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

Maria Fenicia Vescio[1], **Pietro Gallo**[1], **Francesca Farchi**[1], **Luca Avellis**[1], **Teresa Spadea**[2], **Massimo Giuliani**[3], **Giovanna Pedone**[1], **Ilario Mammone**[4], **Hyppolite Tchidjou Kuekou**[5], **Giovanni Rezza**[1], **Enrico Girardi**[6], **Patrizio Pezzotti**[1], and the MeDi Study Group*

[1]*Dipartimento di Malattie Infettive, Istituto Superiore di Sanità, Rome, Italy*
[2]*Unità di Epidemiologia, Azienda Sanitaria Locale Torino 3 (Asl TO3), Turin, Italy*
[3]*Dermatologia Allergologica Professionale e Ambientale, Istituto Dermatologico San Gallicano, Rome, Italy*
[4]*Società Italiana di Psicologia e Psichiatria, Rome, Italy*
[5]*Immunoinfettivologia Pediatrica, Dipartimento Pediatrico Universitario-Ospedaliero, Ospedale Pediatrico Bambino Gesù, Rome, Italy*
[6]*Istituto Nazionale per le Malattie Infettive, Ospedale Lazzaro Spallanzani, Rome, Italy*
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.

Address for correspondence: Maria Fenicia Vescio, Unità di Epidemiologia, Biostatistica e Modelli Matematici, Dipartimento di Malattie Infettive, Istituto Superiore di Sanità, Viale Regina Elena 299, 00161 Rome, Italy. E-mail: vescio@iss.it.

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*).
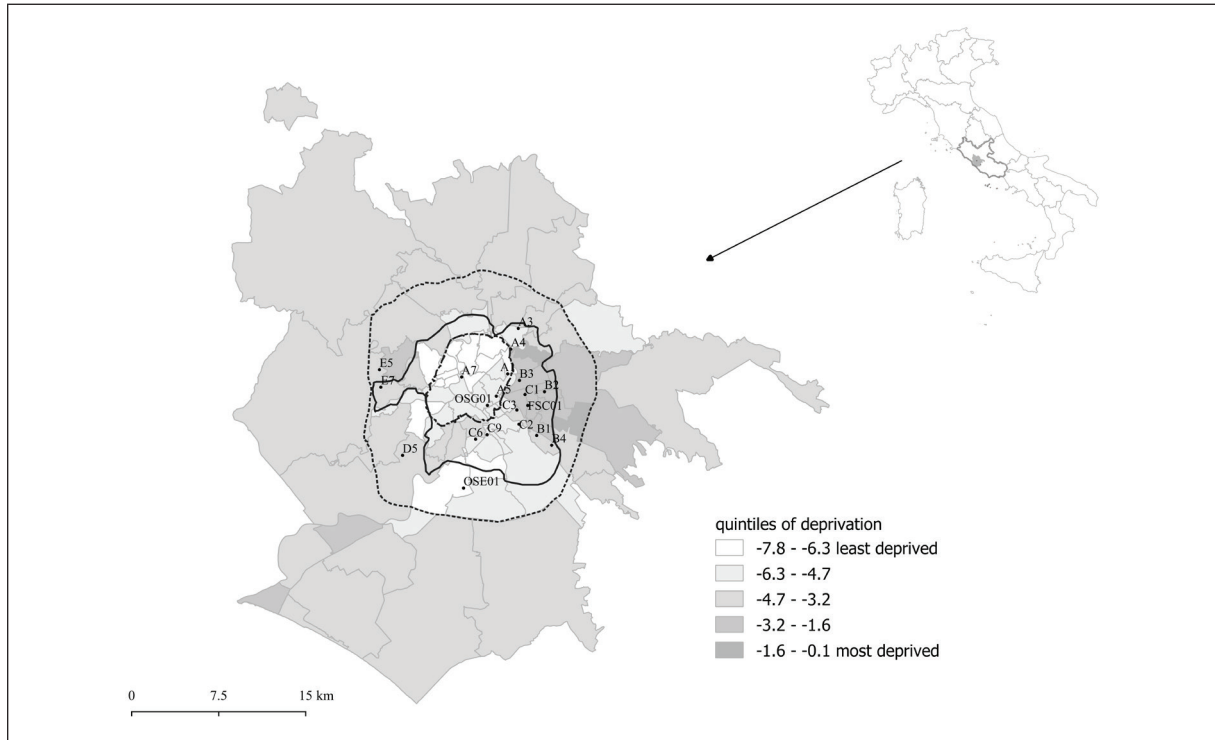
id	ASL	Name	Postal code	Type of clinic	Volume of prescription exempt from the co-pay fee for low income	N. of questionnaires			
						Handed in	**Data entered**	**Valid**	**Refusals**
A1	A	SA	00198	medium size within district	low	952	952	793	135
A3	A	LM	00141	medium size within district	low	243	183	179	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).
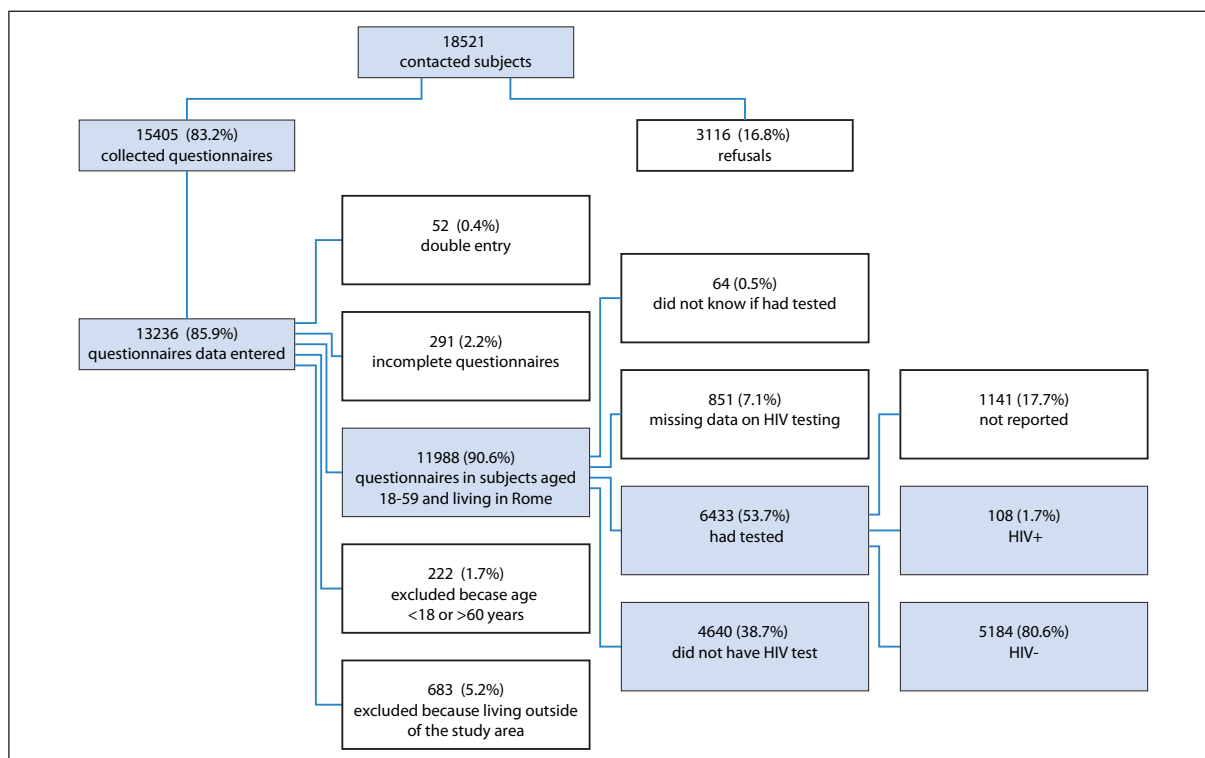
Figure 2
Flow chart of the study population: men and women aged 18-59 living in Rome and participating in the MeDi survey between January 2012 and November 2014.

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	

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-area[a] 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 test-

ing 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.

MeDi (Measuring health Disparities in HIV prevention) Study Group

Dipartimento di Malattie Infettive, Istituto Superiore di Sanità, Rome, Italy, coordination unit:
MF Vescio, L Avellis, P Gallo, G Pedone, F Farchi.
Società Italiana di Psicologia e Psichiatria (SiPsi), Rome, Italy, data collection unit:
I Mammone, E Arganese, F Caltagirone, V Di Rago, MC Ferrari, G Gabrielli, C Iacobucci, A Messner, D Milos, B Pace, D Raspanti, S Roccabella, N Tani, C Zaky, M Racco.

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