. According to the data provided by the COA in 2015, the incidence of new HIV infection diagnoses has decreased slightly from the previous three years, with 3,444 new HIV infection diagnoses equal to 5.7 new cases of HIV infection per 100,000 residents reported. As new diagnoses increase with the number of tests performed, we believe it plausible that the incidence of infection has not increased, but rather the increase in the number of tests has simply led to the discovery of infection that would otherwise be hidden.

Since the mid-1980s, the distribution of new HIV transmission diagnoses has changed dramatically: the proportion of IDUs declined from 76.2% to 3.2% in 2015, while the cases attributable to sexual transmission, in particular those attributable to heterosexual transmission, increased from 1.7% in 1985 to 44.9% in 2015 and cases attributable to homosexual transmission over the same period increased from 6.3% to 40.7%. Our data correlate with this trend, 48% of HIV-positive people were heterosexual and 41% were homosexual. Yet, our data show that the majority of new diagnoses of infection by HIV can be attributed to unprotected sexual intercourse at a rate of 83%, in line with COA data that attributes 85.5% of all cases to unprotected sexual intercourse [25, 26].

Conclusions

Data from the National Institute of Health in Italy (the AIDS Operating Center) show that the distribution of HIV methods of transmission has undergone remarkable changes in recent years. As the major cause of the risk of HIV exposure is represented by unprotected sex, we believe it is essential to promote knowledge about diseases and their complications. Since students are more vulnerable to unprotected sex, it is clear that there is an urgent need to introduce sex education as a proper subject in Italian schools in order to promote the practice of sexual relationships in safe and responsible manner and to enhance awareness of the risk of contracting and transmitting STIs [27].

It is essential to undertake constant monitoring of behaviour and risk perception, as well as the application of the screening test in Italy and other countries via a surveillance system and other methods in order to implement effective and efficient prevention [28, 29].

In agreement with other studies [7, 30], we affirm that the changed pattern of the HIV epidemic in Italy highlights the need for a nation-wide surveillance system for HIV infection, aimed also at the allocation of adequate economic resources and the planning of specific prevention.

Over the last decade, the proportion of late presenters or those with indications of advanced infection has increased, from 20.5% in 2006 to 74.5% in 2015. This means that these individuals are diagnosed only when their immune system is already failing. There is no cure for HIV, but early diagnosis allows access to lifesaving treatment that prolongs healthy life.

The above provides an understanding of the importance of promoting HIV testing. This is important because it allows the emergence of previously hidden non-diagnosed cases of HIV infection; later diagnosis of HIV is worse

for the immune system, while timely diagnosis helps manage the infection effectively. Providing antiretroviral therapy in the early stages of HIV infection allows people with HIV to live longer and healthier lives. It also reduces costs for the healthcare system and above all reduces the risk of transmitting HIV to others.

Acknowledgements

Authors' contributions

IP and GV conceived, designed and coordinated the research; EA collected data; GV, MPB,AD, PSand PL contributed to the acquisition, interpretation of data,identified the endpoints analysed and prepared the figures and tables; IP, AD and GVwrote the paper.
All Authors revised the manuscript and gave their contribution to improve the paper. All authors read and approved the final manuscript.

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