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# Prevalence and attitudes to HIV testing among adults visiting public outpatient clinics in Rome: results of the MeDi (Measuring health Disparities in HIV prevention) survey. Part 1

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**The composition of the MeDi Study Group is reported before the References*

**Abstract**

***Background.*** It is estimated that, in Italy, 12 000-18 000 (11-13% of 130 000) HIV-infected subjects are not aware of their serostatus. People in this condition may visit the healthcare system multiple times without being diagnosed. If tested on one of these occasions, they could modify their high-risk behaviours and benefit from treatment, factors that reduce HIV transmission. In Italy, no data on HIV testing in the general population are available so far and little is known on the relationship between socioeconomic determinants (at individual and neighbourhood levels) and testing uptake.

***Methods.*** A large anonymous survey was performed in 2012-2014 on more than 10 000 individuals 18-59 years old who underwent 21 public ambulatories in Rome to determine the proportion of subjects tested for HIV and factors related to testing uptake. Subjects' socio-demographic characteristics, sexual orientation, number of sexual partners, HIV risk behaviour, HIV testing uptake were collected by a self-administered questionnaire. Level of area deprivation was measured at the postal code level by the index of social disadvantage (ISD). Multilevel Poisson regressions were carried out to take heterogeneity between clusters (post code and clinics) into account.

***Results.*** Among people participating in the study, 58.1% of subjects self-reported to have been tested at least once for HIV. Those who had one high risk behaviour for HIV-infection were 11% more likely to test than those not reporting any, and subjects who had had a STI (sexually-transmitted-infection) in the past were 12% more likely to test than those who had not had a STI. However only 44% (54% among subjects aged 18-35 years) of those with self-reported risks of contracting HIV had been tested at least once in life. This percentage increases, as expected, with the level of education, but, even so, about 40% of university educated subjects self-reporting risks of contracting HIV had never undergone an HIV test.

***Conclusions.*** This study highlights that, while the percentage of subjects tested is even higher than observed in other western nations, only 44% of subjects, self-reporting risks of contracting HIV, had tested at least once in life and about 40% of university educated subjects self reporting risks of contracting HIV had never tested.

**Key words**
- HIV
- HIV testing
- SEP
- deprivation
- Italy
- urban

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## BACKGROUND

Anti-retroviral therapy (ART) has resulted in substantial reductions of HIV/AIDS-related morbidity and mortality, which allowed not only to achieve but also to exceed, in 2000, the AIDS targets of Millennium Development Goal 6 [1]. Building on those achievements, UNAIDS set the ambitious target of ending the AIDS epidemic by 2030 [2].

Mathematical modelling suggests that to achieve this target it is necessary that, by 2020, 90% of people living with HIV know their status, 90% of people on treatment achieve viral suppression and the number of new infections is reduced by 75% [2].

Different strategies have been proposed to increase the proportion of persons living with HIV that are aware of their status. In the United States, the Centers for Disease Control and Prevention proposed in 2006 to test all individuals aged 13 to 64 years coming into contact with the health system, at least once during life independent from any risk assessment [3]. In Europe, it has been proposed to test routinely individuals presenting with an "HIV indicator disease" such as infections that share with HIV a common mode of transmission (subjects presenting with symptoms indicative of sexually transmitted infections or with reported high-risk behaviour) or whose onset is favoured by HIV-induced immunodeficiency, and any other medical condition associated with an undiagnosed HIV prevalence greater than 0.1% [4, 5]. However, the European MSM Internet Survey, found that in a sample of Italian men who had had sex with another man (MSM) in the last year, 28.9% had never tested for HIV [6]. A European pilot study conducted in 2010, which analysed, among others also Italian data, found that only 56.3% of subjects with STI had tested for HIV at least once lifetime [7], despite most of them being likely to see a doctor years before the diagnosis of HIV. Furthermore, a study carried out in 2011, found that only 37.4% of injecting drug users had tested for HIV in the previous 12 months [8].

Health risk behaviour that have an impact on HIV transmission and health literacy are often socially patterned [9], with low socio-economic position (SEP) individuals being more likely to engage in high risk sexual behaviour. Unsurprisingly, low SEP individuals and families are more likely to concentrate in deprived neighbourhoods which have also less resources and services, so neighbourhoods can thwart individual's likelihood of HIV testing and compound their disadvantage beyond personal circumstances [9, 10]. But the effect of neighbourhood context on testing uptake has received little attention in Italy, so far.

We carried out a survey of the general adult population living in Rome and accessing some outpatient clinics of the local health units, between January 2012 to November 2014 to determine the proportion of subjects tested for HIV and factors related to testing uptake. Specific aims of the survey were: 1) to estimate the proportion of subjects who underwent HIV testing in the population living in Rome who attended one of the outpatient clinics included in the study; 2) to assess whether the participation in HIV testing varied across segments of the population defined by categories of risk for STI; 3) to evaluate the association between participation in HIV testing, subjects' socio-demographic characteristics and the socioeconomic deprivation of their area of residence; and 4) to explain geographical heterogeneity in HIV testing if present. To the best of our knowledge, no other data on HIV testing in the general population are available in Italy, so far.

## MATERIALS AND METHODS

### *MeDi (Measuring health Disparities in HIV prevention) survey*

The MeDi survey was conducted in 2012-2014 as part of the Italian Ministry of Health HIV/AIDS projects to provide baseline information on existing levels of positive health behaviours and HIV related risk factors, through a self-completion questionnaire, against which changes could be monitored.

### *Setting*

The study was carried out within public outpatient clinics based either in hospitals or local health units to retrieve a sample as representative as possible of the general population and at the same time preserve subjects' privacy.

### *Sampling strategy*

A list containing the number of accesses (medical examinations, clinical and diagnostic tests) for the outpatient clinics of the local health units (ASL) in the city of Rome for the year 2009, was made available by the regional health authority. From this list, clinics providing only specialistic care or which were located outside of the metropolitan area were excluded, thus leaving a total of 81 outpatient clinics. Out of them, 41 were selected and 21 agreed to participate in the study. For each of them the number of questionnaires to be collected was determined on the basis of the number of accesses in 2009 to obtain a sample of 20 000 questionnaires (the size of the sample was determined to show changes in HIV prevalence and enable detailed age, sex and multi-factor analysis, an objective not addressed in this paper).

### *Study population*

All men and women, aged 18 to 59 years, resident in the Roman metropolitan area, attending the selected clinics from January 2012 to November 2014 were handed in a self-completion questionnaire by *ad hoc* trained study personnel (14) present in each clinic at given scheduled times.

### *Questionnaire*

The MeDi questionnaire was developed by the authors building on previous research (an Italian version of the questionnaire is contained in the Supplementary Material available online) [11, 12]. Participants were asked details about their socio-demographic characteristics (gender, nationality, age, duration of stay in Rome, postal code of the area of residence, educational level, occupation, marital status, duration of stable relationships, health exemption tickets and pregnancy status),

their sexual orientation, the number of sexual partners they had had in the last six months, over the past five years and lifetime and were asked to indicate whether they had ever been tested for HIV. Those ever tested were asked to report the number of tests taken and the year of the testing.

HIV risk behaviour was evaluated by asking subjects whether they had ever been in one or more situations at high risk for HIV transmission. Two lists of hypothetical situations were provided. The first one included: "I have used injective drugs", "I have had sex under the effect of alcohol or drugs", "I have had anal intercourse without a condom", "I have given or received money in exchange for sex"; the second one included: "I have had multiple sexual partners over the same period", "my partner has had multiple sexual partners over the same period", "I have not used a condom during the last intercourse with a casual partner", "I have not used a condom during sexual intercourse with a HIV positive partner".

Participants were also asked whether they had ever suffered from chlamydia, gonorrhea, syphilis, herpes genitalis and genital warts.

### *Pilot study*

The questionnaire and the study procedures were field tested on the first 300 subjects enrolled in the study to investigate questions comprehensions/acceptability and train the 14 field workers (i.e. random call back, check that the returned data had the required high standards).

### *Data management and statistical analysis*

All questionnaires were registered in *ad hoc* database and the dataset was cleaned and ready in December 2016.

Crude, age and gender specific, and age-standardized percentages of ever having performed HIV testing were calculated using the 2012 European population provided by Eurostat as reference [13].

Fisher exact chi square tests were computed to investigate the association between HIV testing uptake and possible determinants/predictors variables such as socio-demographic characteristics, sexual behaviour, STI in the past, and different levels of social disadvantage in the area where the participant was living (see below for description). Poisson regression models were used to produce unbiased prevalence ratios estimates [14]. A test for linear trend was carried out, if necessary, across strata of ordinal categorical variables, including them as "continuous" variables in a Poisson model. Poisson regressions, with stepwise selection, were carried out to identify independent predictor variables from those with a p-value < 0.20 at the univariate analysis.

Within and between clusters (post code and clinics) variances were investigated using a multilevel framework. Since the variance at the postal code level was not significant in a null non –hierarchical multilevel model, in which subjects simultaneously belonged to outpatient clinics and postcodes of residence, a model with a random term at the clinic level only was carried out (i). To this model were added in the following order: individual (ii) and contextual level covariates (iii) as identified with the stepwise procedure, the random slopes for contextual variables (iv) and the cross level interaction terms between deprivation and strata of age, sex, sexual orientation and SEP (v). Only significant effects (from log-likelihood ratio test) were retained. We assumed that: outpatient clinics were exchangeable with the remaining random sample of outpatient clinics, individuals were independent within clusters. Similar analyses were also carried out excluding people who reported to have performed HIV-tests only because of pregnancy or blood donation in order to identify diagnostic testing. A secondary analysis was carried out to investigate if uptake of HIV testing in subjects at high risks of contracting HIV varied by age-class, sex, strata of educational attainment and employment categories. Subjects reporting at least one risk behaviour and/or had had a STI in the past were defined as "high risk"; those not reporting a risk behaviour and/or a STI were considered "low risk".

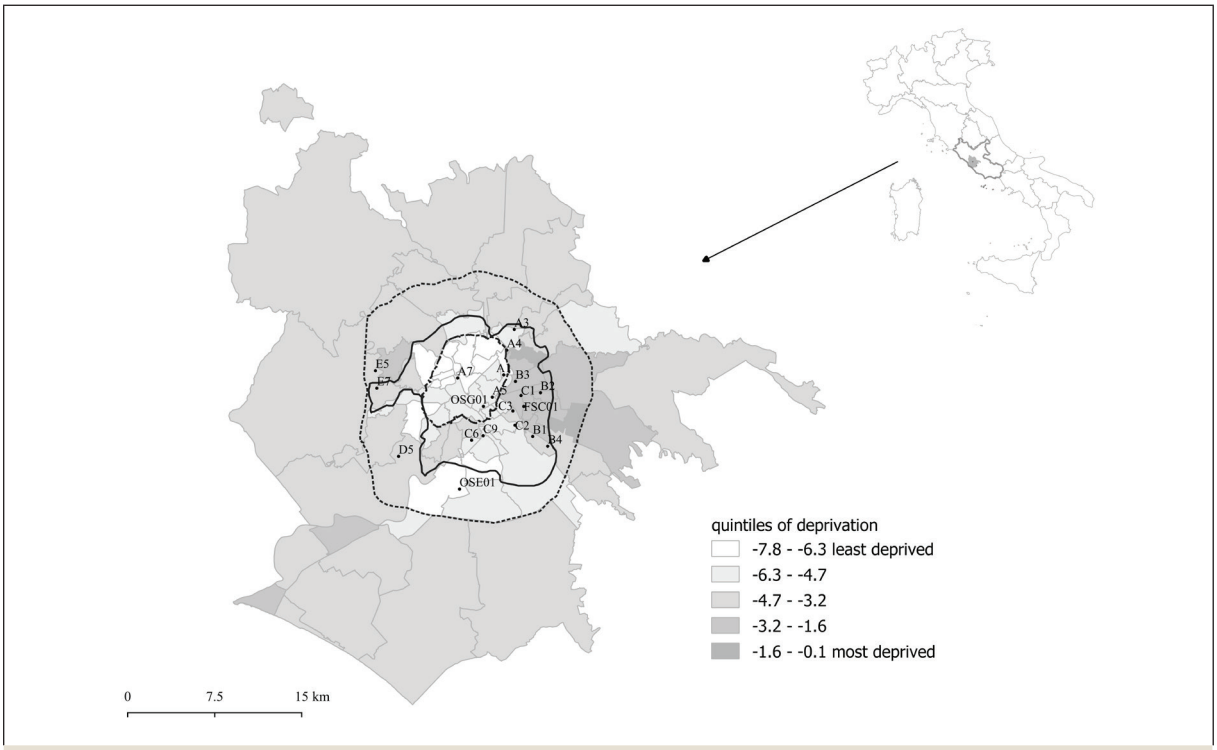
Statistical analyses were carried out in Stata 13 [15].

### *Index of social disadvantage (ISD) by postal codes*

The ISD [16] was used to provide a measure of deprivation in Rome. This index was developed by the "Ufficio Metropolitano di Statistica" and the "Ufficio di Statistica di Roma Capitale" to produce a statistical report on the Roman metropolitan area and it is obtained by summing the unweighted z-scores for the following census variables: unemployment, employment, youth concentration and schooling [16]. Since survey data were measured for postal codes while social deprivation indicators collected by the Census Office were available for census sections and the two geographies are non-overlapping, the ISD deprivation index was re-aggregated from census section to postal codes polygons by areal interpolation in "Quantum" GIS (QGIS) [17]. Postal codes define geographical areas, which may be potentially heterogeneous in terms of social and physical characteristics, but divide the city of Rome into areas of a similar population size (median = 15 977; iqr = 12 539; 19 393) which means that the analyses do not concentrate on small population groups and do not ignore the different experiences of people living in densely inhabited areas. The ISD was categorized in quintiles of frequencies (population weighted).

### *Characteristics of outpatient clinics*

Clinics were classified according to whether they were located within a hospital or not (district facilities) and to whether the amount of prescriptions provided by all clinics combined in the year 2009 was above or below the median as: small size clinics within district facilities (annual amount of prescriptions below 12 000 in 2009); medium size clinics within district facilities (amount of prescriptions of 12 000 or greater); and hospital based outpatient clinics. Clinics were also classified, according to the proportion of prescriptions exempted from the co-pay fee for low income in the year 2009 to the total number of prescriptions for the same year, in tertiles of frequency (population weighted) of co-pay fee for low income as: clinics with a proportion of co-pay fee exemption for low income below 1.1%; between 1.1 and 1.4%; and of 1.4% or more (see *Figure 1*).




| id | ASL | Name | Postal code | Type of clinic | Volume of prescription exempt from the co-pay fee for low income | N. of questionnaires | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Handed in | Data entered | Valid | Refusals |
| A1 | A | SA | 00198 | medium size within district | low | 952 | 952 | 793 | 135 |
| A3 | A | LM | 00141 | medium size within district | low | 243 | 183 | 179 | 46 |
| A4 | A | NM | 00162 | low size within district | low | 409 | 409 | 391 | 77 |
| A5 | A | LZ | 00185 | low size within district | medium | 471 | 471 | 447 | 63 |
| A7 | A | CN | 00186 | low size within district | low | 178 | 178 | 163 | 51 |
| B1 | B | CR | 00174 | medium size within district | high | 1551 | 1549 | 1346 | 436 |
| B2 | B | BR | 00171 | medium size within district | high | 1354 | 1059 | 1015 | 261 |
| B3 | B | CB | 00157 | medium size within district | high | 850 | 850 | 802 | 126 |
| B4 | B | AN | 00174 | medium size within district | medium | 411 | 338 | 308 | 131 |
| C1 | C | SC | 00176 | medium size within district | high | 2096 | 2080 | 1941 | 414 |
| C2 | C | DN | 00179 | medium size within district | low | 399 | 391 | 365 | 42 |
| C4 | C | NU | 00181 | medium size within district | medium | 776 | 569 | 562 | 127 |
| C6 | C | NM | 00145 | low size within district | low | 572 | 572 | 467 | 138 |
| C9 | C | ML | 00147 | low size within district | low | 121 | 121 | 99 | 58 |
| D4 | D | CN | 00164 | low size within district | high | 451 | 301 | 300 | 0 |
| D5 | D | CR | 00148 | low size within district | high | 352 | 352 | 350 | 34 |
| E5 | E | BC | 00167 | low size within district | low | 524 | 524 | 516 | 112 |
| E7 | E | MN | 00166 | low size within district | low | 344 | 197 | 195 | 74 |
| FSC | C | VN | 00177 | hospital based | medium | 1675 | 984 | 824 | 299 |
| OSE | C | EG | 00144 | hospital based | low | 1323 | 974 | 745 | 400 |
| OSG | D | GN | 00184 | hospital based | low | 353 | 182 | 180 | 92 |

ASL: Local Health Authorities as defined in 2009 (some of these were aggregated in 2015). Clinics were classified as: small size clinics within district facilities (annual amount of prescriptions below 12 000 in 2009); medium size clinics within district facilities (amount of prescriptions of 12 000 or greater); and hospital-based outpatient clinics. Prescriptions exempted from the co-pay fee for low income in the year 2009 to the total number of prescriptions for the same year: - clinics with a proportion of co-pay fee exemption for low income below 1.1%, - between 1.1 and 1.4% and - of 1.4% or more.

**Figure 1**

Index of social disadvantage (ISD) by postal codes in the metropolitan area of Rome. The dotted line indicates the city ring road – GRA, the dashed line the railway ring and the solid line the green band (urban area subject to traffic restrictions for polluting vehicles). The area delineated by the ring road is the one in which the study was carried out. The points represent the clinics participating in the study. The table at the bottom of the Figure shows the characteristics of the outpatient clinics included in the study (participating in the MeDi survey between January 2012 and November 2014).

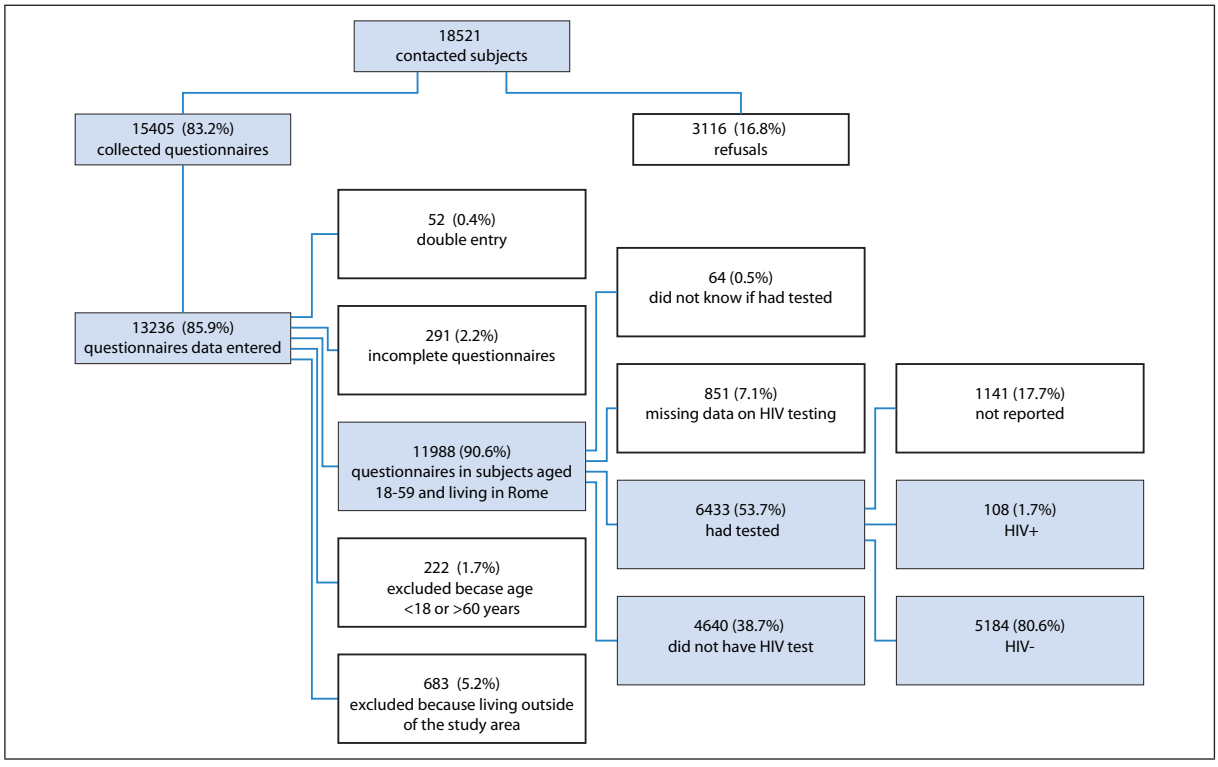



**Figure 2**
Flow chart of the study population: men and women aged 18-59 living in Rome and participating in the MeDi survey between January 2012 and November 2014.

### *Ethical issues and approval from the Ethics Committee*

The survey was approved by the Ethics Committee of Istituto Superiore di Sanità, Rome, Italy n. CE/12/338, date 7/5/2012. Each subject was also asked to formally consent to participate in the study.

## RESULTS

### *Response rate*

As shown in *Figure 2*, 18 521 subjects were contacted and 3116 (average response rate: 83.2%) refused to participate. Of the 15 405 questionnaires that were handed in, some were not returned, others were returned blank or incomplete. Overall, 13 236 valid questionnaires were data entered and out of them 11 988 met the survey eligibility criteria (see *Figure 2*).

Non respondents were asked about their age and sex. The age distribution of subjects who did not participate in the study was comparable to that observed in non participants. Non participants were significantly more likely to be males than participants (non participant males 41.7%; participant males 33.0% $p < 0.001$).

### *Subjects' characteristics*

*Figure 2* shows the flow of the study population involved in the MeDi survey between January 2012 and November 2014. Out of 11 988 subjects, 6433 (53.7%) had undergone HIV testing at least one time ever (1973 men and 4409 women); 64 (0.5%) did not know whether or not they had undergone HIV testing and 851 (7.1%) did not answer. These subjects were excluded from analyses, leaving a total of 11 073 subjects (3650 men and 7320 women) aged between 18 and 59 years (median 38; iqr: 30-46). Characteristics of the study population evaluated are reported in *Table 1*. Fifty-one point two percent of them had a high school diploma, 15% were unemployed by at least one year and 15.9% were exempt from paying the health ticket because of low income. Seventy-five point six percent of subjects were heterosexuals, 74.1% were in a stable relationship, 50.1% were married or cohabiting, 80.0% had had up to 3 sexual partners in their life, with a median of 1 partner in the last 6 (iqr: 0-10) months and of 2 (iqr: 0-511) lifetime.

### *Prevalence of HIV testing for any reason*

Overall, crude prevalence of having performed at least one HIV-testing was 58.1% (95% CI: 57.2%; 59.0%), as well as that age standardized (95% CI: 53.8; 56.4).

Subjects who underwent HIV testing were more likely to be 35-49 years old (67.4%), women (60.2%), homosexuals/lesbians (67.4%), highly educated (61.8%), in a stable relationship (62.5%) and had had a STI in the past (66.6%) (*Table 1*).

Respectively, 59.3% and 43.8% of subjects who reported having had one or more high risk behaviours for HIV tested at least once for HIV, compared to 59.0% of those not reporting any. In particular, the chance to test for HIV was lower for subjects who had high risk sexual relationships, compared to those not having it. At the area level, prevalences of HIV testing for any reason increased at increasing levels of deprivation

**Table 1**
Socio-demographic characteristics of the 11 073 men and women (aged 18-59 years) participating in the MeDi survey from January 2012 to November 2014 by having ever/never performed a HIV test (for any reason and after excluding tests for pregnancy and blood donation); Rome, Italy

| | All | | Any reason | | | Excluded pregnancy and blood donors | | | Blood donors | | | Pregnancy | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Freq. | col (%) | Freq. | row (%) | p | Freq. | row (%) | p | Freq. | row (%) | p | Freq. | row (%) | p |
| ***Individual level variables*** | | | | | | | | | | | | | | |
| **Gender** | | | | | <0.001 | | | <0.001 | | | <0.001 | | | <0.001 |
| Female | 7325 | 66.2 | 4409 | 60.2 | | 3262 | 44.5 | | 1080 | 14.7 | | 370 | 5.1 | |
| Male | 3650 | 33.0 | 1973 | 54.1 | | 1085 | 29.7 | | 888 | 24.3 | | 0 | 0.0 | |
| Not reported | 98 | 0.9 | 51 | 52.0 | | 38 | 38.8 | | 13 | 13.3 | | 0 | 0.0 | |
| **Years of age** | | | | | <0.001 | | | <0.001 | | | <0.001 | | | <0.001 |
| 18-34 | 4317 | 39.0 | 2100 | 48.6 | | 1394 | 32.3 | | 691 | 16.0 | | 86 | 2.0 | |
| 35-49 | 4946 | 44.7 | 3334 | 67.4 | | 2413 | 48.8 | | 881 | 17.8 | | 237 | 4.8 | |
| 50-64 | 1777 | 16.1 | 978 | 55.0 | | 561 | 31.6 | | 407 | 22.9 | | 45 | 2.5 | |
| Not reported | 33 | 0.3 | 21 | 63.6 | | 17 | 51.5 | | 2 | 6.1 | | 2 | 6.1 | |
| **Marital status** | | | | | <0.001 | | | <0.001 | | | 0.316 | | | <0.001 |
| Single | 4251 | 38.4 | 1952 | 45.9 | | 1216 | 28.6 | | 732 | 17.2 | | 38 | 0.9 | |
| Married/ cohabiting | 5545 | 50.1 | 3707 | 66.9 | | 2632 | 47.5 | | 1023 | 18.5 | | 281 | 5.1 | |
| Separated/ widowed | 1152 | 10.4 | 714 | 62.0 | | 495 | 43.0 | | 208 | 18.1 | | 49 | 4.3 | |
| Not reported | 125 | 1.1 | 60 | 48.0 | | 42 | 33.6 | | 18 | 14.4 | | 2 | 1.6 | |
| **Educational attainment** | | | | | <0.001 | | | <0.001 | | | 0.001 | | | 0.065 |
| Low | 1415 | 12.8 | 778 | 55.0 | | 568 | 40.1 | | 200 | 14.1 | | 31 | 2.2 | |
| Medium | 5665 | 51.2 | 3196 | 56.4 | | 2123 | 37.5 | | 1038 | 18.3 | | 205 | 3.6 | |
| High | 3921 | 35.4 | 2423 | 61.8 | | 1670 | 42.6 | | 731 | 18.6 | | 132 | 3.4 | |
| Not reported | 72 | 0.7 | 36 | 50.0 | | 24 | 33.3 | | 12 | 16.7 | | 2 | 2.8 | |
| **Occupation** | | | | | <0.001 | | | <0.001 | | | <0.001 | | | 0.003 |
| Unemployed | 1663 | 15.0 | 937 | 56.3 | | 702 | 42.2 | | 230 | 13.8 | | 39 | 2.4 | |
| Employed | 4808 | 43.4 | 3014 | 62.7 | | 2047 | 42.6 | | 941 | 19.6 | | 190 | 4.0 | |
| Self-employed | 1627 | 14.7 | 927 | 57.0 | | 604 | 37.1 | | 318 | 19.6 | | 39 | 2.4 | |
| Other | 2926 | 26.4 | 1530 | 52.3 | | 1017 | 34.8 | | 483 | 16.5 | | 99 | 3.4 | |
| Not reported | 49 | 0.4 | 25 | 51.0 | | 15 | 30.6 | | 9 | 18.4 | | 3 | 6.1 | |
| **Sexual orientation** | | | | | 0.006 | | | <0.001 | | | 0.013 | | | 0.130 |
| Heterosexual | 8368 | 75.6 | 4853 | 58.0 | | 3336 | 39.9 | | 1463 | 17.5 | | 283 | 3.4 | |
| Homosexuals/ lesbians | 239 | 2.2 | 161 | 67.4 | | 121 | 50.6 | | 40 | 16.7 | | 2 | 0.8 | |
| Bisexual | 249 | 2.3 | 146 | 58.6 | | 103 | 41.4 | | 43 | 17.3 | | 11 | 4.4 | |
| Other | 320 | 2.9 | 203 | 63.4 | | 153 | 47.8 | | 46 | 14.4 | | 7 | 2.2 | |
| Not reported | 1897 | 17.1 | 1070 | 56.4 | | 672 | 35.4 | | 389 | 20.5 | | 67 | 3.5 | |
| **Stable partner** | | | | | <0.001 | | | <0.001 | | | 0.160 | | | <0.001 |
| No | 2691 | 24.3 | 1205 | 44.8 | | 736 | 27.4 | | 465 | 17.3 | | 25 | 0.9 | |
| Yes | 8209 | 74.1 | 5130 | 62.5 | | 3574 | 43.5 | | 1493 | 18.2 | | 342 | 4.2 | |
| Not reported | 173 | 1.6 | 98 | 56.7 | | 75 | 43.4 | | 23 | 13.3 | | 3 | 1.7 | |

Continues

**Table 1**
Continued

| | All | | Any reason | | | Excluded pregnancy and blood donors | | | Blood donors | | | Pregnancy | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Freq. | col (%) | Freq. | row (%) | p | Freq. | row (%) | p | Freq. | row (%) | p | Freq. | row (%) | p |
| **Number of partners in the last 6 months** | | | | | <0.001 | | | <0.001 | | | 0.025 | | | <0.001 |
| 0-1 | 9076 | 82.0 | 5536 | 61.0 | | 3824 | 42.1 | | 1648 | 18.2 | | 348 | 3.8 | |
| 2-3 | 768 | 6.9 | 381 | 49.6 | | 237 | 30.9 | | 142 | 18.5 | | 14 | 1.8 | |
| 4-5 | 146 | 1.3 | 64 | 43.8 | | 39 | 26.7 | | 25 | 17.1 | | 0 | 0.0 | |
| 5+ | 184 | 1.7 | 83 | 45.1 | | 66 | 35.9 | | 17 | 9.2 | | 0 | 0.0 | |
| Not reported | 899 | 8.1 | 369 | 41.1 | | 219 | 24.4 | | 149 | 16.6 | | 8 | 0.9 | |
| **Number of partners in the last 5 years** | | | | | <0.001 | | | <0.001 | | | 0.317 | | | <0.001 |
| 0-1 | 7619 | 68.8 | 4823 | 63.3 | | 3391 | 44.5 | | 1369 | 18.0 | | 319 | 4.2 | |
| 2-3 | 1531 | 13.8 | 746 | 48.7 | | 471 | 30.8 | | 273 | 17.8 | | 37 | 2.4 | |
| 4-5 | 444 | 4.0 | 212 | 47.8 | | 119 | 26.8 | | 93 | 21.0 | | 4 | 0.9 | |
| 6-9 | 284 | 2.6 | 122 | 43.0 | | 72 | 25.4 | | 50 | 17.6 | | 2 | 0.7 | |
| 10+ | 433 | 3.9 | 204 | 47.1 | | 139 | 32.1 | | 64 | 14.8 | | 1 | 0.2 | |
| Not reported | 762 | 6.9 | 326 | 42.8 | | 193 | 25.3 | | 132 | 17.3 | | 7 | 0.9 | |
| **Number of partners lifetime** | | | | | <0.001 | | | <0.001 | | | 0.316 | | | <0.001 |
| 0-1 | 7530 | 68.0 | 4526 | 60.1 | | 3158 | 41.9 | | 1314 | 17.5 | | 227 | 3.0 | |
| 2-3 | 1335 | 12.1 | 749 | 56.1 | | 498 | 37.3 | | 241 | 18.1 | | 71 | 5.3 | |
| 4-5 | 704 | 6.4 | 386 | 54.8 | | 254 | 36.1 | | 131 | 18.6 | | 29 | 4.1 | |
| 6-10 | 858 | 7.8 | 473 | 55.1 | | 308 | 35.9 | | 164 | 19.1 | | 32 | 3.7 | |
| 11-19 | 224 | 2.0 | 116 | 51.8 | | 66 | 29.5 | | 49 | 21.9 | | 8 | 3.6 | |
| 20+ | 144 | 1.3 | 85 | 59.0 | | 52 | 36.1 | | 33 | 22.9 | | 3 | 2.1 | |
| Not reported | 278 | 2.5 | 98 | 35.3 | | 49 | 17.6 | | 49 | 17.6 | | 0 | 0.0 | |
| **High risk sexual behaviours** | | | | | <0.001 | | | <0.001 | | | <0.001 | | | <0.001 |
| None | 7467 | 67.4 | 4407 | 59.0 | | 3011 | 40.3 | | 1351 | 18.1 | | 288 | 3.9 | |
| One | 1690 | 15.3 | 1002 | 59.3 | | 700 | 41.4 | | 297 | 17.6 | | 33 | 2.0 | |
| More than one | 928 | 8.4 | 406 | 43.8 | | 290 | 31.3 | | 116 | 12.5 | | 11 | 1.2 | |
| Not reported | 988 | 8.9 | 618 | 62.6 | | 384 | 38.9 | | 217 | 22.0 | | 38 | 3.9 | |
| **Partner had multiple partners** | | | | | <0.001 | | | <0.001 | | | <0.001 | | | <0.001 |
| No | 9681 | 87.4 | 5762 | 59.5 | | 3905 | 40.3 | | 1791 | 18.5 | | 352 | 3.6 | |
| Yes | 1084 | 9.8 | 493 | 45.5 | | 344 | 31.7 | | 149 | 13.8 | | 17 | 1.6 | |
| Not reported | 308 | 2.8 | 178 | 57.8 | | 136 | 44.2 | | 41 | 13.3 | | 1 | 0.3 | |
| **Risky sexual behaviours** | | | | | 0.011 | | | 0.004 | | | 0.101 | | | <0.001 |
| No | 3292 | 29.7 | 1842 | 56.0 | | 1232 | 37.4 | | 589 | 17.9 | | 81 | 2.5 | |
| Yes | 7473 | 67.5 | 4413 | 59.1 | | 3017 | 40.4 | | 1351 | 18.1 | | 288 | 3.9 | |
| Not reported | 308 | 2.8 | 178 | 57.8 | | 136 | 44.2 | | 41 | 13.3 | | 1 | 0.3 | |
| **History of STI** | | | | | <0.001 | | | <0.001 | | | 0.086 | | | 0.763 |
| No | 10335 | 93.3 | 5942 | 57.5 | | 4010 | 38.8 | | 1870 | 18.1 | | 348 | 3.4 | |
| Yes | 730 | 6.6 | 486 | 66.6 | | 372 | 51.0 | | 109 | 14.9 | | 22 | 3.0 | |
| Not reported | 8 | 0.1 | 5 | 62.5 | | 3 | 37.5 | | 2 | 25.0 | | 0 | 0.0 | |

Continues

**Table 1**
Continued

| | All | | Any reason | | | Excluded pregnancy and blood donors | | | Blood donors | | | Pregnancy | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Freq. | col (%) | Freq. | row (%) | p | Freq. | row (%) | p | Freq. | row (%) | p | Freq. | row (%) | p |
| ***Contextual level variables*** | | | | | | | | | | | | | | |
| **Index of social deprivation - area level**[a] | | | | | <0.001 | | | <0.001 | | | 0.294 | | | 0.247 |
| Medium (-5.8/-4.5) | 3056 | 27.6 | 1779 | 58.2 | | 1192 | 39.0 | | 571 | 18.7 | | 102 | 3.3 | |
| Low(< -5.8) | 3692 | 33.3 | 1976 | 53.5 | | 1292 | 35.0 | | 663 | 18.0 | | 110 | 3.0 | |
| High (>4.5) | 4325 | 39.1 | 2678 | 61.9 | | 1901 | 43.9 | | 747 | 17.3 | | 158 | 3.6 | |
| **Type of clinic** | | | | | <0.001 | | | <0.001 | | | <0.001 | | | 0.002 |
| low prescription volume (<12 000) | 4844 | 43.8 | 2425 | 50.1 | | 1593 | 32.9 | | 809 | 16.7 | | 158 | 3.3 | |
| high prescription volume (≥12 000) | 4761 | 43.0 | 2942 | 61.8 | | 2149 | 45.1 | | 760 | 16.0 | | 141 | 3.0 | |
| hospital outpatient clinics | 1468 | 13.3 | 1066 | 72.6 | | 643 | 43.8 | | 412 | 28.1 | | 71 | 4.8 | |
| **Health care low income card - area level**[a] | | | | | <0.001 | | | <0.001 | | | <0.001 | | | 0.018 |
| Low (<1.1%) | 3778 | 34.1 | 2139 | 56.6 | | 1363 | 36.1 | | 763 | 20.2 | | 145 | 3.8 | |
| Median (1.1%-1.4%) | 3738 | 33.8 | 2486 | 66.5 | | 1754 | 46.9 | | 696 | 18.6 | | 130 | 3.5 | |
| High (≥1.4) | 3557 | 32.1 | 1808 | 50.8 | | 1268 | 35.7 | | 522 | 14.7 | | 95 | 2.7 | |

[a]in tertiles (population weighted); STI: sexually transmitted infection.

while it varied from 50.1% in small clinics to 72.6% in the hospitals.

Results from the random effect multivariable Poisson models, reported in *Table 2*, were in line with the univariate analysis. Men were 6% less likely to test for HIV than women (prevalence ratio (PR): 0.94; 95% CI: 0.89; 0.99). Homosexuals/lesbians and bisexuals had prevalence rates for HIV testing 1.37 (95% CI: 1.17; 1.61) and 1.24 (95% CI: 1.05; 1.47) times that of heterosexuals. Prevalences were 1.29 (95% CI: 1.20; 1.39) and 1.33 (95% CI: 1.21; 1.46) times higher for married/cohabiting and separated/widowed than for single men and women. In the same way, subjects in a stable relationship were about 1.15 (PR: 1.15; 95% CI: 1.06; 1.24) times more likely to test for HIV than their counterparts who were not in a stable relationship.

HIV testing prevalence increased linearly from lowest to highest levels of education, but it reached significance only in the latter category (PR: 1.11; 95% CI: 1.02; 1.21; p linear trend = 0.004).

Those who reported having had one high risk behaviours for contracting HIV infection were 11% (PR: 1.11; 95% CI: 1.04; 1.20) more likely to test for HIV than those who had none of them. Subjects who had had a STI in the past were 1.12 (PR: 1.12; 95% CI: 1.02; 1.23) times more likely to test for HIV than those not reporting any STI. At the area level, compared to outpatient clinics with a volume of prescriptions below 12 000 per year, in the clinics with a greater number of prescriptions (PR: 1.88; 95% CI: 1.30; 2.73) and in the hospitals (PR: 1.42; 95% CI: 1.10; 1.82), the prevalence of subjects ever tested for HIV was more than 40% higher. Clinics with a high *vs* low proportion of co-fee exemption to the total number of prescriptions had a PR of 0.52 (95% CI: 0.37; 0.74). After excluding tests carried out for donation or pregnancy, the results obtained were in the same direction as those for the entire population. Subjects not reporting being (or not) in a stable relationship were as likely to test for HIV as those in a stable relationship.

When markers of sexual risk behaviours were used to approximate risk we found 44.1% of subjects with self-reported risks of contracting HIV (subjects reporting at least one risk behaviour and/or had had a STI in the past) had tested at least once in life. This percentage was 54.1% at the age of 18-35 years, 39.6% for the high educated and 36.6% for the homosexuals/lesbians, bisexual and other sexual orientations combined.

## DISCUSSION

Using data from a large survey performed in 2012-2014 on more than 10 000 individuals 18-59 year olds who underwent public ambulatories visits we found that 58.1% of adults reported to have been tested at least once for HIV in Rome, Italy. This percentage is higher than that reported in other countries. In Britain, the Natsal-3 found that in 2010-2012, 18.1% of men and 23.2% of women 16-74 years old reporting sexual experience, had tested for HIV for diagnostic purposes (excluding testing in the context of blood donation) [18]. In the United States, the 2013 National Health Interview Survey (NHIS) and the 2013 Behavioural

**Table 2**

Prevalence ratio (PR) of HIV testing (for any reason and after exclusion of pregnancy and blood donation) by socioeconomic and demographic characteristics of 11 073 men and women (aged 18-59 years) participating in the MeDi survey from January 2012 to November 2014. Results from random intercept and random slope multivariable Poisson models of HIV testing

| | Any reason | | | | Excluded pregnancy and blood donors | | | |
|---|---|---|---|---|---|---|---|---|
| | PR | 95% CI | | p | PR | 95% CI | | p |
| ***Individual level variables*** | | | | | | | | |
| **Gender** | | | | | | | | |
| Female | 1 | | | | 1 | | | |
| Male | 0.94 | 0.89 | 0.99 | 0.027 | 0.71 | 0.66 | 0.76 | <0.001 |
| Not reported | 0.99 | 0.76 | 1.31 | 0.963 | 1.05 | 0.76 | 1.45 | 0.755 |
| **Years of age** | | | | | | | | |
| 18-34 | 1 | | | | 1 | | | |
| 35-49 | 1.18 | 1.11 | 1.25 | <0.001 | 1.22 | 1.13 | 1.31 | <0.001 |
| 50-59 | 0.94 | 0.86 | 1.02 | 0.154 | 0.81 | 0.72 | 0.90 | <0.001 |
| Not reported | 0.95 | 0.61 | 1.46 | 0.798 | 0.98 | 0.61 | 1.59 | 0.937 |
| **Marital status** | | | | | | | | |
| Single | 1 | | | | 1 | | | |
| Married/cohabiting | 1.29 | 1.20 | 1.39 | <0.0011 | 1.45 | 1.33 | 1.58 | <0.001 |
| Separated/widowed | 1.33 | 1.21 | 1.46 | <0.001 | 1.48 | 1.32 | 1.66 | <0.001 |
| Not reported | 1.05 | 0.80 | 1.37 | 0.735 | 1.21 | 0.88 | 1.67 | 0.237 |
| **Educational attainment** | | | | | | | | |
| Low | 1 | | | | 1 | | | |
| Medium | 1.03 | 0.95 | 1.11 | 0.504 | 0.93 | 0.85 | 1.02 | 0.132 |
| High | 1.11 | 1.02 | 1.20 | 0.019 | 0.99 | 0.89 | 1.09 | 0.810 |
| Not reported | 0.85 | 0.52 | 1.40 | 0.518 | 0.71 | 0.38 | 1.33 | 0.285 |
| **Sexual orientation** | | | | | | | | |
| Heterosexual | 1 | | | | 1 | | | |
| Homosexuals/lesbians | 1.37 | 1.17 | 1.61 | <0.001 | 1.69 | 1.40 | 2.03 | <0.001 |
| Bisexual | 1.24 | 1.05 | 1.47 | 0.013 | 1.29 | 1.06 | 1.58 | 0.013 |
| Other | 1.11 | 0.96 | 1.28 | 0.169 | 1.21 | 1.03 | 1.43 | 0.022 |
| Not reported | 1.03 | 0.94 | 1.12 | 0.518 | 1.06 | 0.95 | 1.18 | 0.280 |
| **Stable partner** | | | | | | | | |
| No | 1 | | | | 1 | | | |
| Yes | 1.15 | 1.06 | 1.24 | <0.001 | 1.21 | 1.10 | 1.34 | <0.001 |
| Not reported | 1.10 | 0.89 | 1.36 | 0.388 | 1.29 | 1.01 | 1.64 | 0.044 |
| **High risk sexual behaviours** | | | | | | | | |
| None | 1 | | | | 1 | | | |
| One | 1.11 | 1.04 | 1.20 | 0.003 | 1.24 | 1.13 | 1.35 | <0.001 |
| More than one | 1.06 | 0.95 | 1.19 | 0.263 | 1.31 | 1.15 | 1.49 | <0.001 |
| Not reported | 1.01 | 0.92 | 1.10 | 0.870 | 0.92 | 0.82 | 1.02 | 0.124 |
| **History of STI** | | | | | | | | |
| No | 1 | | | | 1 | | | |
| Yes | 1.12 | 1.02 | 1.23 | 0.021 | 1.20 | 1.08 | 1.34 | 0.001 |
| Not reported | 0.90 | 0.37 | 2.17 | 0.818 | 0.67 | 0.21 | 2.07 | 0.483 |
| ***Contextual level variables*** | | | | | | | | |
| **Type of clinic** | | | | | | | | |
| Low prescription volume (<12 000) | 1 | | | | 1 | | | |
| High prescription volume (≥12 000) | 1.88 | 1.30 | 2.73 | 0.001 | 2.23 | 0.78 | 6.41 | 0.136 |
| Hospital outpatient clinics | 1.42 | 1.10 | 1.82 | 0.007 | 1.09 | 0.94 | 1.27 | 0.260 |
| **Health care low income card-areaa level** | | | | | | | | |
| Low (<1.1%) | 1 | | | | 1 | | | |
| Median (1.1%-1.4%) | 1.03 | 0.82 | 1.29 | 0.831 | 0.86 | 0.47 | 1.58 | 0.635 |
| High (≥1.4) | 0.52 | 0.37 | 0.74 | <0.001 | 0.33 | 0.12 | 0.92 | 0.034 |
| Var (health care low income card): | 0.00338 | 0.01490 | 0.56573 | | 0.07795 | 0.02972 | 0.20444 | |
| Var (clinic level): | 0.02666 | 0.06910 | 0.21815 | | 0.08988 | 0.03973 | 0.20331 | |

Index of social deprivation-area level was not included in the multivariate analyses. [a]in tertiles (population weighted); STI: sexually transmitted infection.

Risk Factor Surveillance System (BRFSS) estimated that 42.2-45.0% of 18-64 years old US residents had ever tested for HIV [19, 20].

We found that those who had one high risk behaviour for contracting HIV infection were 11% more likely to test for HIV than those not reporting any, and subjects who had had a STI in the past were 12% more likely to test for HIV than those who had never had a STI. However, when markers of sexual risk behaviours were used to approximate risk we found that only 44.1% of those with self-reported risks of contracting HIV had tested at least once in life. This percentage was even higher among subjects aged 18-35 years (54.1%). A cross-sectional survey carried out in 2008, reported that 73% of newly diagnosed individuals in Belgium, Estonia, Finland and Portugal had not previously tested for HIV due to a low perception of risk [21]. Hoyos *et al*. also found that 46.5% of subjects classified as high risk considered themselves to be at low risk for HIV infection [22].

We also found that homosexuals/lesbians were more likely than heterosexuals to test for HIV, still 37% of them (homosexuals/lesbians/bisexual/other combined) had never tested for HIV and this proportion was of similar magnitude in men with a high or low risk profile. To this regard, the Natsal-3 survey found that 84.8% of MSM reporting recent unsafe sex rated themselves as low risk for HIV infection [18]. Similarly, a qualitative study found that more than half of HIV positive MSM were surprised by their diagnosis and believed themselves to have only practiced safe sex [23].

Other factors associated with HIV testing in our study included being female, in a stable relationship/ married/ cohabiting and highly educated. The BRFSS for the state of Georgia found that participants that attained educational levels greater than high school tested more than those with a lesser education [24]. In the same way, a survey carried out in 2011 in a sample of 1568 delivering women enrolled in 36 maternal hospitals in the Lazio region, found that women who missed test were of lower education level, with a lower HIV-knowledge score and fewer visits during pregnancy [25]. Still, in our study, about 40% of the highly educated self reporting risks of contracting HIV had never tested.

At the area level the highest prevalence of subjects ever tested for HIV was observed in the hospitals and in high volume clinics. These, perhaps, are characterized by better quality of care and more resources for HIV testing. We found no evidence that HIV testing was associated with neighbourhood deprivation after adjustment for SEP at the individual level. Overall, our results are in line with a study carried out in a large urban US city which found that income inequality and socioeconomic deprivation were associated with higher rates of late HIV diagnosis only in crude models (not adjusted for covariates) [26].

### *Limitations and strengths*

Some limitations can be highlighted: 1) the MeDi data are self-reported and may be subject to biases such as social desirability or recall bias and underreporting of risk behaviours associated with HIV; 2) HIV testing performed was also self reported; 3) reasons for not testing were not explored; 4) the study was conducted in local and hospital based outpatient clinics and we cannot exclude that the prevalence of HIV-testing could have been different for those not accessing the outpatient clinics in the study period. In particular, it appears from *Figure 1* that some part of the city may be less well represented. However, medical appointments are centrally managed by a phone booking system which identifies the first available place in any clinic in Rome. For this reason, we have collected the postal code of the area of residence and re-allocated each subject accordingly; 5) the survey was based on non-institutionalized populations. Incarcerated persons may have higher risks for HIV. However, some subjects self reported to have been tested in correctional facilities before the survey took place; 6) the sampling frame was the Roman metropolitan area, rural/sub-urban areas outside of the metropolitan belt were not represented. Because of these limitations, the results might be either underestimated or overestimated when generalized to other populations.

Our data are the only one available in Rome and the only one to examine socio-demographic factors related to HIV testing. A strength of the present study is the utilization of data from a large survey of the general population with a response rate as high as 83%.

### *Conclusions and implications*

From our study it emerges that while the percentage of subjects tested is even higher than observed in other western nations, only 44% of subjects self reporting risks of contracting HIV (54% among subjects aged 18-35 years) had tested at least once in life. This percentage decreases, as expected, with the level of education, but even so, about 40% of university educated subjects self reporting risks of contracting HIV had never tested. We do not know why this happens but certainly the current system based on proposing the test based on risk, either self-perceived or defined by a doctor, does not allow reaching all patients in need to be tested.

### *Conflict of interest statement*

There are no potential conflicts of interest or any financial or personal relationships with other people or organizations that could inappropriately bias conduct and findings of this study.

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## REFERENCES


1. United Nations. The Millennium Developments Goals Report. 2011.
2. UNAIDS. 90-90-90 An ambitious treatment target to help end the AIDS epidemic. Geneva: UNAIDS; 2014.
3. Branson BM, Handsfield HH, Lampe MA, Janssen RS, Taylor AW, Lyss SB, et al. Revised recommendations for HIV testing of adults, adolescents, and pregnant women in health-care settings. 2006. (MMWR Recomm Rep, RR14).
4. Gazzard B, Clumeck N, d'Arminio MA, Lundgren JD. Indicator disease-guided testing for HIV – the next step for Europe? HIV Med. 2008;9(Suppl. 2):34-40. doi: 10.1111/j.1468-1293.2008.00592
5. Sullivan AK, Raben D, Reekie J, Rayment M, Mocroft A, Esser S, et al. Feasibility and effectiveness of indicator condition-guided testing for HIV: results from HIDES I (HIV indicator diseases across Europe study). PLoS One. 2013;8(1):e52845. doi: 10.1371/journal.pone.0052845
6. Prati G, Breveglieri M, Lelleri R, Furegato M, Gios L, Pietrantoni L. Psychosocial correlates of HIV testing among men who have sex with men in Italy: a cross-sectional study. Int J STD AIDS. 2014;25(7):496-503. doi: 10.1177/0956462413515193
7. Sönnerborg A, Mocroft A, Lundgren JD, Raben D, Gatell J, Vassilenko A, et al. A pilot study to determine the prevalence of HIV in persons presenting for care with selected conditions: preliminary results from the HIV in Europe study. J Int AIDS Soc. 2010;13(Suppl 4):O16. doi: 10.1186/1758-2652-13-S4-O16
8. Camoni L, Federico B, Capelli G, Regine V, Salfa MC, Nicoletti G, et al. Few Italian drug users undergo HIV testing. AIDS Behav. 2011;15(4):711-7. doi: 10.1007/s10461-009-9616-0
9. Pellowski JA, Kalichman SC, Matthews KA, Adler N. A pandemic of the poor: social disadvantage and the U.S. HIV epidemic. Am Psychol. 2013;68(4):197-209. doi: 10.1037/a0032694
10. Poundstone KE, Strathdee SA, Celentano DD. The social epidemiology of human immunodeficiency virus/acquired immunodeficiency syndrome. Epidemiol Rev. 2004;26:22-35. doi: 10.1093/epirev/mxh005
11. University of Cambridge. The GP patient survey questionnaire. Available from: www phpc cam ac uk/gpaq/home/downloads/. 2017
12. BRFSS Questionnaire/Final/11.18.2009 [computer program]. 2010.
13. EUROSTAT. Available from: http://ec.europa.eu/eurostat/web/population-demography-migration-projections/population-data. 2017.
14. CoutinhoI MS, ScazufcaII M, Menezes PR. Methods for estimating prevalence ratios in cross-sectional studies. Rev Saúde Pública. 2008;46(6):992-8.
15. StataCorp. 2013. Stata Statistical Software: Release 13. College Station, TX: StataCorp LP. [computer program]. 2013.
16. Direzione sistemi informativi di pianificazione e controllo finanziario. UO Statistica. Comune di Roma. Gli indici di disagio sociale ed edilizio a Roma. Analisi per municipio e zona urbanistica. Censimento 2011. Available from: www.comune.roma.it/PCR/resources/cms/documents/Gli_indici_di_disagio_sociale_ed_edilizio_a_Roma_X.pdf. 2016.
17. Quantum GIS Geographic Information System. Open Source Geospatial Foundation Project. [computer program]. Version 2.18 2017.
18. Clifton S, Nardone A, Field N, Mercer CH, Tanton C, Macdowall W, et al. HIV testing, risk perception, and behaviour in the British population. AIDS. 2016;30(6):943-52. doi: 0.1097/QAD.0000000000001006
19. Center for Disease Control and Prevention. Behavioral Risk Factor Surveillance System (BRFSS) About BRFSS. 16-5-2014. 17-5-2017.
20. Van Handel MM, Branson BM. Monitoring HIV Testing in the United States: Consequences of Methodology Changes to National Surveys. PLoS One. 2015;10(4):e0125637. doi: 10.1371/journal.pone.0125637
21. Deblonde J, Hamers FF, Callens S, Lucas R, Barros H, Ruutel K, et al. HIV testing practices as reported by HIV-infected patients in four European countries. AIDS Care. 2014;26(4):487-96. doi: 10.1080/09540121.2013.841831.
22. Hoyos J, Fernandez-Balbuena S, de la FL, Sordo L, Ruiz M, Barrio G, et al. Never tested for HIV in Latin-American migrants and Spaniards: prevalence and perceived barriers. J Int AIDS Soc. 2013;16:18560. doi: 10.7448/IAS.16.1.18560
23. Dowson L, Kober C, Perry N, Fisher M, Richardson D. Why some MSM present late for HIV testing: a qualitative analysis. AIDS Care. 2012;24(2):204-9. doi: 10.1080/09540121.2011.597711
24. Ansa BE, White S, Chung Y, Smith SA. Trends in HIV Testing among Adults in Georgia: Analysis of the 2011-2015 BRFSS Data. Int J Environ Res Public Health. 2016;13(11). doi: 10.3390/ijerph13111126
25. Valle S, Pezzotti P, Floridia M, Pellegrini MG, Bernardi S, Puro V, et al. Percentage and determinants of missed HIV testing in pregnancy: a survey of women delivering in the Lazio region, Italy. *AIDS Care* 2014;26(7):899-906. doi: 10.1080/09540121.2013.861572
26. Ransome Y, Kawachi I, Braunstein S, Nash D. Structural inequalities drive late HIV diagnosis: The role of black racial concentration, income inequality, socioeconomic deprivation, and HIV testing. Health Place. 2016;42:148-58. doi: 10.1016/j.healthplace.2016.09.004