Austrian
A HIVCOS
Cohort
Study

HIV
AIDS

in

Austria

37th Report of the Austrian HIV Cohort Study

Innsbruck, November 30st, 2019

HIV / AIDS
in Austria

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Edited by Robert Zangerle, MD
Professor of Dermatovenerology and Infectious Diseases
Medical University of Innsbruck
Innsbruck, Austria

Authors:
Gisela Leierer
Michaela Rappold
Stefanie Strickner
Robert Zangerle

e-mail: lki.ha.hiv-kohorte@tirol-kliniken.at

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1   Introduction

At the end of the year 2001, representatives of 5 Austrian HIV treatment centres (AKH Vienna, Otto-Wagner-Hospital Vienna, AKH Linz, LKH Innsbruck and LKH Graz West) have founded the **„Austrian HIV Cohort Study (AHIVCOS)"**. In 2008, two more centres (LKH Salzburg and LKH Klagenfurt), in 2016 one more centre (Kaiser-Franz-Josef-Hospital Vienna) and in 2018 one more centre (Feldkirch) joined the AHIVCOS. The responsibility for the medical and scientific coordination lies with Robert Zangerle from the Medical University of Innsbruck.

Aims of Austrian cohort study are:
1) Optimization of patient management
2) HIV surveillance
3) Research projects

A special software, the *"HIV Patient Management System (HIP)"* is used in all centres and has replaced the previous *HIV data base* in 2005. The input of data is (was) done peripherally in the HIV treatment centres which consistently use the data base for clinical care. The input of laboratory findings is mostly done electronically. Apart from nurses and doctors, additional professional groups are involved in data entry in some centres (social workers, psychologists). Before data can be merged, the cohort participants are made anonymous. Therefore, it is cumbersome to identify cohort participants who are/were treated in more than just one treatment centre. This cannot be done by the use of personal data such as initials, birthday or postal code, but with HIV specific data (date of the HIV test, CD4 cell counts etc.).

*HIV Patient Management System***:**
Designed as a client-server application, the *HIP* stores its data in a persistent SQL database. The software is based on the model driven architecture paradigm and has been implemented with Microsoft .NET technology. The company DI Heinz Appoyer (now called *network vita*) was entrusted with the development of the *HIP*. The required hardware is provided by the local IT departments in the centres. In terms of data protection the programme fully complies with the Austrian data protection act (DSG 2000, valid since 1.1.2000). Access to the data base in the centres is restricted to authorized users only.

On the one hand, the *HIP* fulfils complex tasks for the clinical management of HIV infected patients, and on the other hand it allows queries and analyses to be performed by the users without restrictions. However, to allow both individual patient management and scientific queries is an enormous challenge which scientific HIV cohorts in other countries have not had to deal with. In Austria, there was no acceptance for a purely scientific data base. While for the clinical patient management the focus is on readability of diagnoses and therapies, creation of medical reports, prescriptions (trade names!), print-out of results etc., scientific queries need precise coding and categorization. Furthermore, the optimization of individual patient management requires an ongoing adjustment to the progress of information technology, whereas purely scientific data bases do not have such technological renewal pressure.

Special challenges for the *HIV Patient Management System* are:
- Checking of plausibility of the data <u>after</u> entry in the database
- Meeting the requirements of both clinical patient management and scientific database
- Weak/ overburdened infrastructure in HIV treatment centres

2 Organization of the Austrian HIV cohort study

The organization and further development of the HIV cohort study will stay complex, because some goals of the *Austrian HIV Cohort Study* are also of interest to health authorities and/ or institutions. The Federal Ministry of Labour, Social Affairs, Health and Consumer Protection (BMASGK, Department IX/A/7, Dr. Bernhard Benka) is in charge of HIV, whereas some agenda of this responsibility has been shifted to the Agency for Health and Food Safety (AGES). In contrast, patient care has to be provided by the different federal states, and the social insurance companies bear the costs of the HIV medication. The IT departments in the hospitals have to provide the IT hardware as well as the service/ data security. Because of the support of BMG and AGES, the collaboration between the *Austrian HIV Cohort Study* and the hospitals, especially with the local IT departments (e. g. interfaces between HIP and local IT systems) is legitimized. For IT departments, HIP as an "isolated application" is seen as an additional liability. On the other hand, hospitals have also an interest in the *HIV Patient Management System* because tasks of quality management and standardization of care can be managed more efficiently by using HIP. The establishment of the *HIV Patient Management System* is a big advance in the management of patients with HIV/AIDS ("Good Chronic Disease Practice").
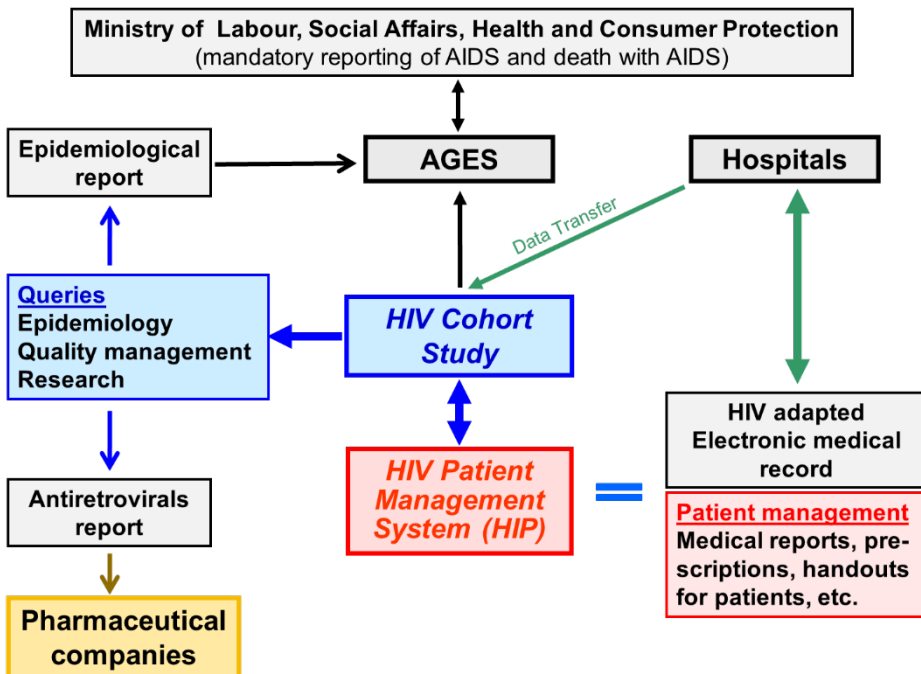
The development of the *HIV Patient Management System* incorporated the international standard format, the HIV Cohorts Data Exchange Protocol (HICDEP), so that data merging with networks of cohorts like ART-CC, EuroSIDA and RESPOND are greatly facilitated.

Centres of the Austrian HIV Cohort Study

■	Vienna AKH Vienna*	Dermatovenereology
	OWS Vienna	Pulmonary Medicine
	KFJ Vienna	Infectious Diseases
■	Graz	Infectious Diseases
■	Linz**	Dermatovenereology
■	Salzburg**	Oncology/Infectious Diseases
■	Klagenfurt	Oncology
■	Innsbruck*	Dermatovenereology
■	Feldkirch (2018)	Oncology

* University Hospitals
** University in development or associated with private university
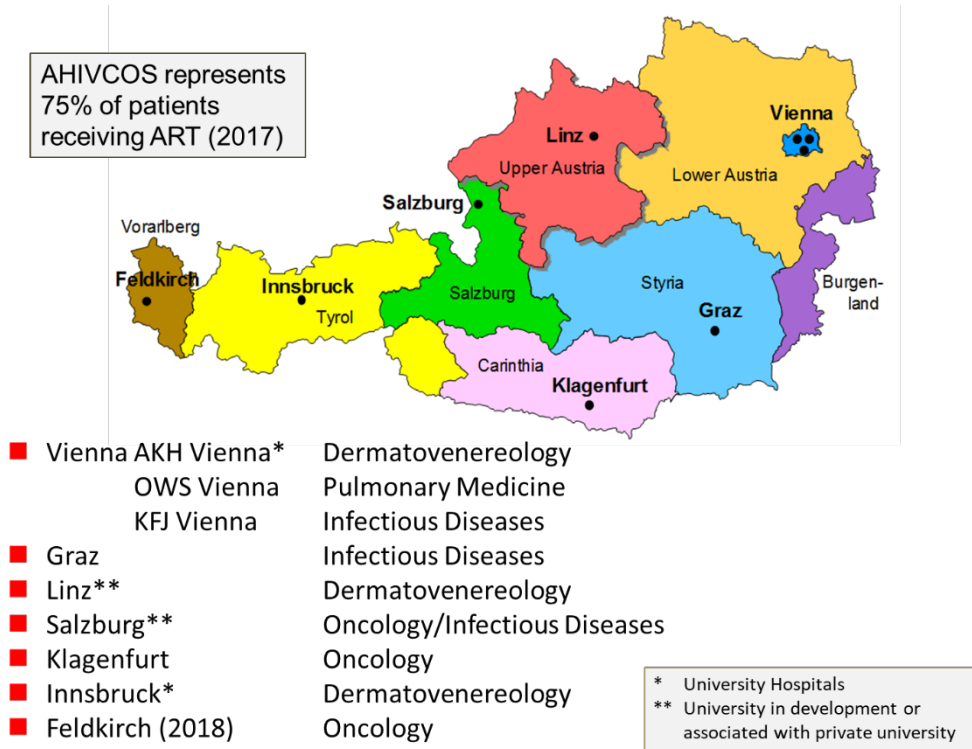
3   Funding

The Austrian HIV Cohort Study (AHIVCOS) will be financed until September 2019. The maintenance and the further development of the *HIV Patient Management System ("HIP")* as well as the provision of epidemiological reports *(e.g. „Report of the Austrian HIV Cohort Study")* are secured with the public sector (AGES, by order of the Federal Ministry of Health), the partners in the pharmaceutical industry (all companies providing HIV drugs) and the participating hospitals (routine maintenance contracts).

4   Cohort participants

4.1   Definition of Cohort participants

The Austrian HIV Cohort Study has gained approval of the ethical committees of the HIV treatment centres. With this the Austrian HIV Cohort Study has been ready to join the international network of cohorts like ART-CC, CASCADE, COHERE and RESPOND.

Inclusion criteria:
- Patients living with HIV infection

Exclusion criteria:
- Physician's decision
- Patient withholds consent

Frequency of the monitoring („Follow-up"):
Cohort participants will be examined and findings/ results documented at regular visits (at least semianually), therefore no additional costs will arise.

Minimal dataset:
- Last negative, first positive HIV test, seroconversion illness, AIDS diagnoses, all cases of death
- First contact with the HIV centre
- Age, sex, mode of transmission of HIV
- CD4 count, HIV RNA, co-infections and co-morbidities
- Resistances to antiretroviral drugs
- Antiretroviral therapies (past and present)
- Co-morbidities
- Co-medication

Merger of data:
- Only indirectly personal data according to the data protection act
- Semiannual (March and September)

4.2   HIV, AIDS and Death per calendar year
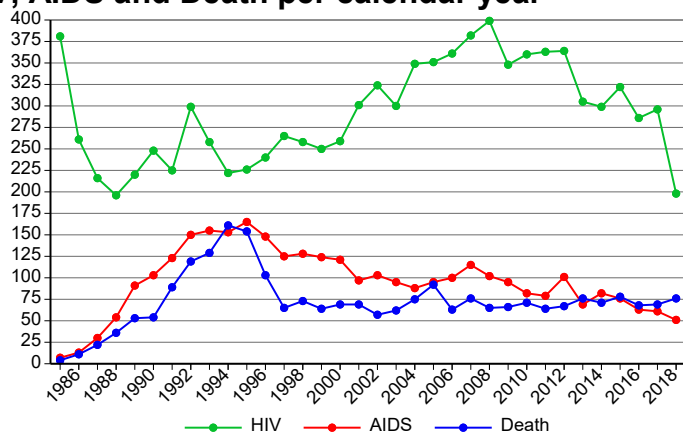
Year	HIV	AIDS	DEATH
1985	381	7	4
1986	261	13	11
1987	216	30	22
1988	196	54	36
1989	220	91	53
1990	248	103	54
1991	225	123	89
1992	299	150	119
1993	258	155	129
1994	222	153	161
1995	226	165	154
1996	240	148	103
1997	265	125	65
1998	258	128	73
1999	250	124	64
2000	259	121	69
2001	301	97	69
2002	324	103	57
2003	300	95	62
2004	349	88	75
2005	351	95	92
2006	361	100	63
2007	382	115	76
2008	399	102	65
2009	348	95	66
2010	360	82	71
2011	363	79	64
2012	364	101	67
2013	305	69	76
2014	299	82	71
2015	322	76	78
2016	286	63	68
2017	296	61	69
2018	198	51	76
2019	134	32	24
Total	10066	3276	2495

4.3　　Who initiated, offered and performed the HIV test?

Who initiated, offered and performed the HIV test for HIV-positive individuals entering the Austrian HIV cohort study in recent years? Data to answer this questions is very incomplete, however the treatment centres in Linz, Salzburg, Innsbruck and Graz provide important findings.
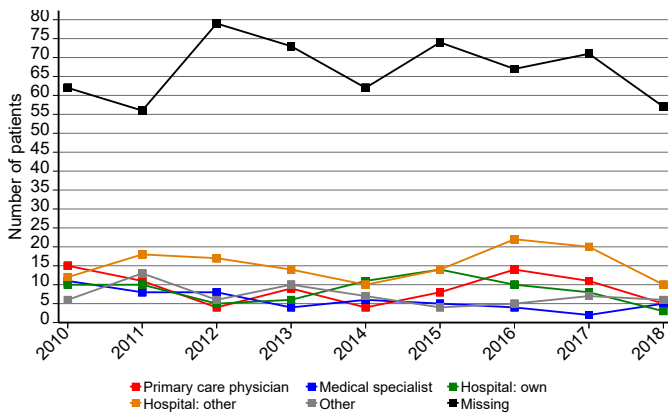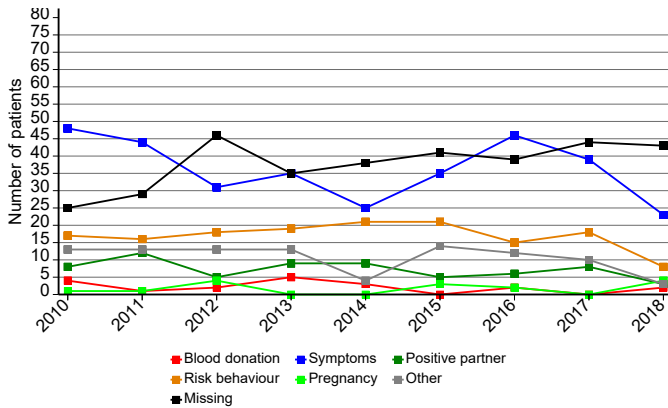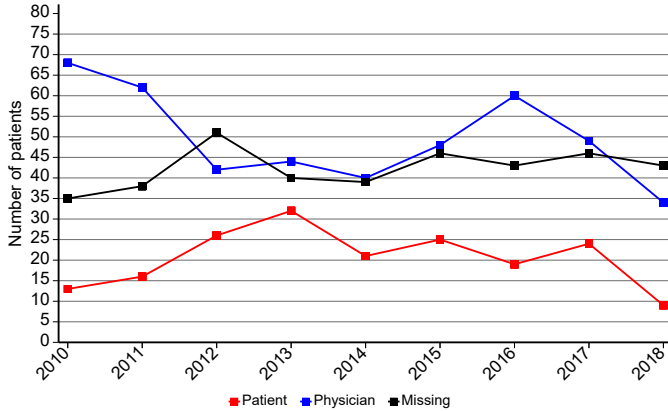
4.4   Recruitment and follow-up of cohort participants

So far, 10066 HIV infected patients providing 102058.5 years of follow-up have been recruited into the cohort study. We assume that there were more than 2495 deaths, but data entry from patients with loss of follow-up or last contact a long time ago is incomplete. Most centres do not have enough resources to enter data retrospectively.

Cumulative number of all cohort participants

	OWS Vienna	AKH Vienna	KFJ Vienna	Linz	Salz-burg	Inns-bruck	Feld-kirch	Graz	Klagen-furt	Total
01.09.2019	2693	3070	211	1120	480	1376	94	744	278	**10066**

Last contact with HIV treatment centre and alive or not known to be dead

	Follow-up within the last 12 months	Living/moved to care abroad	Lost to follow-up	Total
OWS Vienna	915	65	664	**1644**
AKH Vienna	1618	79	856	**2553**
KFJ Vienna	182	8	18	**208**
Linz	577	14	152	**743**
Salzburg	296	37	108	**441**
Innsbruck	715	194	81	**990**
Feldkirch	77	2	12	**91**
Graz	466	16	163	**645**
Klagenfurt	210	12	34	**256**
Total	**5056**	**427**	**2088**	**7571**

	Death		
	Death within the last 12 months	Death since more than 12 months	Total
OWS Vienna	10	1039	**1049**
AKH Vienna	15	502	**517**
KFJ Vienna	1	2	**3**
Linz	4	373	**377**
Salzburg	3	36	**39**
Innsbruck	7	379	**386**
Feldkirch	1	2	**3**
Graz	7	92	**99**
Klagenfurt	2	20	**22**
Total	**50**	**2445**	**2495**

Risk factors for no follow-up within the last 12 months

Persons with residency abroad were excluded from this analysis.

All centres	Frequencies		%	Univariable logistic Regression			Multivariable logistic Regression		
Variable	2088	7144	29.23%	OR	(95%CI)	p-value	OR	(95%CI)	p-value
Demographic characteristics									
Age at last contact									
< 30	482	802	60.10%	10.28	[8.54,12.39]	0.000	8.00	[6.56,9.77]	0.000
30-50	1306	3994	32.70%	3.32	[2.89,3.81]	0.000	2.82	[2.43,3.26]	0.000
> 50	300	2348	12.78%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
HIV transmission category									
Male IDU	232	698	33.24%	1.19	[0.99,1.41]	0.058	1.14	[0.94,1.38]	0.171
Female IDU	73	312	23.40%	0.73	[0.55,0.96]	0.022	0.71	[0.53,0.95]	0.021
Male hetero	330	1251	26.38%	0.85	[0.74,0.99]	0.034	0.96	[0.81,1.14]	0.629
Female hetero	315	1287	24.48%	0.77	[0.66,0.90]	0.001	0.69	[0.58,0.82]	0.000
Other	218	486	44.86%	1.94	[1.59,2.35]	0.000	1.59	[1.27,1.99]	0.000
MSM	920	3110	29.58%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Population size of residence area									
Vienna	1311	3511	37.34%	2.33	[2.09,2.59]	0.000	2.25	[2.01,2.52]	0.000
Missing	53	78	67.95%	8.29	[5.12,13.43]	0.000	3.81	[2.13,6.79]	0.000
Outside Vienna	724	3555	20.37%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Nationality									
High prevalence	331	757	43.73%	2.39	[2.04,2.80]	0.000	2.16	[1.78,2.61]	0.000
Low prevalence	451	1320	34.17%	1.60	[1.40,1.82]	0.000	1.23	[1.06,1.41]	0.005
Missing	88	100	88.00%	22.57	[12.31,41.40]	0.000	12.53	[6.56,23.94]	0.000
Austria	1218	4967	24.52%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Stage of disease									
AIDS									
Yes	334	1546	21.60%	0.60	[0.53,0.69]	0.000	0.79	[0.68,0.91]	0.002
No	1754	5598	31.33%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.

4.5 Patients currently in care

4.5.1 Overall

Patients were seen as currently in care when they had at least one contact to an HIV centre within the previous 6 months.
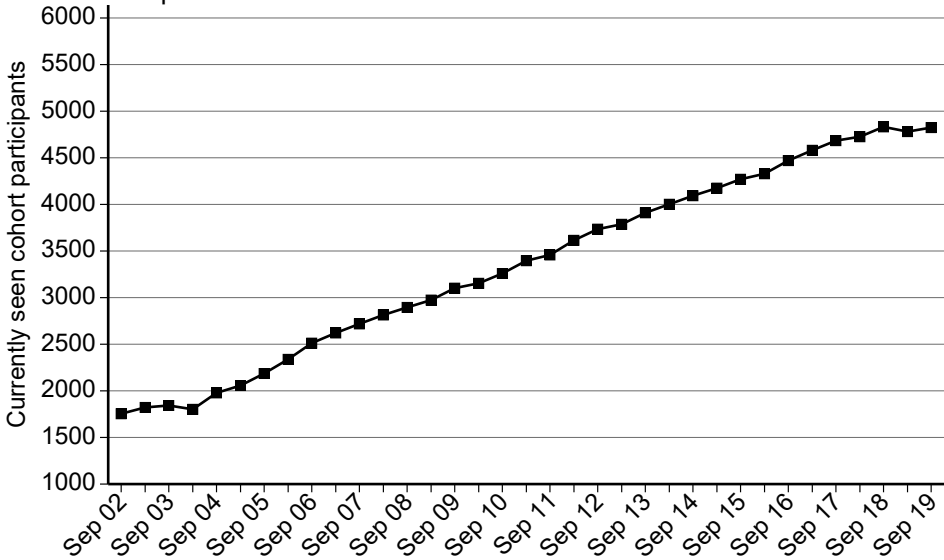
Number of patients currently in care

	OWS Vienna	AKH Vienna	KFJ Vienna	Linz	Salz-burg	Inns-bruck	Feld-kirch	Graz	Klagen-furt	Total
01.09.2019	863	1497	176	565	284	709	69	450	211	**4824**

■ OWS Vienna ■ AKH Vienna ■ KFJ Vienna ■ Linz ■ Salzburg ■ Innsbruck ■ Feldkirch ■ Graz ■ Klagenfurt

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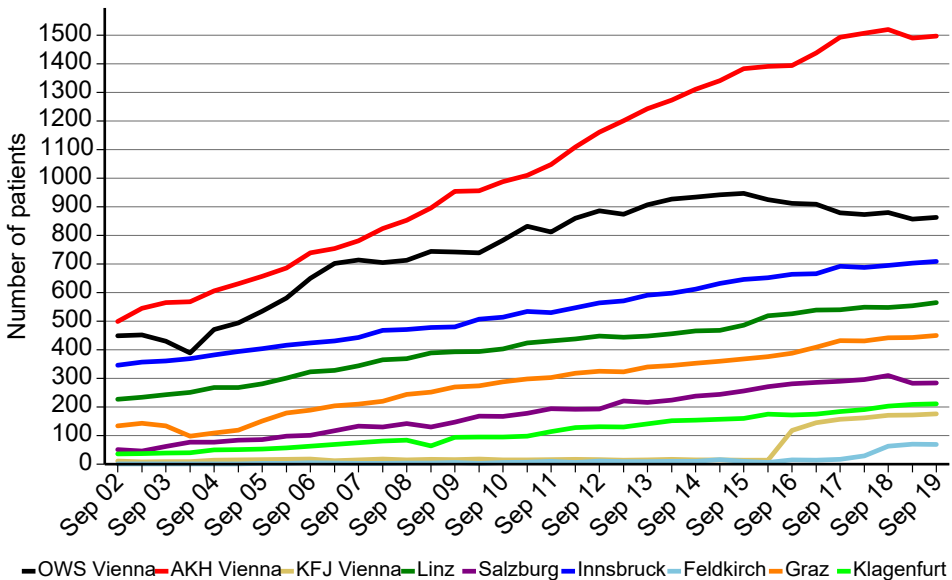
Number of currently seen patients by residence

	HIV-centre									
	OWS Vienna	AKH Vienna	KFJ Vienna	Linz	Salz-burg	Inns-bruck	Feld-kirch	Graz	Klagen-furt	**Total**
Burgenland	21	31	6	0	0	0	0	13	0	**71**
Carinthia	1	0	0	2	5	7	0	11	204	**230**
Lower Austria	169	253	14	38	2	4	0	2	0	**482**
Upper Austria	0	4	0	502	26	6	0	0	0	**538**
Salzburg	0	2	0	4	211	32	0	1	0	**250**
Styria	2	6	0	5	7	4	0	411	2	**437**
Tyrol	0	1	0	2	5	509	0	2	0	**519**
Vorarlberg	0	0	0	1	0	122	68	0	0	**191**
Vienna	663	1190	151	8	0	12	0	8	1	**2033**
Foreign/missing	7	10	5	3	28	13	1	2	4	**73**
Total	**863**	**1497**	**176**	**565**	**284**	**709**	**69**	**450**	**211**	**4824**

4.5.2 Number of patients currently on antiretroviral therapy

4758 patients (98.6%) were on antiretroviral therapy in the 9 HIV treatment centres. Of the 66 patients not on treatment 23 had received antiretroviral treatment at an earlier point in time (women who were on ART to prevent mother-to-child transmission, patients who received transient ART during/ after the acute HIV infection, etc.).
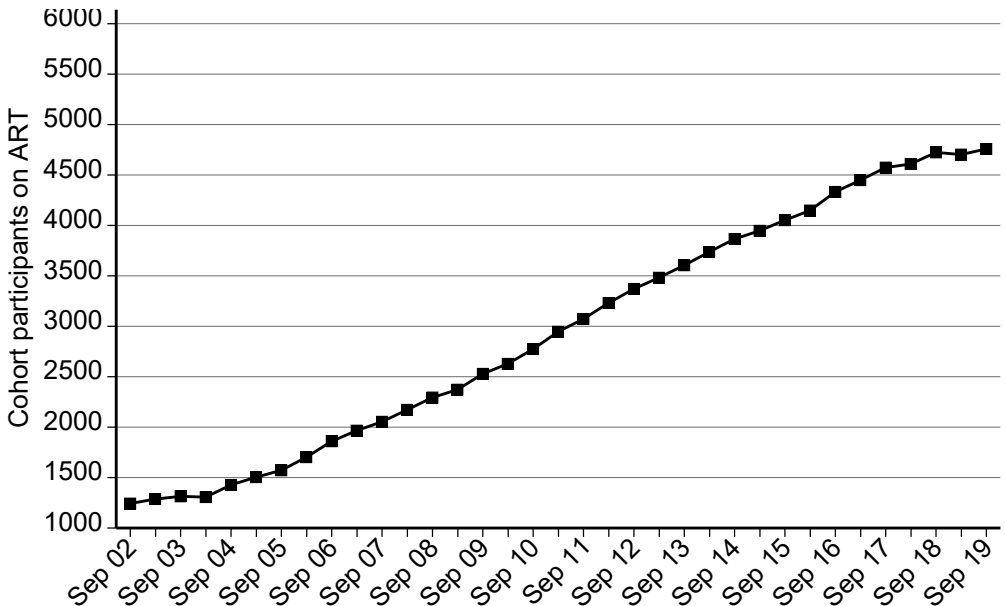
Number of participants currently on antiretroviral therapy

	OWS Vienna	AKH Vienna	KFJ Vienna	Linz	Salz-burg	Inns-bruck	Feld-kirch	Graz	Klagen-furt	**Total**
01.09.2019	848	1484	171	562	280	699	68	437	209	**4758**

Legend: ■ OWS Vienna ■ AKH Vienna ■ KFJ Vienna ■ Linz ■ Salzburg ■ Innsbruck ■ Feldkirch ■ Graz ■ Klagenfurt
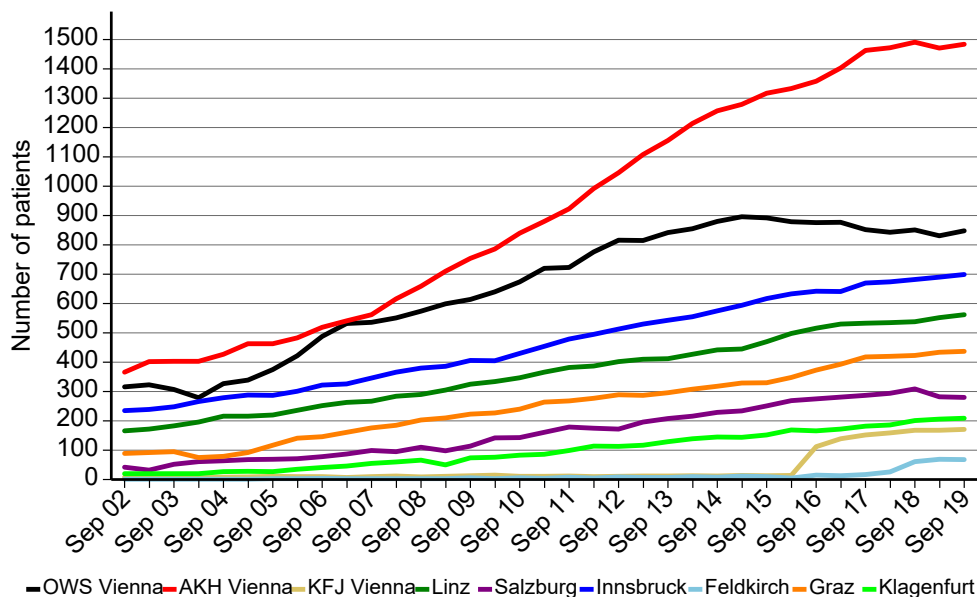
Number of participants currently on antiretroviral therapy by area of residence

	HIV-centre									
	OWS Vienna	AKH Vienna	KFJ Vienna	Linz	Salz-burg	Inns-bruck	Feld-kirch	Graz	Klagen-furt	**Total**
Burgenland	21	31	5	0	0	0	0	13	0	**70**
Carinthia	1	0	0	2	5	7	0	10	202	**227**
Lower Austria	167	251	14	38	2	4	0	2	0	**478**
Upper Austria	0	4	0	499	26	6	0	0	0	**535**
Salzburg	0	2	0	4	207	32	0	1	0	**246**
Styria	2	6	0	5	7	4	0	400	2	**426**
Tyrol	0	1	0	2	5	502	0	2	0	**512**
Vorarlberg	0	0	0	1	0	120	67	0	0	**188**
Vienna	651	1180	147	8	0	12	0	8	1	**2007**
Foreign/missing	6	9	5	3	28	12	1	1	4	**69**
Total	**848**	**1484**	**171**	**562**	**280**	**699**	**68**	**437**	**209**	**4758**

4.5.3   How many persons living with HIV (PLHIV) are there in Austria?

As of January 1st 2017, the modelling tool of ECDC reveals a number of 9440 PLHIV, assuming that AHIVCOS is representative for the whole of Austria. This is very likely an overestimation, since the ascertainment of patients who left the country is incomplete. According to *Hauptverband der Sozialversicherungsträger*, 6847 persons received cART in 2018. An analysis within AHIVCOS, based on the same method, revealed 4945 persons with cART in 2017 representing 74% of all patients in Austria receiving cART. Overall, we estimate, according to the ECDC tool, that about 80-85% of PLHIV are receiving cART. Thus the estimate for PLHIV, based on the number given by the Hauptverband and the calculation of 80-85% receiving cART, add up to 8055-8560 PLHIV for end of 2018 (see also page 93).

4.6 Use of antiretroviral drugs to prevent HIV infection

PEP

	Non-occupational PEP started in		
	2016	**2017**	**2018**
Sex			
Women	37	40	62
Men	107	134	157
Age (years)			
<30	64	98	111
30- 49	72	71	100
>50	8	5	8
Area of residence			
Vienna	74	99	121
Lower Austria	4	5	9
Burgenland	1	0	1
Upper Austria	3	14	18
Salzburg	0	6	8
Tyrol	16	7	17
Vorarlberg	2	1	2
Styria	9	7	13
Carinthia	0	0	1
Missing	35	35	29

PrEP

	PrEP started in				On PrEP at 01.03.2019
	2016	**2017**	**2018**	**2019**	
Sex					
Women	0	0	5	0	3
Men	3	98	194	44	304
Age (years)					
<30	1	32	54	17	87
30- 49	2	60	120	26	190
>50	0	6	25	1	31
Area of residence					
Vienna	1	78	79	9	148
Lower Austria	0	3	7	4	14
Burgenland	0	0	0	0	0
Upper Austria	0	0	21	5	25
Salzburg	0	0	5	0	5
Tyrol	2	13	63	24	87
Vorarlberg	0	1	14	1	16
Styria	0	1	6	0	5
Carinthia	0	0	0	0	0
Missing	0	2	5	1	8

5 HIV/AIDS Surveillance in Austria

5.1 General overview (ECDC data)

HIV diagnoses, per 100 000 population, reported for 2017: Heterosexual cases
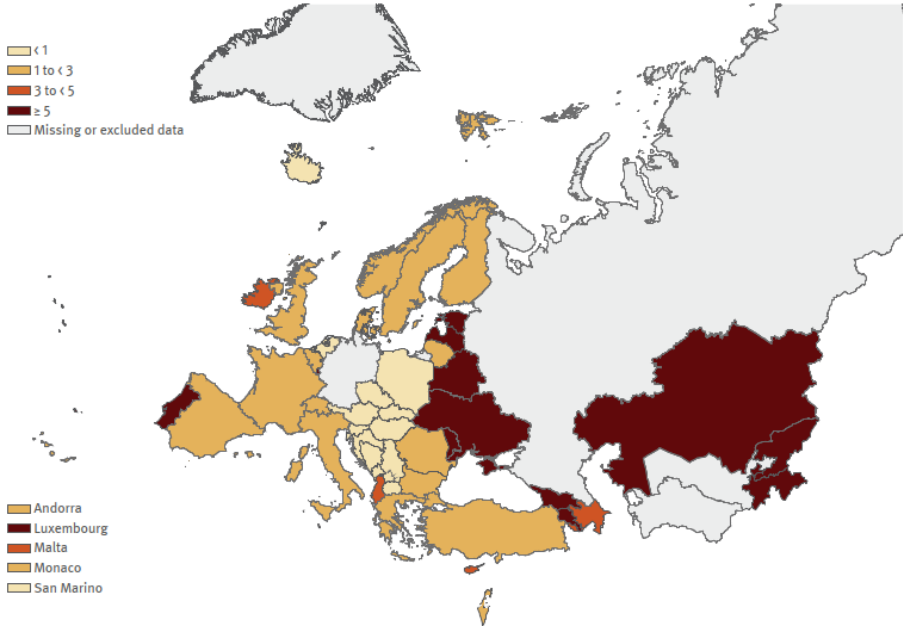
HIV diagnoses, per 100 000 population, reported for 2017: Men who have sex with men cases

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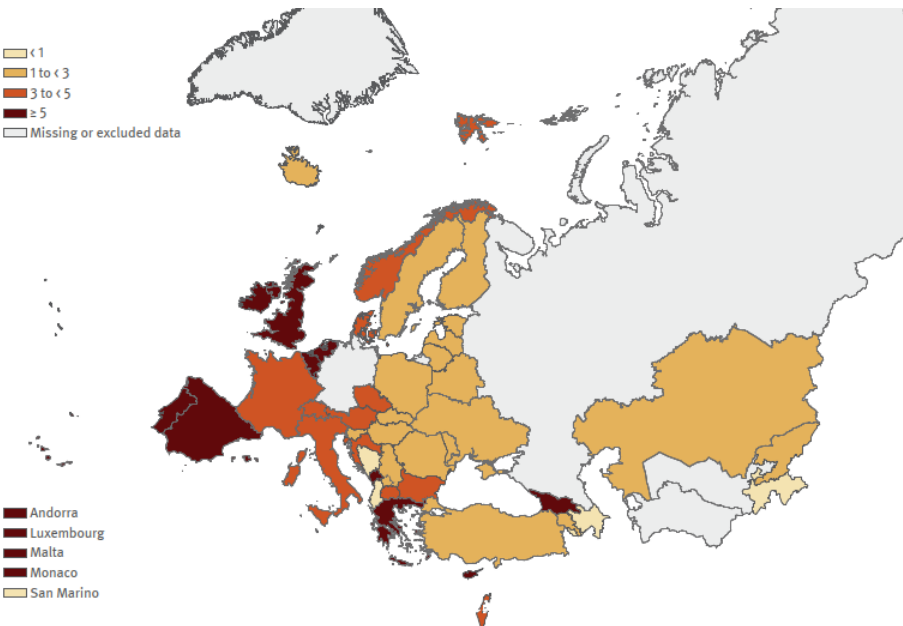
Percentage of HIV diagnoses, by age group and country, EU/EEA, 2017 (n=25 255)
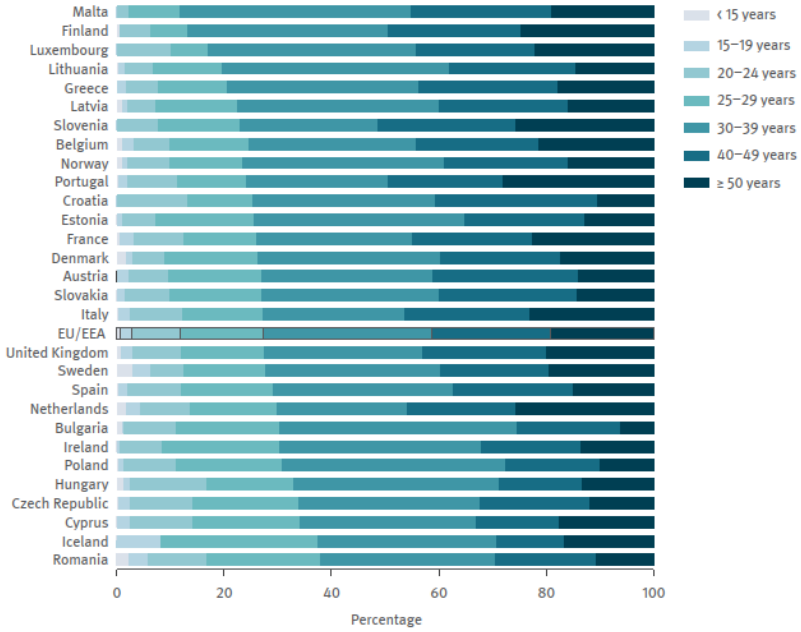
Note: Germany did not report data for 2017, and no cases were reported by Liechtenstein.

Male-to-female ratio in HIV diagnoses, by country, EU/EEA, 2017 (n=25 210)
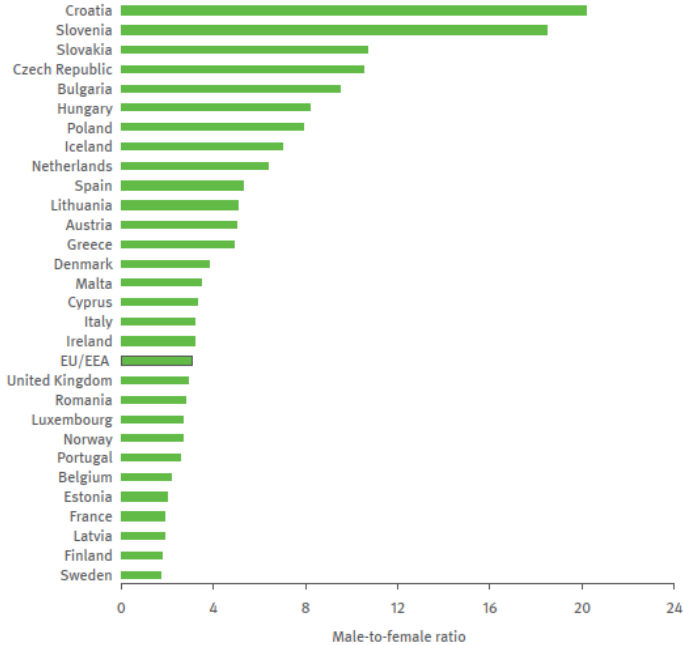
Note: Germany did not report data for 2017.

Percentage of new HIV diagnoses with known mode of transmission, by transmission route and country, EU/EEA, 2017 (n=19 230)
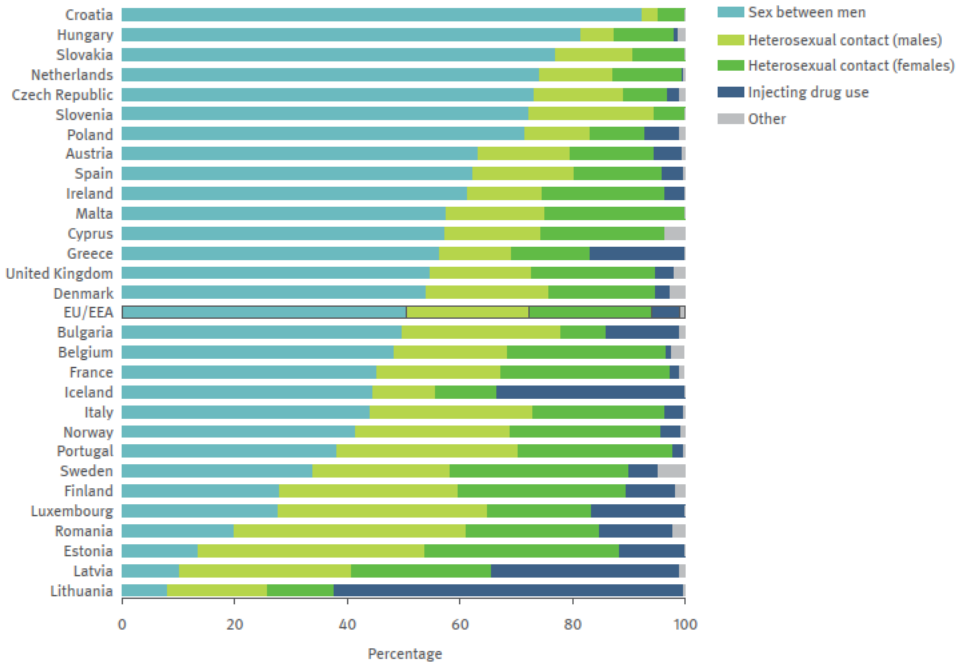
Note: Germany did not report data for 2017, and no cases were reported by Liechtenstein; unknown route of transmission is excluded from proportions presented here.

Percentage of new HIV diagnoses among migrants out of all reported cases with known information on region of origin, by country, EU/EEA, 2017 (n=25 008)
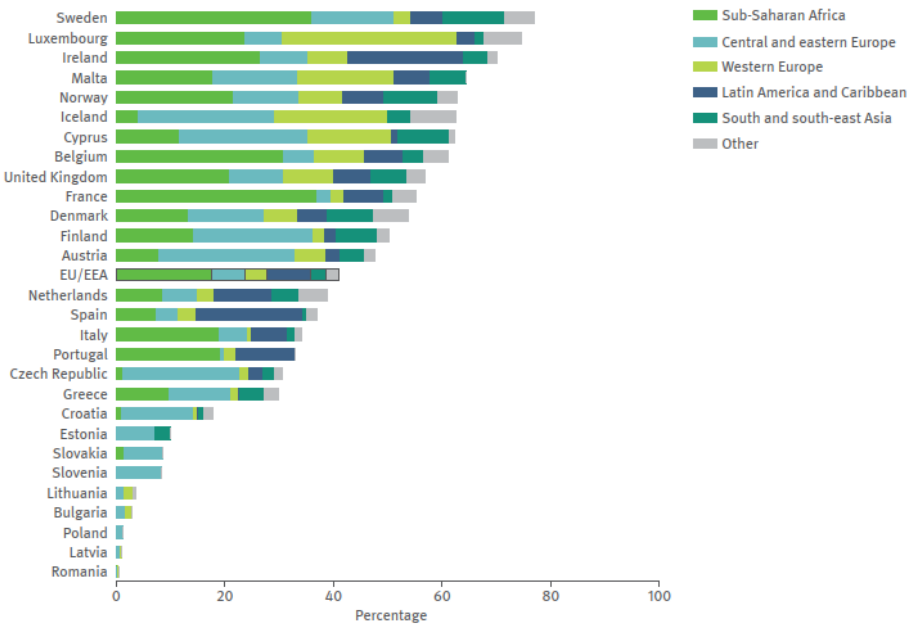
Note: Germany did not report data for 2017, and no cases were reported among people born abroad in Hungary and Liechtenstein.

5.2 Mode of transmission
5.2.1 All modes of transmission
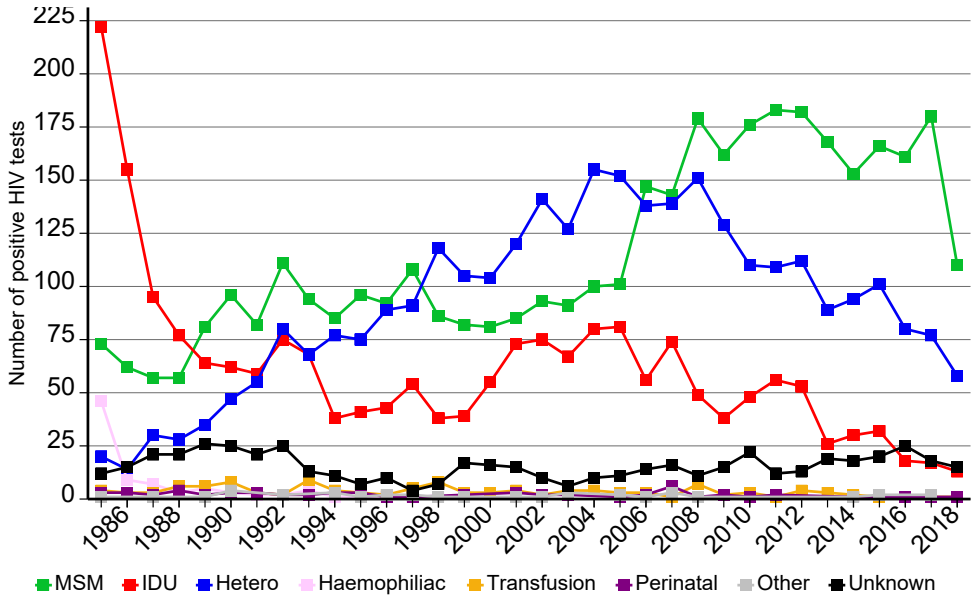
	BMG	AHIVCOS								
		MSM		IDU		Heterosexually infected		Others		Total	Women
Year	Total										
1998	313	86	33.33%	38	14.73%	118	45.74%	16	6.20%	258	60	23.26%
1999	339	82	32.80%	39	15.60%	105	42.00%	24	9.60%	250	70	28.00%
2000	428	81	31.27%	55	21.24%	104	40.15%	19	7.34%	259	71	27.41%
2001	402	85	28.24%	73	24.25%	120	39.87%	23	7.64%	301	73	24.25%
2002	442	93	28.70%	75	23.15%	141	43.52%	15	4.63%	324	91	28.09%
2003	423	91	30.33%	67	22.33%	127	42.33%	15	5.00%	300	91	30.33%
2004	470	100	28.65%	80	22.92%	155	44.41%	14	4.01%	349	107	30.66%
2005	453	101	28.77%	81	23.08%	152	43.30%	17	4.84%	351	98	27.92%
2006	435	147	40.72%	56	15.51%	138	38.23%	20	5.54%	361	87	24.10%
2007	515	143	37.43%	74	19.37%	139	36.39%	26	6.81%	382	84	21.99%
2008	505	179	44.86%	49	12.28%	151	37.84%	20	5.01%	399	94	23.56%
2009	507	162	46.55%	38	10.92%	129	37.07%	19	5.46%	348	77	22.13%
2010	487	176	48.89%	48	13.33%	110	30.56%	26	7.22%	360	67	18.61%
2011	525	183	50.41%	56	15.43%	109	30.03%	15	4.13%	363	75	20.66%
2012	523	182	50.00%	53	14.56%	112	30.77%	17	4.67%	364	73	20.05%
2013	481	168	55.08%	26	8.52%	89	29.18%	22	7.21%	305	46	15.08%
2014	403	153	51.17%	30	10.03%	94	31.44%	22	7.36%	299	63	21.07%
2015	428	166	51.55%	32	9.94%	101	31.37%	23	7.14%	322	41	12.73%
2016	447	161	56.29%	18	6.29%	80	27.97%	27	9.44%	286	46	16.08%
2017	510	180	60.81%	17	5.74%	77	26.01%	22	7.43%	296	45	15.20%
2018	397*	110	55.56%	13	6.57%	58	29.29%	17	8.59%	198	29	14.65%
2019		74	55.22%	10	7.46%	40	29.85%	10	7.46%	134	17	12.69%

*78 of them have been tested anonymously

Transmission and residence in patients with follow-up within the last 12 months

Legend: MSM, IDU, Hetero, Blood Products, Vertical, Other, Unknown
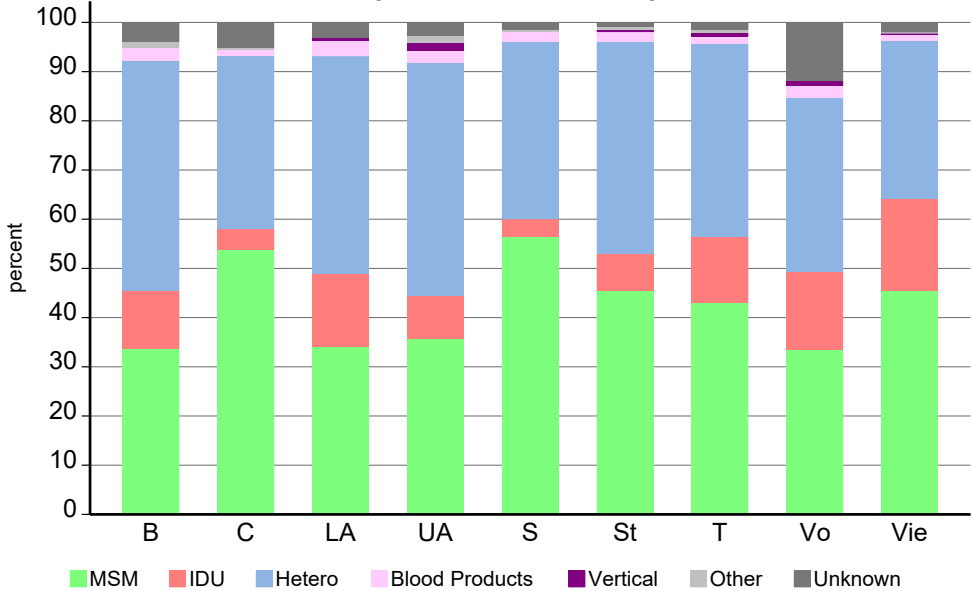
The abbreviation MSM is used for „Men who have sex with men". IDU means „Injecting Drug Use". The category IDU also includes men who are both MSM and IDU. The category "blood products" includes cohort participants who have received coagulation compounds or blood transfusions. Among the patients with a follow-up in the last 12 months, 37.4% have been infected through heterosexual contacts, 43.3% through homosexual contacts and 13.9% through the injection of drugs.

5.2.2   Categories of heterosexually acquired infections

Because of missing data, the HIV treatment centre OWS Vienna has been excluded from some analyses.

All

Legend: Originating from high prevalence, Sex with MSM, Sex with IDU, Sex with hemophilac, Sex with persons from high prevalence, Sex with HIV+ persons not matching above, Believes to be infected heterosexually, Heterosexual with no information

Men

Women

Categories of transmission

Men

| MSM | IDU | Hetero | Other |

Women

| IDU | Hetero | Other |

Sub-categories of transmission

Men

Legend:
- MSM
- IDU
- Originating from a high prevalence country
- Sex with bisexual male,IDU,haemophiliac
- Sex with person from high prevalence
- Sex with HIV+ persons not matching above
- Believes to be infected heterosexually
- Heterosexual with no information
- Other risk

Men values: 54.3, 16.3, 4.6, 0.6, 4.8, 1.6, 8.5, 1.2, 8.0

Women

Women values: 23.8, 23.7, 7.6, 8.6, 10.3, 15.3, 3.4, 7.2

Sub-categories of heterosexually acquired infections

Legend:
- Origin high prevalence country
- Sex with MSM
- Sex with IDU
- Sex with hemophilac
- Sex with high prevalence
- Sex with HIV+ other
- Believes hetero
- Hetero with no information

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5.2.3   Mother-to-child-transmission

Nowadays, mother-to-child-transmission is the only route of HIV transmission amongst children. All HIV infected children in Austria are followed in paediatric HIV treatment centres, therefore the data presented here are related to patients who have also been in care by the adult HIV treatment centres. Obviously, these data are incomplete.

	Living participants		Deceased participants	Total
	<18 years	>18 years		
Burgenland	0	1	0	1
Carinthia	0	0	0	0
Lower Austria	1	3	0	4
Upper Austria	4	7	1	12
Salzburg	1	0	0	1
Styria	0	2	0	2
Tyrol	0	4	4	8
Vorarlberg	2	0	3	5
Vienna	7	14	3	24
Missing residency	0	1	0	1
Foreign	0	2	0	2
Total	15	34	11	60

In January 2010, routine HIV testing was introduced in Austria. The HIV test is part of the mother-child booklet (*Mutter-Kind-Pass*). In order to be eligible for childcare allowance *(Kinderbetreuungsgeld)* you must have the first ten examinations stipulated in the mother-child booklet done correctly and obtain proof of it.

Recently, at least two transmissions of mother-to-child in Austria have been linked to counselling with HIV denialists.

All

Born in Austria
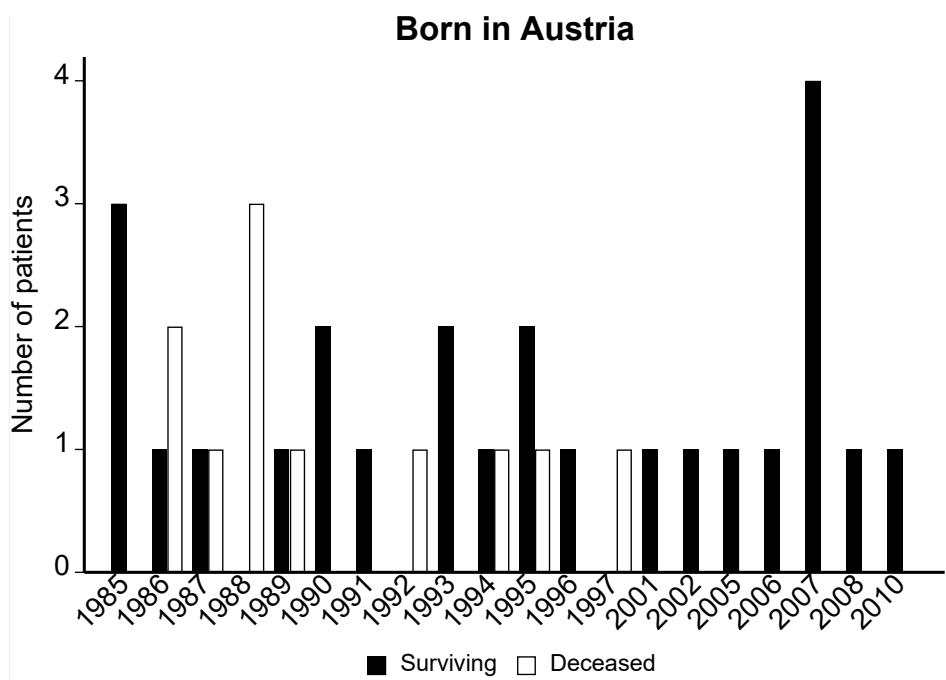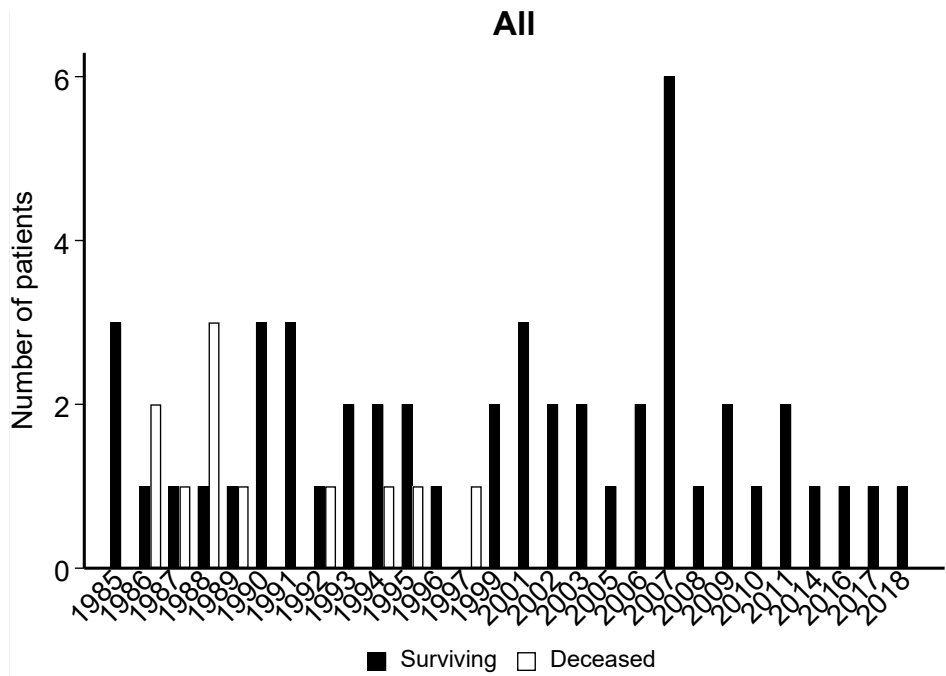
5.3　Sex

25.1% of the patients with a follow-up within the last 12 months are female. The rate is highest in Upper Austria (33.2%), Burgenland (32.5%) and Vorarlberg (27.6%).
In the subgroup of heterosexually acquired infections, the rate of the women is 51.4%. It is highest in Upper Austria (56.9%), Styria (56.6%), Tyrol (52.9%), and Burgenland (52.8%).

Sex of the patients with a follow-up in the last 12 months
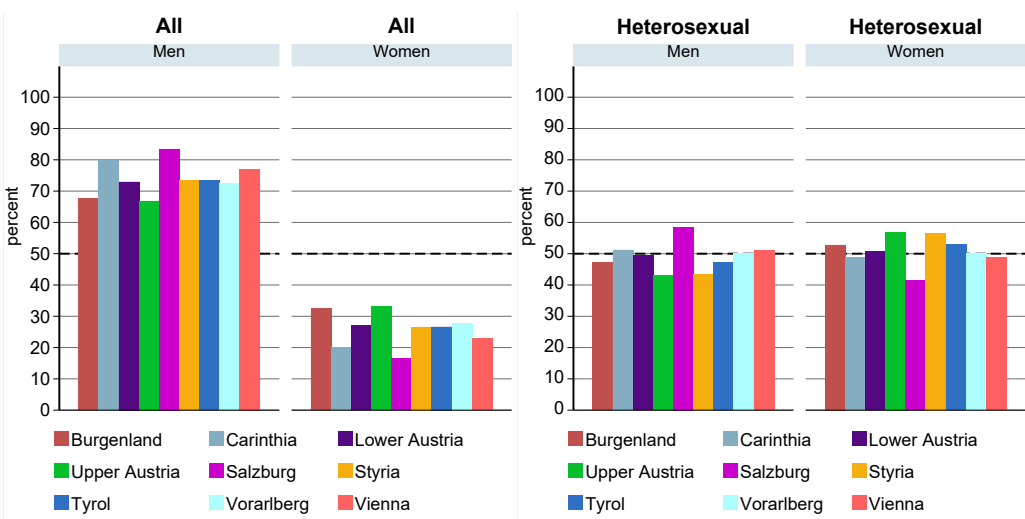
5.4　　Age
5.4.1　　Age at time of HIV diagnosis

Median age at time of the HIV diagnosis

Age at time of the HIV diagnosis

MSM

Male heterosexual

Female heterosexual
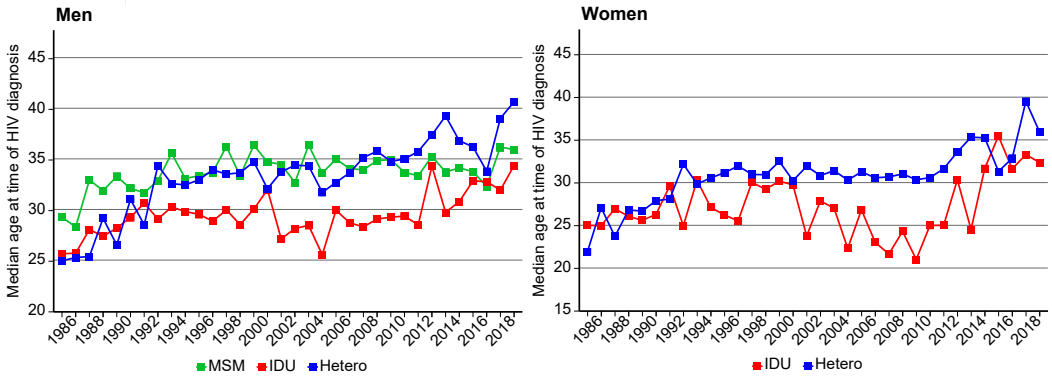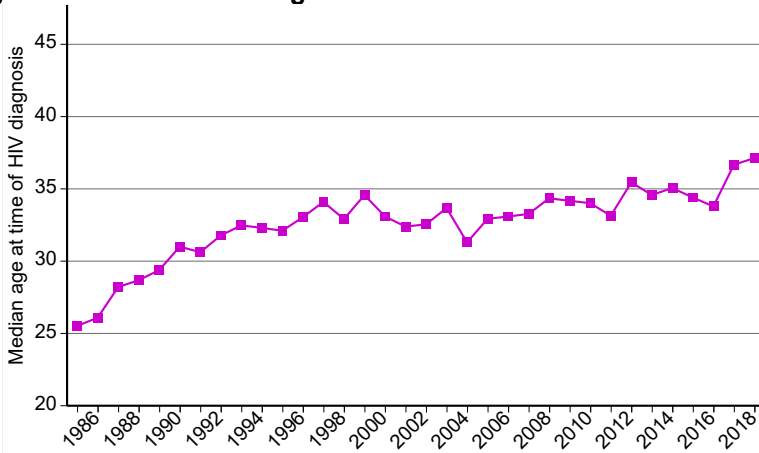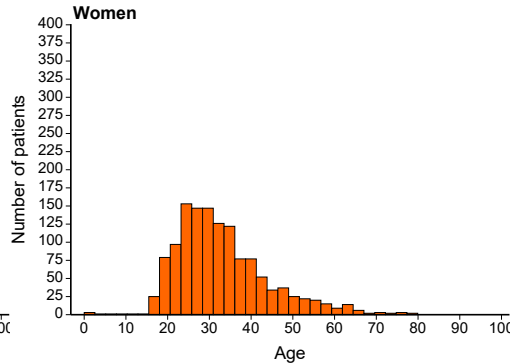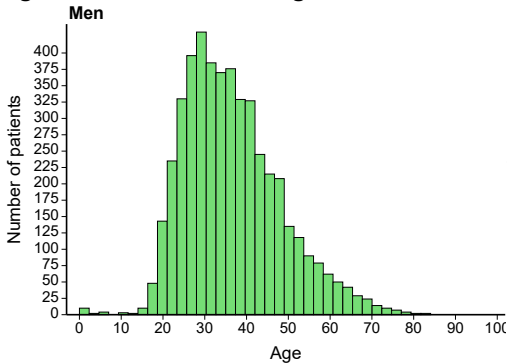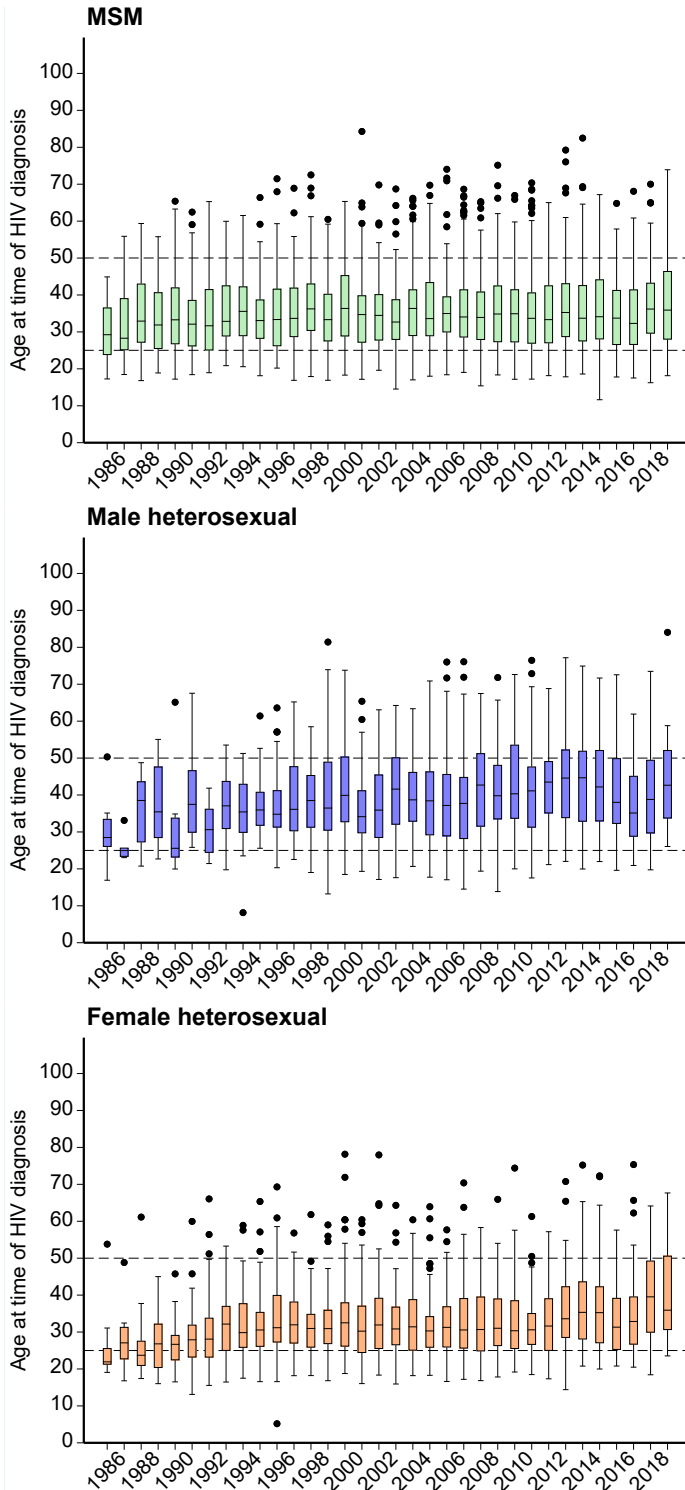
5.4.2   Age of patients currently in care

Overall, median age increased from 39.1 in September 2002 to 47.9 in September 2019. In MSM, median age increased from 41.1 in September 2002 to 46.5 in September 2019, in men (not MSM) from 39.9 to 50.9 and in women from 37.1 to 46.9.
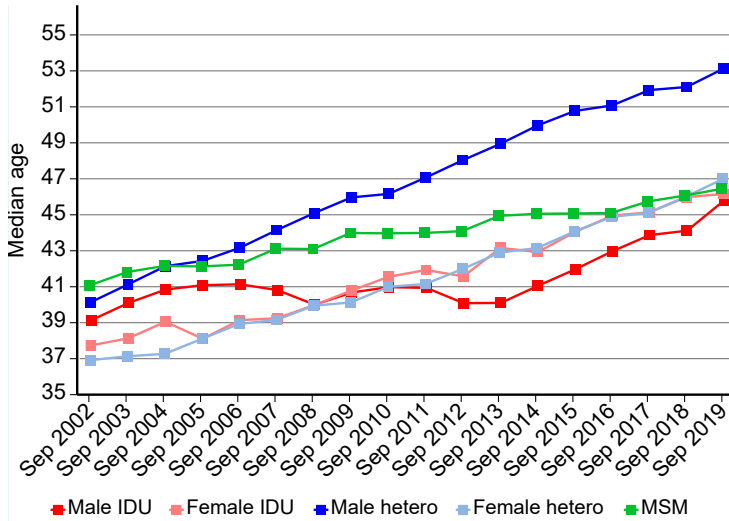
Median and average age are 48.0 and 48.2 years, respectively. 15.7% are older than 60 years, 44.1% are older than 50 years.
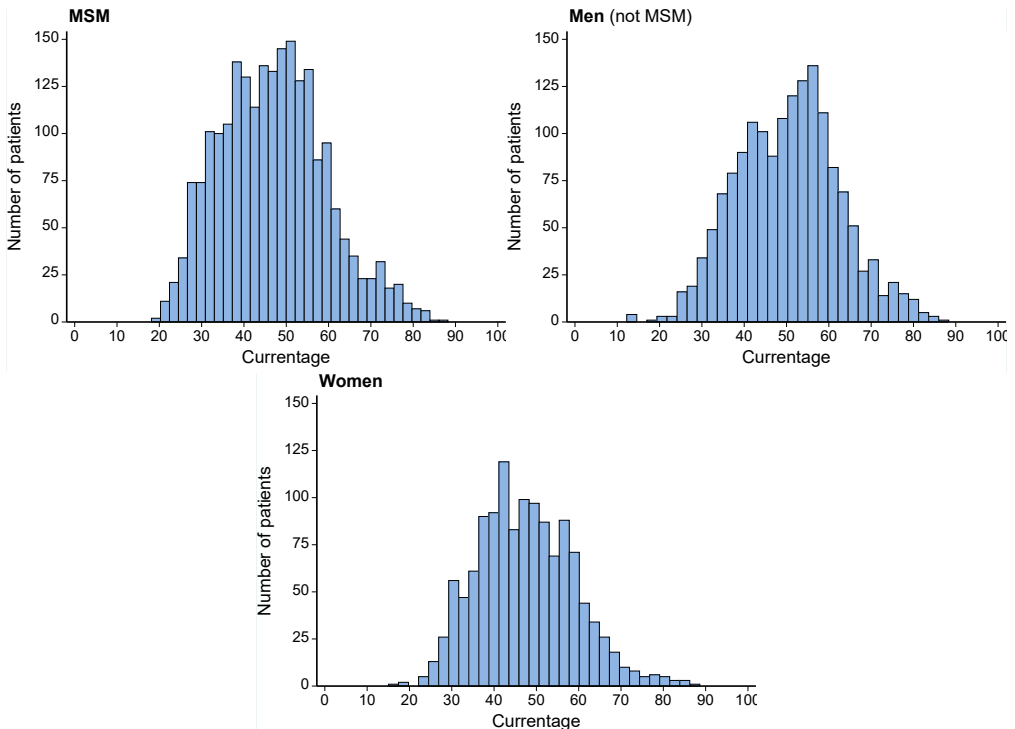
Age across the federal states: follow-up in the last 12 months

Federal state	Median Age years	≥50 years	≥60 years	≥75 years
Burgenland	49.6	48.1	14.3	2.6
Carinthia	49.3	47.0	17.1	1.7
Lower Austria	50.0	50.4	19.0	4.7
Upper Austria	48.3	46.4	19.1	1.5
Salzburg	47.3	43.5	16.5	3.5
Styria	46.8	38.6	13.3	1.5
Tyrol	50.1	50.4	16.9	2.3
Vorarlberg	49.5	48.3	17.2	3.4
Vienna	47.0	41.0	14.0	1.9
Total	**48.1**	44.1	15.7	2.3

Federal states: Patients with a follow-up in the last 12 months – injecting drug use
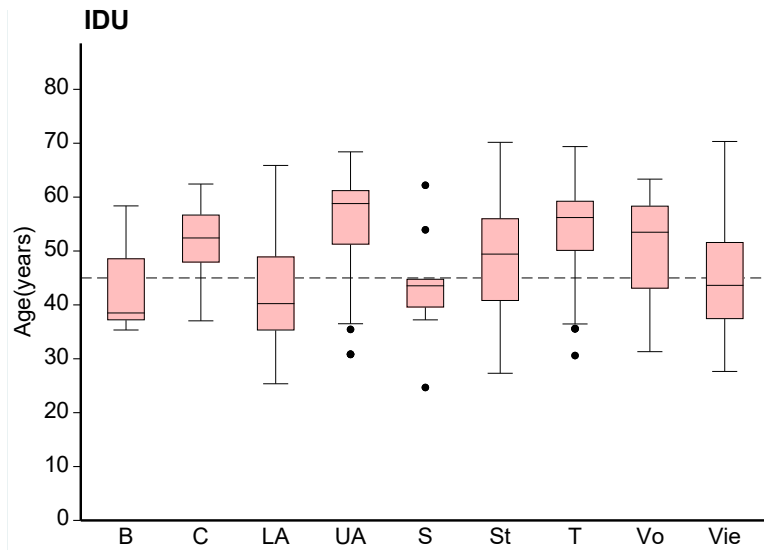
5.5 Nationality and country of birth

Nationality

Country of birth
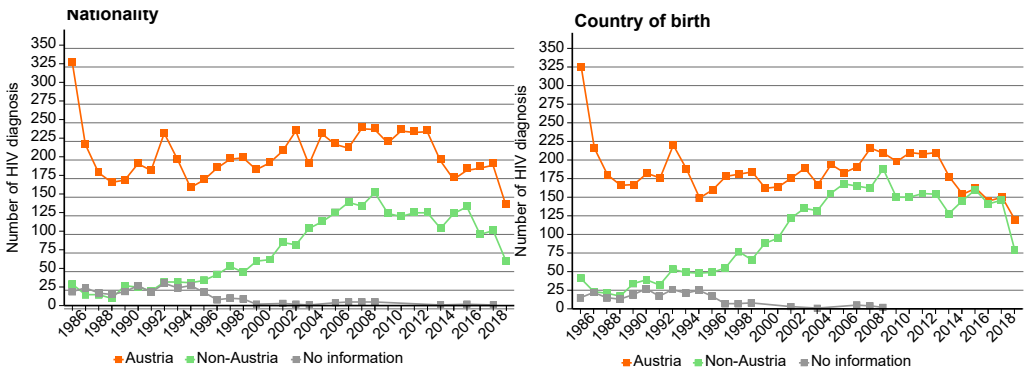
5.5.1 Overview

Year	BMG Total	Austria		Low prevalence countries		High prevalence countries		Missing value		Total
1998	313	203	78.68%	29	11.24%	17	6.59%	9	3.49%	258
1999	339	187	74.80%	41	16.40%	20	8.00%	2	0.80%	250
2000	428	196	75.68%	31	11.97%	32	12.36%	0	0.00%	259
2001	402	212	70.43%	47	15.61%	39	12.96%	3	1.00%	301
2002	442	239	73.77%	48	14.81%	35	10.80%	2	0.62%	324
2003	423	194	64.67%	54	18.00%	51	17.00%	1	0.33%	300
2004	470	235	67.34%	56	16.05%	58	16.62%	0	0.00%	349
2005	453	221	62.96%	55	15.67%	71	20.23%	4	1.14%	351
2006	442	216	59.83%	78	21.61%	62	17.17%	5	1.39%	361
2007	515	242	63.35%	72	18.85%	63	16.49%	5	1.31%	382
2008	505	241	60.40%	98	24.56%	55	13.78%	5	1.25%	399
2009	507	223	64.08%	76	21.84%	49	14.08%	0	0.00%	348
2010	487	239	66.39%	90	25.00%	31	8.61%	0	0.00%	360
2011	525	237	65.29%	97	26.72%	29	7.99%	0	0.00%	363
2012	523	238	65.38%	90	24.73%	36	9.89%	0	0.00%	364
2013	481	199	65.25%	82	26.89%	23	7.54%	1	0.33%	305
2014	403	174	58.19%	92	30.77%	33	11.04%	0	0.00%	299
2015	428	186	57.76%	100	31.06%	34	10.56%	2	0.62%	322
2016	447	189	66.08%	72	25.17%	25	8.74%	0	0.00%	286
2017	510	193	65.20%	87	29.39%	15	5.07%	1	0.34%	296
2018	397*	138	69.70%	49	24.75%	11	5.56%	0	0.00%	198
2019		96	71.64%	32	23.88%	6	4.48%	0	0.00%	134

*78 of them have been tested anonymously

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5.5.2 Nationality: HIV diagnoses between 2017 and 2019

Austria ■ Eastern and Southeastern Europe ■ CIS-states ■ Western Europe ■ Africa ■ Asia ■ Others/missing value

HIV diagnosis 2017 N=296	
Afghanistan	1
Albania	1
Austria	193
Bosnia and Herzegovina	3
Brazil	1
Bulgaria	2
Cameroon	2
China	2
Colombia	1
Congo	1
Croatia	2
Czech Republic	1
Dominica	1
France	1
Georgia	3
Gambia	1
Germany	8
Hungary	2
Iran	3
Iraq	2
Cote d'Ivoire	1
Mexico	1
Morocco	1
Netherlands	1
Nigeria	4
Peru	1
Poland	4
Portugal	3
Romania	9
Russian Federation	2
Serbia	9
Slovakia	7
Slovenia	1
Somalia	1
South Africa	2
Spain	1
Switzerland	1
Thailand	2
Tunisia	1
Turkey	6
Ukraine	3
United States of America	1
Uzbekistan	1
Venezuela	1
Unknown	1

HIV diagnosis 2018 N=198	
Afghanistan	1
Angola	1
Argentina	1
Austria	138
Bosnia and Herzegovina	1
Bulgaria	3
Colombia	2
Croatia	1
Cuba	1
Czech Republic	2
Dominican Republic	1
Germany	3
Hungary	5
India	2
Iran	1
Iraq	1
Italy	1
Kenya	1
Republic of Korea	1
Mauritius	1
Republic of Moldova	1
Nigeria	5
Poland	5
Portugal	1
Romania	4
Russian Federation	1
Serbia	4
Slovakia	2
Syrian Arab Republic	1
Thailand	1
Turkey	2
Uganda	1
Ukraine	2

HIV diagnosis 2019 N=134	
Afghanistan	1
Austria	96
Bosnia and Herzegovina	1
Bulgaria	2
France	1
Germany	7
Ghana	1
Hungary	2
Iran	1
Iraq	1
Italy	3
Kazakhstan	1
Libya	1
Lithuania	1
Mexico	1
Nigeria	1
Romania	2
Russian Federation	1
Serbia	2
Slovakia	1
South Africa	1
Zimbabwe	1
Sudan	1
Thailand	1

5.5.3   Nationality

All

MSM

IDU

Heterosexually acquired infection

Low prevalence countries are countries with an HIV infection rate of adults <1%, high prevalence countries are countries with an HIV infection rate of adults ≥1%.

34

5.6 Residence
5.6.1 Population size of area of residence

	Living with HIV/AIDS			Deceased		
	< 100 000	≥ 100 000	> 1 million	< 100 000	≥ 100 000	> 1 million
	N (% women)	N (% women)	N (% women)	N (% women)	N (% women)	N (% women)
B	101 (31.7%)	-	-	16 (25.0%)	-	-
C	166 (24.7%)	80 (17.5%)	-	20 (25.0%)	7 (14.3%)	-
LA	714 (26.8%)	-	-	145 (17.9%)	-	-
UA	423 (30.3%)	279 (35.1%)	-	173 (30.6%)	187 (32.1%)	-
S	175 (16.0%)	179 (18.4%)	-	25 (20.0%)	36 (13.9%)	-
St	361 (30.2%)	255 (17.6%)	-	54 (22.2%)	32 (18.8%)	-
T	364 (26.6%)	198 (25.8%)	-	107 (23.4%)	126 (25.4%)	-
Vo	222 (27.5%)	-	-	59 (30.5%)	-	-
Vie	-	-	3511 (21.4%)	-	-	1363 (20.2%)

Federal state outside capital city
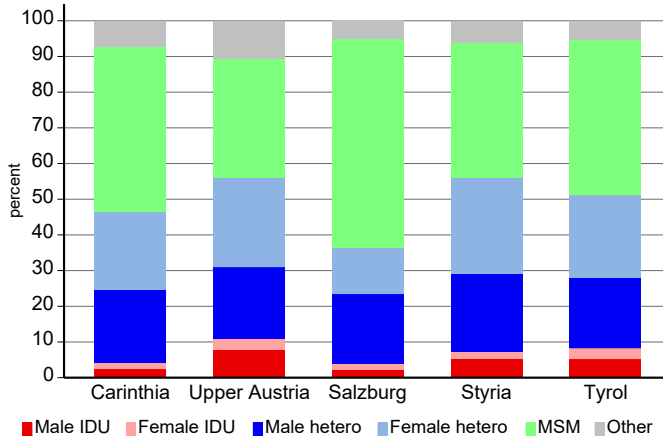
Capital city of federal state

35
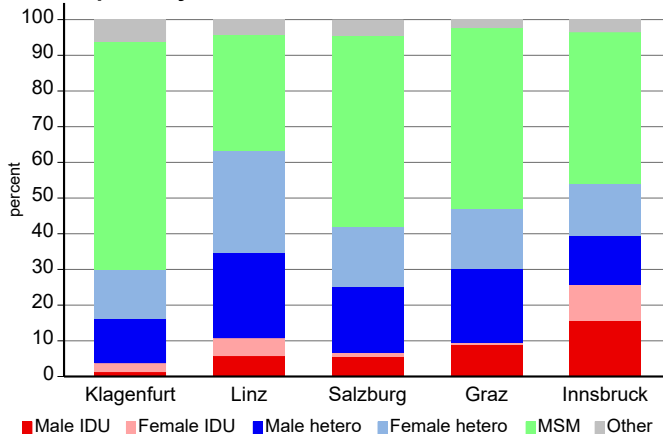
5.6.2   Residence: Federal states
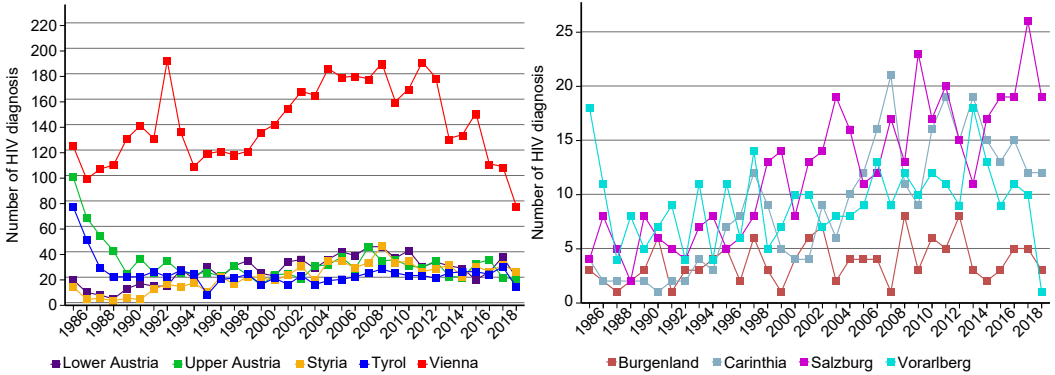
5.7   Health insurance

In the framework of statutory health insurance, all gainfully active persons must become insured. Approximately 99% of the Austrian population are protected by statutory health insurance. Depending on the type of employment there are different kinds of mandatory health insurance: e.g. BVA for civil servants, SVA for businessmen and businesswomen, and GKK for most employees.

Providers of health insurance according to the federal state (patients with a follow-up within the last 12 months)
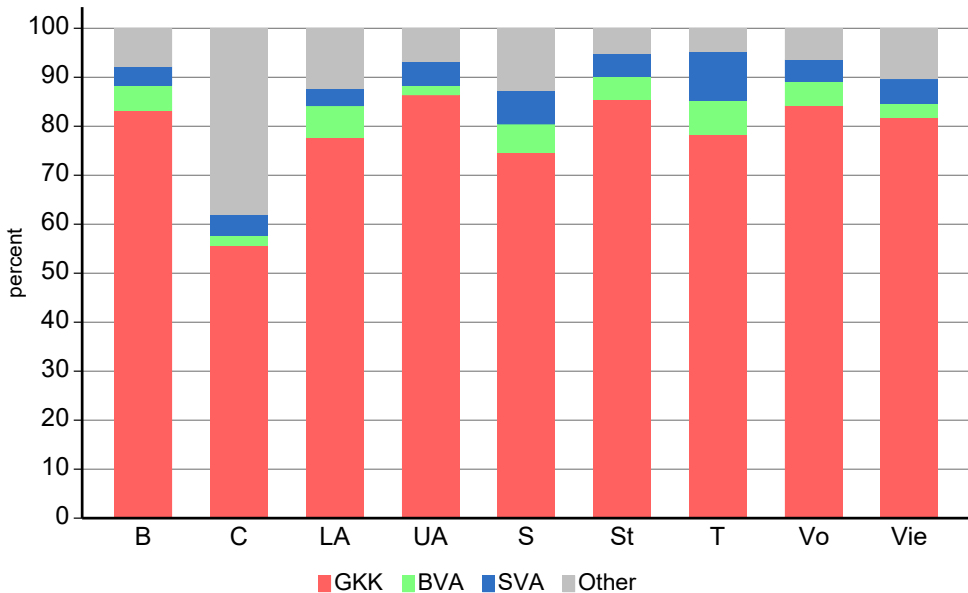
5.8 Providers of health care

Included are patients from the HIV centers in Linz and Innsbruck with a follow-up in the last 12 months.

	N of patients	General practice		Psychiatry		Internal medicine		Dermatology		Pulmo-nology		Others	
Innsbruck	715	527	73.70%	50	7.00%	38	5.30%	12	1.70%	4	0.60%	82	11.50%
Linz	577	321	55.60%	23	4.00%	46	8.00%	8	1.40%	18	3.10%	140	24.30%
Age < 50	651	375	57.60%	29	4.50%	22	3.40%	9	1.40%	7	1.10%	94	14.40%
Age ≥ 50	641	473	73.80%	44	6.90%	62	9.70%	11	1.70%	15	2.30%	128	20.00%
< 100 000	845	569	67.30%	43	5.10%	60	7.10%	10	1.20%	17	2.00%	130	15.40%
≥ 100 000	447	279	62.40%	30	6.70%	24	5.40%	10	2.20%	5	1.10%	92	20.60%
Total	1292	848	65.60%	73	5.70%	84	6.50%	20	1.50%	22	1.70%	222	17.20%

	N of patients	No doctors outside centre		GP, no specialist		Specialist, no GP		GP, + specialist	
Innsbruck	715	153	21.40%	399	55.80%	35	4.90%	128	17.90%
Linz	577	202	35.00%	179	31.00%	54	9.40%	142	24.60%
Patients without ART	13	3	23.10%	7	53.80%	1	7.70%	2	15.40%
Patients with ART	1279	352	27.50%	571	44.60%	88	6.90%	268	21.00%
HIV RNA > 50 (with ART)	68	18	26.50%	32	47.10%	3	4.40%	15	22.10%
HIV RNA ≤ 50 (with ART)	1211	334	27.60%	539	44.50%	85	7.00%	253	20.90%
Chronic hepatitis C	16	6	37.50%	5	31.30%	2	12.50%	3	18.80%
Use of antidepressants	211	39	18.50%	96	45.50%	12	5.70%	64	30.30%
MSM	526	171	32.50%	264	50.20%	20	3.80%	71	13.50%
Male IDU	92	20	21.70%	48	52.20%	5	5.40%	19	20.70%
Female IDU	59	6	10.20%	24	40.70%	5	8.50%	24	40.70%
Male hetero	246	85	34.60%	110	44.70%	10	4.10%	41	16.70%
Female hetero	295	45	15.30%	102	34.60%	43	14.60%	105	35.60%
Age < 50	651	231	35.50%	272	41.80%	45	6.90%	103	15.80%
Age ≥ 50	641	124	19.30%	306	47.70%	44	6.90%	167	26.10%
< 100 000	845	226	26.70%	397	47.00%	50	5.90%	172	20.40%
≥ 100 000	447	129	28.90%	181	40.50%	39	8.70%	98	21.90%
Total	1292	355	27.50%	578	44.70%	89	6.90%	270	20.90%

5.9   HIV-1 subtypes

Subtypes were determined by genotypic resistance testing of Reverse Transcriptase and Protease according to Stanford database. Overall 3483 subtypes were available.

Heterosexually acquired infections

MSM

IDU
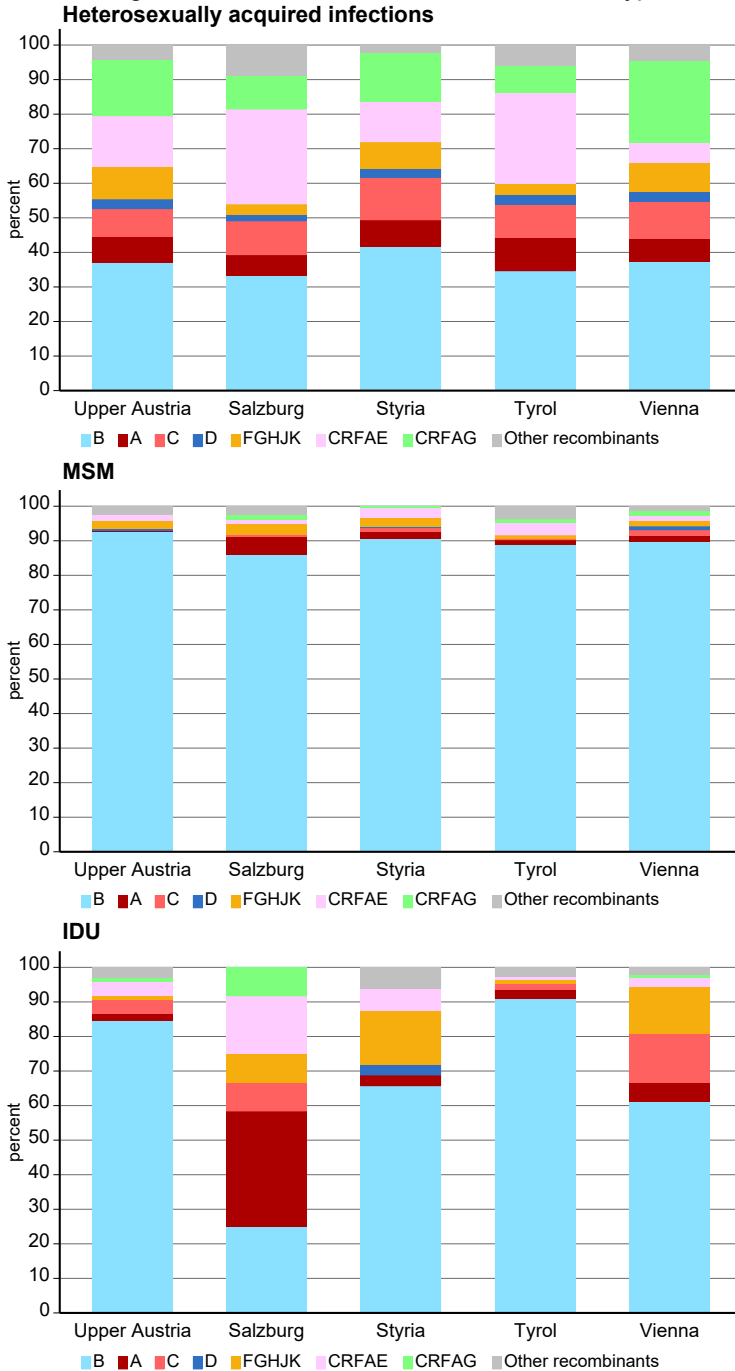
5.10 Stage of HIV disease

5.10.1 Lowest ever measured CD4 cell count

The median of the lowest CD4 cell count ever measured („CD4 nadir") in the patients with follow-up in the last 12 months is 233/µl.

CD4 nadir (patients with follow-up the last 12 months)
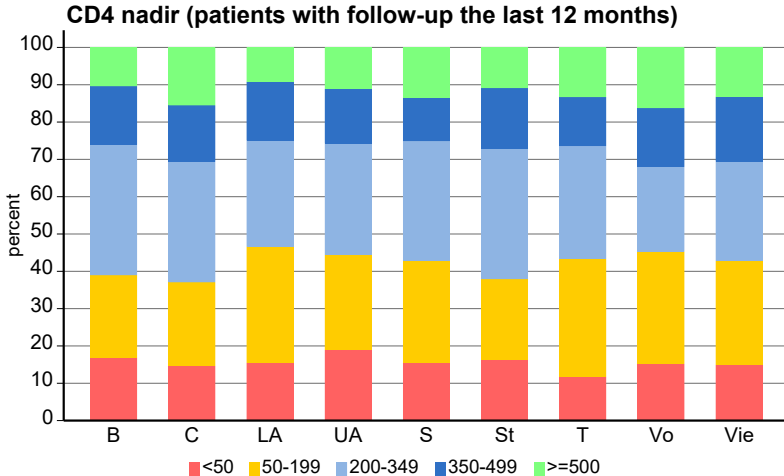
5.10.2 Proportion of Patients with AIDS

The classification of the HIV infection according to CDC puts patients in one of three clinical categories (A, B, C) and one of three CD4 cell count categories (1, 2, 3).

CD4 count		A Asymptomatic	B Non-AIDS defining conditions	C AIDS
1	≥ 500/µl	A1	B1	C1
2	200-499/µl	A2	B2	C2
3	< 200/µl	A3	B3	C3
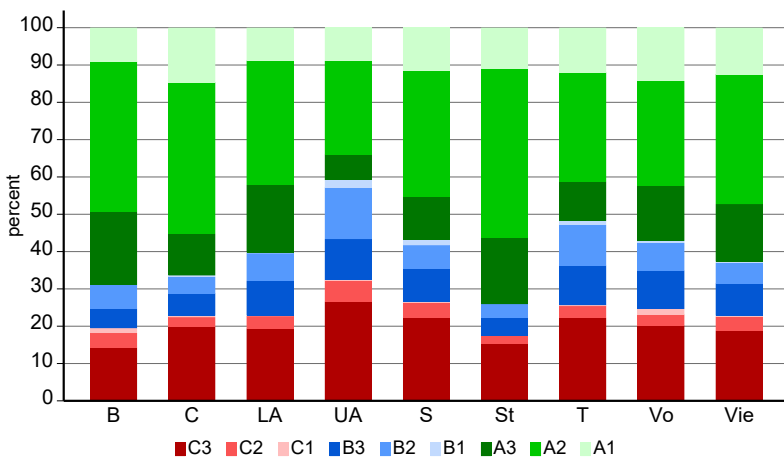
5.11 „Elite-controllers" and „viremia-controllers"

Median time from HIV-1 infection to death in untreated patients is estimated to be approximately 10-12 years. However, there is considerable variation in survival time between patients. A small number of patients remain asymptomatic for many years and maintain high CD4 cell counts or low plasma HIV RNA levels, or both, without antiretroviral therapy. Patients able to maintain high CD4 counts have been called "long-term non-progressors", whilst those with low viral loads have been called "HIV controllers" or "elite controllers". Viremic controllers have low but readily measurable virus loads. Elite controllers suppress HIV to extremely low levels, measurable only by sensitive laboratory techniques.

Being ART naive	HIV-infected up to 10 years N=2145		HIV-infected for over 10 years N=2911	
	N	%	N	%
HIV RNA ≤ 50 copies/ml	9	0.4%	12	0.4%
HIV RNA < 400 copies/ml	11	0.5%	16	0.5%
CD4 > 500 cells/µl	16	0.7%	10	0.3%
CD4 > 500 cells/µl and HIV RNA ≤ 50 copies/ml	4	0.2%	5	0.2%
CD4 > 500 cells/µl and HIV RNA < 400 copies/ml	6	0.3%	8	0.3%

6 Diagnosis of HIV and presentation to an HIV centre

6.1 Presentation to an HIV centre

Austria has one of the highest rates of HIV tests in Europe (more than 75 tests per year per 1000 population). Nevertheless, a substantial portion of the patients (>40%) are diagnosed late (CD4 cell count <350/µl).

| Year of HIV diagnosis | Time between HIV test and first CD4 cell count measurement in months | | | | | | First CD4 cell count (all patients, 425 missing) | | |
| | All Patients | | | IDU | | | | | |
	N	Median	90 Percentile	N	Median	90 Percentile	Median	Quartiles	
1985	342	64.5	181.1	198	49.7	132.3	313.5	119	545
1990	229	20.3	111.1	59	5.3	62.2	250.0	50	528
1995	217	2.6	100.8	39	4.2	110.5	238	84	470
2000	252	1.0	118.3	55	2.2	92.0	361	147.5	564.5
2005	346	0.7	72.6	81	1.1	34.5	349	147	536
2006	351	0.7	56.9	56	1.0	30.6	366	198	576
2007	370	0.7	75.3	73	1.8	61.3	323.5	152	549
2008	391	0.8	65.0	49	1.7	88.3	392	224	556
2009	338	0.6	57.5	38	0.8	49.0	342	192	531
2010	349	0.5	49.3	48	0.7	59.4	389	193	626
2011	350	0.5	39.0	54	1.4	37.8	380	221	561
2012	359	0.5	35.5	53	0.9	45.9	359	142	580
2013	297	0.5	27.5	26	1.4	40.9	398	196	623
2014	288	0.6	25.0	30	2.2	49.3	377	201	559
2015	307	0.5	23.1	32	1.8	27.8	366	175	558
2016	279	0.4	6.1	18	0.7	7.7	369	164	550
2017	287	0.4	4.0	17	1.2	9.4	377	179	562
2018	193	0.3	2.3	12	0.4	3.6	359	187	532
2019	127	0.3	1.1	9	0.7	7.2	372	137	593

CD4 count at HIV-test
All

Legend: ■ <50 ■ 50-199 ■ 200-349 ■ 350-499 ■ >=500 ■ No CD4 within 6 months

Male IDU

Female IDU

Male heterosexual

Legend: <50, 50-199, 200-349, 350-499, >=500, No CD4 within 6 months
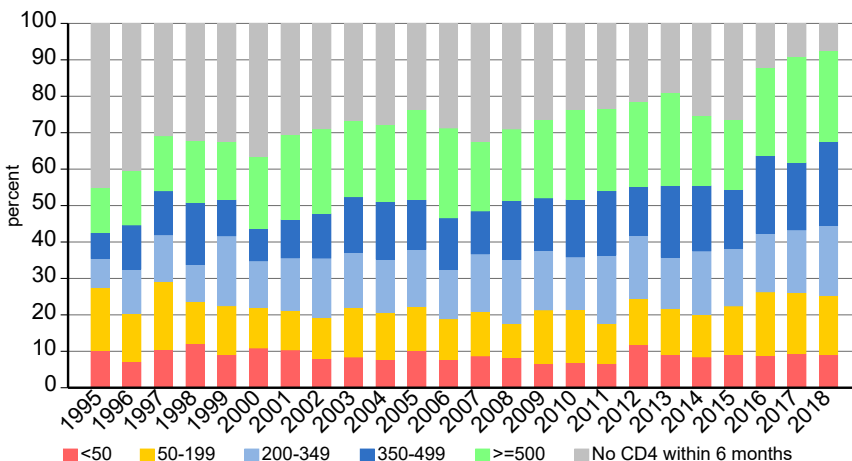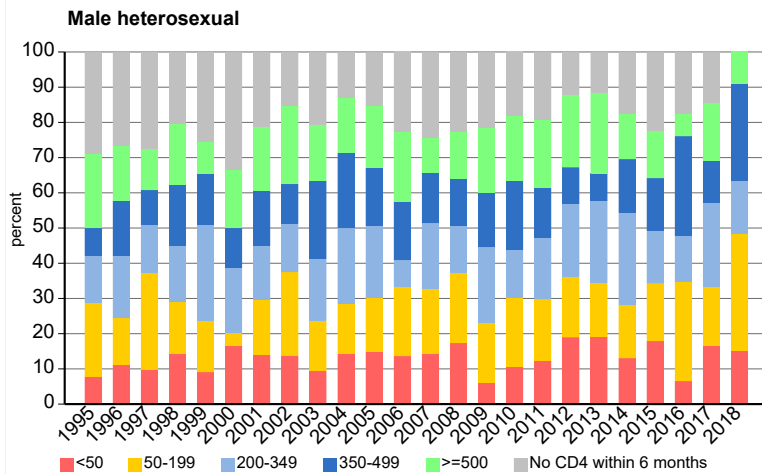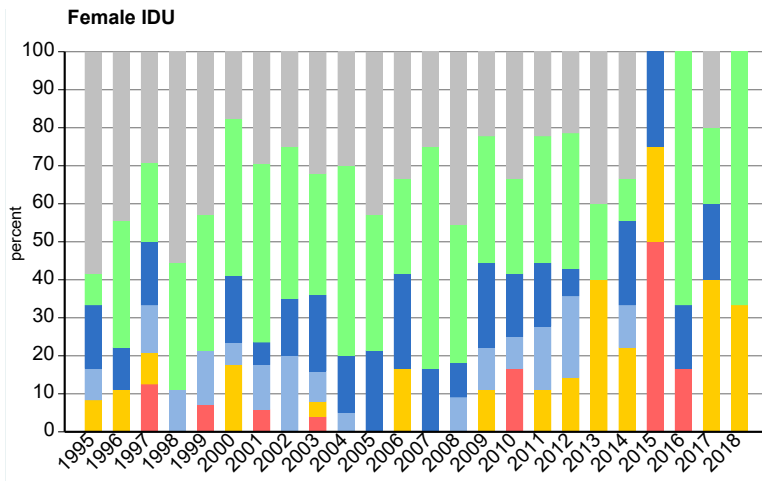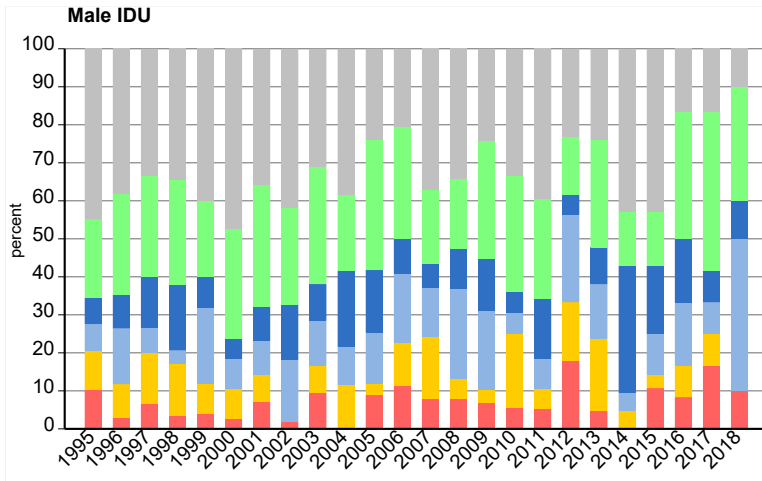
Female heterosexual

MSM

Other

Legend: ■ <50 ■ 50-199 ■ 200-349 ■ 350-499 ■ >=500 ■ No CD4 within 6 months

43
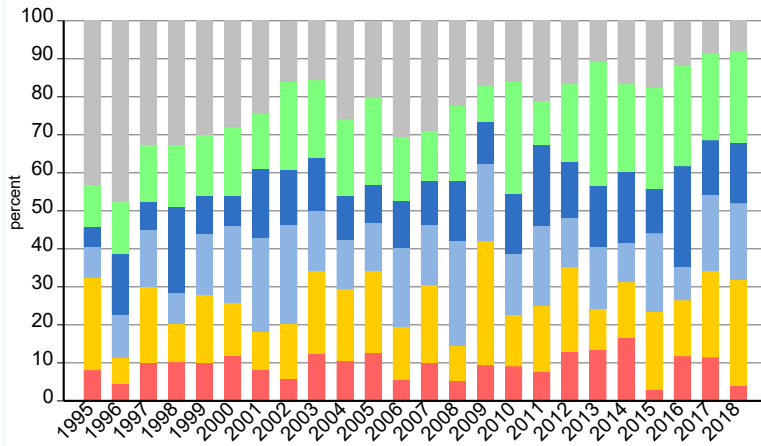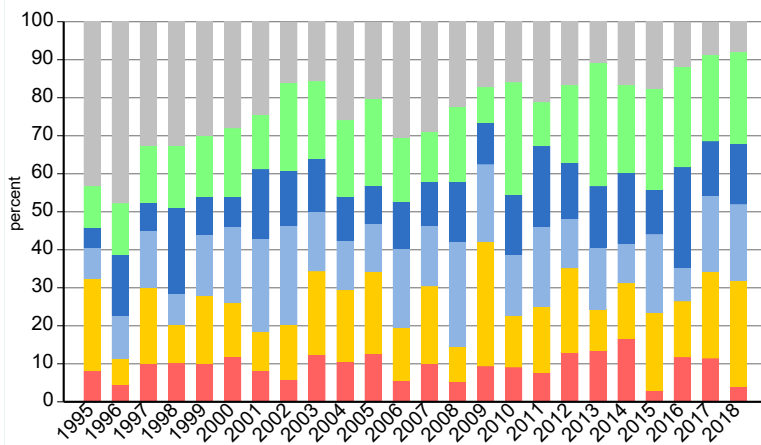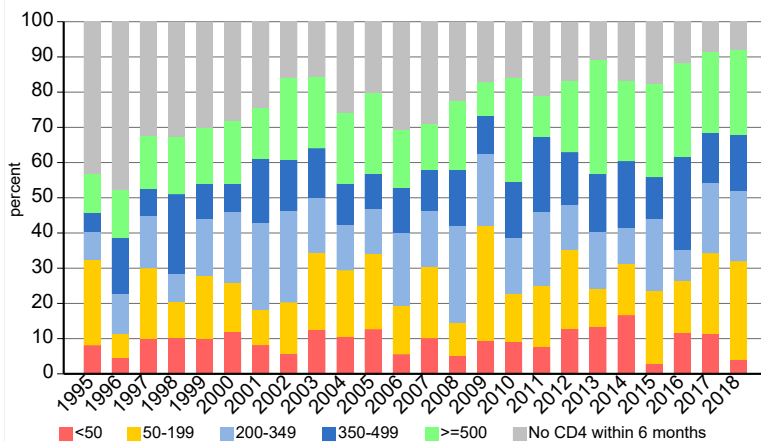
6.2 Patients diagnosed since 2001

6.2.1 Frequency of early and late diagnoses

"Early" diagnosis or **„recent" infection** is defined as: acute HIV infection (westernblot pattern or antigen/HIV RNA combined with clinical presentation) or documented seroconversion with negative HIV test not more than 3 years before the first positive test.

"Late" diagnosis is defined as: CD4 cell count below 350 at time of HIV diagnosis and/or AIDS within 3 months of HIV diagnosis

"Advanced" diagnosis is defined as: CD4 cell count below 200 at time of HIV diagnosis and/or AIDS within 3 months of HIV diagnosis

"Intermediate" diagnosis: CD4 cell count > 200, however not early diagnosed

Percentage of patients with late and advanced diagnosis

AIDS diagnosis within 3 months of testing HIV positive
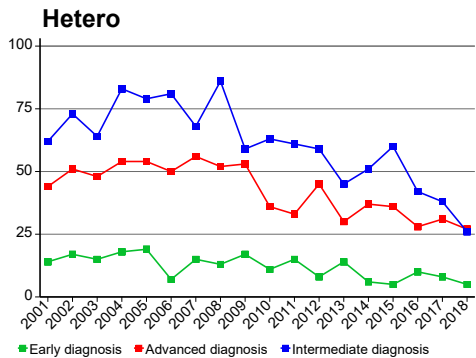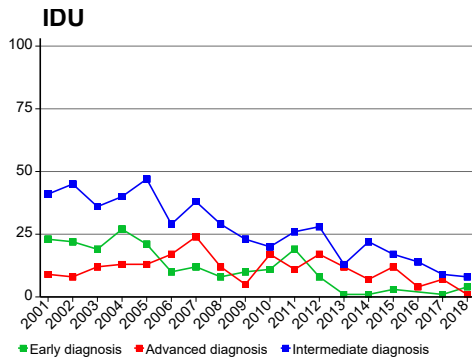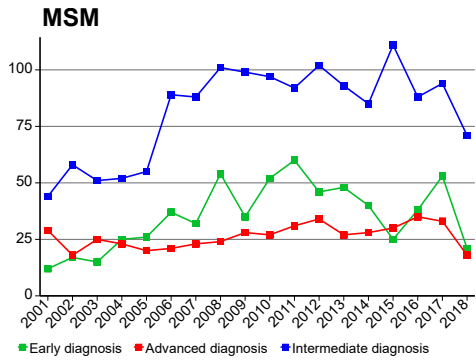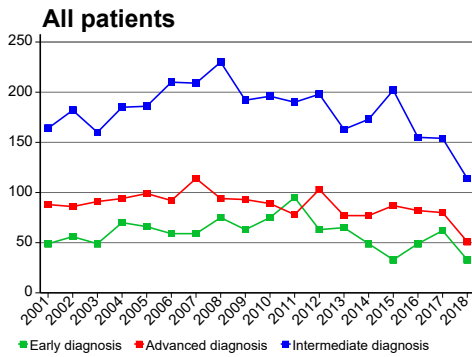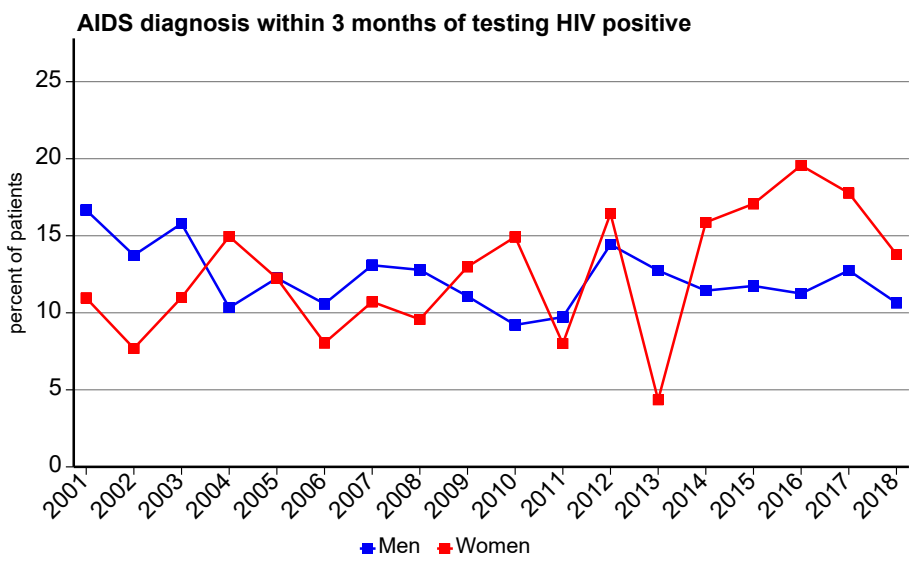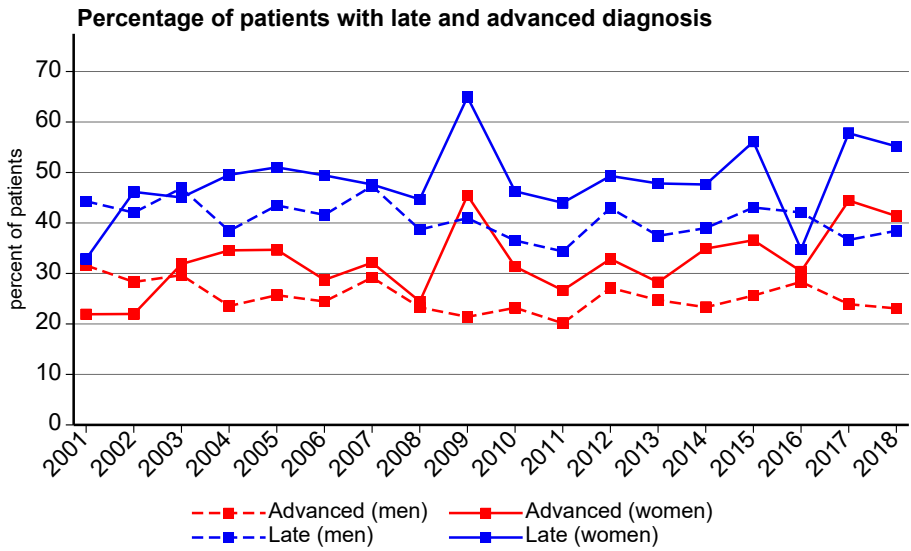
6.2.2 Factors associated with an „early" diagnosis in patients diagnosed since 2001

"Early" diagnosis or „recent" infection is defined as: acute HIV infection (westernblot pattern or antigen/HIV RNA combined with clinical presentation) or documented seroconversion with negative HIV test not more than 3 years before the first positive test.

All centres	1089	6042	18.02%	Univariable logistic Regression			Multivariable logistic Regression		
	Frequencies		%	OR	[95% CI]	p value	OR	[95% CI]	p value
Demographic characteristics									
Age at time of HIV diagnosis									
< 30 years	444	2146	20.69%	1.80	[1.41,2.30]	0.000	1.79	[1.37,2.32]	0.000
30-50 years	554	3177	17.44%	1.46	[1.15,1.85]	0.002	1.38	[1.07,1.77]	0.012
≥ 50	91	719	12.66%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
HIV transmission category									
Male IDU	136	675	20.15%	0.77	[0.63,0.95]	0.016	0.80	[0.64,0.99]	0.044
Female IDU	65	221	29.41%	1.28	[0.95,1.73]	0.110	1.14	[0.83,1.56]	0.435
Male heterosexual	110	1120	9.82%	0.33	[0.27,0.41]	0.000	0.39	[0.31,0.49]	0.000
Female heterosexual	109	1002	10.88%	0.37	[0.30,0.47]	0.000	0.45	[0.36,0.57]	0.000
Other	17	370	4.59%	0.15	[0.09,0.24]	0.000	0.17	[0.10,0.28]	0.000
MSM	652	2654	24.57%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Federal state									
Carinthia	30	242	12.40%	0.77	[0.52,1.14]	0.194			
Upper Austria	102	519	19.65%	1.33	[1.05,1.69]	0.019			
Salzburg	78	313	24.92%	1.80	[1.37,2.38]	0.000			
Styria	86	532	16.17%	1.05	[0.81,1.35]	0.712			
Tyrol	144	399	36.09%	3.07	[2.44,3.86]	0.000			
Other federal states	165	858	19.23%	1.29	[1.06,1.58]	0.010			
Missing	0	7	0.00%	1.00	[1.00,1.00]	.			
Foreign countries	41	320	12.81%	0.80	[0.57,1.13]	0.200			
Vienna	443	2852	15.53%	1.00	[1.00,1.00]	.			
Population size of area of residence									
Missing value	8	109	7.34%	0.44	[0.21,0.90]	0.025	0.63	[0.30,1.33]	0.226
< 100 000	468	2230	20.99%	1.46	[1.26,1.68]	0.000	1.78	[1.53,2.07]	0.000
≥ 100 000	168	814	20.64%	1.43	[1.17,1.74]	0.000	1.71	[1.39,2.11]	0.000
> 1 million	445	2889	15.40%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Nationality									
Missing value	1	29	3.45%	0.12	[0.02,0.92]	0.041	0.17	[0.02,1.26]	0.083
Low prevalence countries	178	1375	12.95%	0.52	[0.44,0.62]	0.000	0.51	[0.43,0.61]	0.000
High prevalence countries	40	726	5.51%	0.20	[0.15,0.28]	0.000	0.30	[0.21,0.43]	0.000
Austria	870	3912	22.24%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Calendar period of HIV test									
2005-2008	259	1493	17.35%	0.98	[0.81,1.20]	0.871	0.97	[0.79,1.19]	0.754
2009-2012	296	1435	20.63%	1.22	[1.00,1.48]	0.045	1.10	[0.90,1.35]	0.342
≥ 2013	310	1840	16.85%	0.95	[0.79,1.15]	0.593	0.84	[0.69,1.03]	0.093
2001-2004	224	1274	17.58%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.

6.2.3 Factors associated with a „late" diagnosis in patients diagnosed since 2001

"Late" diagnosis is defined as: CD4 cell count below 350 at time of HIV diagnosis and/or AIDS within 3 months of HIV diagnosis

All centres	2562	6042	42.40%	Univariable logistic Regression			Multivariable logistic Regression		
	Frequencies		%	OR	[95% CI]	p value	OR	[95% CI]	p value
Demographic characteristics									
Age at time of HIV diagnosis									
< 30 years	703	2146	32.76%	0.36	[0.30,0.43]	0.000	0.37	[0.31,0.45]	0.000
30-50 years	1445	3177	45.48%	0.61	[0.52,0.72]	0.000	0.65	[0.55,0.78]	0.000
≥ 50	414	719	57.58%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
HIV transmission category									
Male IDU	269	675	39.85%	1.33	[1.11,1.58]	0.001	1.44	[1.20,1.72]	0.000
Female IDU	55	221	24.89%	0.66	[0.48,0.91]	0.011	0.83	[0.60,1.15]	0.267
Male heterosexual	637	1120	56.88%	2.64	[2.29,3.05]	0.000	2.13	[1.83,2.49]	0.000
Female heterosexual	521	1002	52.00%	2.17	[1.87,2.51]	0.000	1.94	[1.65,2.28]	0.000
Other	196	370	52.97%	2.26	[1.81,2.81]	0.000	1.99	[1.58,2.50]	0.000
MSM	884	2654	33.31%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Federal state									
Carinthia	106	242	43.80%	1.12	[0.86,1.46]	0.412			
Upper Austria	239	519	46.05%	1.22	[1.01,1.48]	0.035			
Salzburg	136	313	43.45%	1.10	[0.87,1.39]	0.422			
Styria	240	532	45.11%	1.18	[0.98,1.42]	0.085			
Tyrol	148	399	37.09%	0.85	[0.68,1.05]	0.128			
Other federal states	391	858	45.57%	1.20	[1.03,1.40]	0.020			
Missing	1	7	14.29%	0.24	[0.03,1.99]	0.185			
Foreign countries	129	320	40.31%	0.97	[0.77,1.23]	0.788			
Vienna	1172	2852	41.09%	1.00	[1.00,1.00]	.			
Population size of area of residence									
Missing value	39	109	35.78%	0.80	[0.53,1.19]	0.263	0.67	[0.44,1.02]	0.060
< 100 000	998	2230	44.75%	1.16	[1.04,1.29]	0.010	1.01	[0.89,1.13]	0.920
≥ 100 000	336	814	41.28%	1.01	[0.86,1.18]	0.950	0.90	[0.76,1.06]	0.196
> 1 million	1189	2889	41.16%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Nationality									
Missing/Unknown	6	29	20.69%	0.39	[0.16,0.96]	0.040	0.34	[0.14,0.86]	0.023
Low prevalence countries	568	1375	41.31%	1.05	[0.93,1.19]	0.425	1.14	[1.00,1.30]	0.047
High prevalence countries	420	726	57.85%	2.05	[1.75,2.41]	0.000	1.66	[1.38,1.99]	0.000
Austria	1568	3912	40.08%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Calendar period of HIV test									
2005-2008	658	1493	44.07%	1.04	[0.89,1.21]	0.634	1.05	[0.90,1.23]	0.561
2009-2012	592	1435	41.25%	0.92	[0.79,1.08]	0.313	0.97	[0.83,1.14]	0.755
≥ 2013	762	1840	41.41%	0.93	[0.81,1.08]	0.329	0.98	[0.84,1.14]	0.783
2001-2004	550	1274	43.17%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.

6.2.4 Factors associated with mortality in patients diagnosed since 2001

Date of censoring: last contact with the HIV centre (24missing)

All centres	585	6042	9.68%	Univariable Cox Regression			Multivariable Cox Regression		
	Frequencies		%	HR	[95% CI]	p value	HR	[95% CI]	p value
Demographic characteristics									
Age at time of HIV diagnosis									
< 30 years	147	2146	6.85%	0.25	[0.20,0.31]	0.000	0.17	[0.13,0.23]	0.000
30-50 years	276	3177	8.69%	0.33	[0.27,0.40]	0.000	0.29	[0.23,0.36]	0.000
≥ 50	162	719	22.53%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
HIV transmission category									
Male IDU	170	675	25.19%	3.87	[3.10,4.84]	0.000	4.60	[3.63,5.83]	0.000
Female IDU	51	221	23.08%	3.14	[2.27,4.32]	0.000	4.13	[2.94,5.80]	0.000
Male heterosexual	121	1120	10.80%	1.77	[1.39,2.26]	0.000	1.21	[0.94,1.56]	0.142
Female heterosexual	57	1002	5.69%	0.84	[0.62,1.15]	0.278	0.86	[0.62,1.18]	0.349
Other	45	370	12.16%	2.71	[1.94,3.79]	0.000	1.91	[1.35,2.71]	0.000
MSM	141	2654	5.31%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Population size of area of residence									
Missing value	7	109	6.42%	1.07	[0.50,2.26]	0.865	1.38	[0.63,3.01]	0.415
< 100 000	179	2230	8.03%	0.68	[0.56,0.81]	0.000	0.72	[0.60,0.88]	0.001
≥ 100 000	61	814	7.49%	0.62	[0.47,0.82]	0.001	0.78	[0.59,1.04]	0.088
> 1 million	338	2889	11.70%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Nationality									
Missing/Unknown	4	29	13.79%	1.23	[0.46,3.30]	0.679	1.37	[0.49,3.81]	0.548
Low prevalence countries	73	1375	5.31%	0.54	[0.42,0.69]	0.000	0.70	[0.54,0.90]	0.005
High prevalence countries	34	726	4.68%	0.40	[0.29,0.57]	0.000	0.68	[0.47,0.99]	0.047
Austria	474	3912	12.12%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Stage of disease									
Advanced diagnosis									
Yes	253	1615	15.67%	2.19	[1.86,2.57]	0.000	2.05	[1.73,2.44]	0.000
No	332	4427	7.50%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Calendar period of HIV test									
2005-2008	168	1493	11.25%	0.69	[0.57,0.85]	0.000	0.77	[0.63,0.95]	0.013
2009-2012	113	1435	7.87%	0.69	[0.54,0.87]	0.002	0.76	[0.60,0.96]	0.022
≥ 2013	56	1840	3.04%	0.52	[0.38,0.71]	0.000	0.57	[0.42,0.79]	0.001
2001-2004	248	1274	19.47%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.

Survival after the HIV diagnosis

Number at risk
Advanced	1614	1339	1213	1101	1012	920
Early	4410	3898	3564	3246	2976	2694

Number at risk
Male IDU	672	595	554	517	478	436
Female IDU	221	207	194	185	179	170
Male heterosexual	1119	956	881	803	741	672
Female heterosexual	1001	885	837	780	733	692
MSM	2647	2321	2074	1855	1677	1488
Other	364	273	237	207	180	156
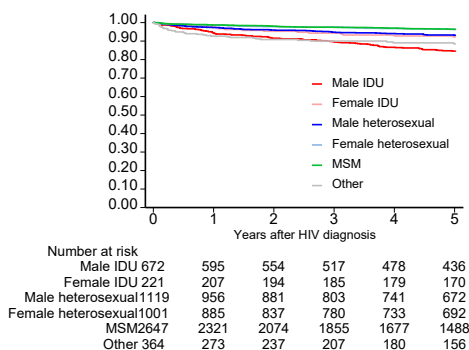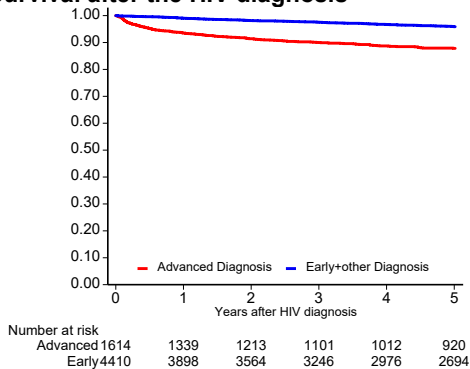
7 Co-infections

7.1 Syphilis

Syphilis can persist for several years when it is not treated, and reinfection with syphilis is possible because there is no protective immunity.

7.1.1 Status post syphilis diagnoses

Included are all patients seen since 1.1.2001.
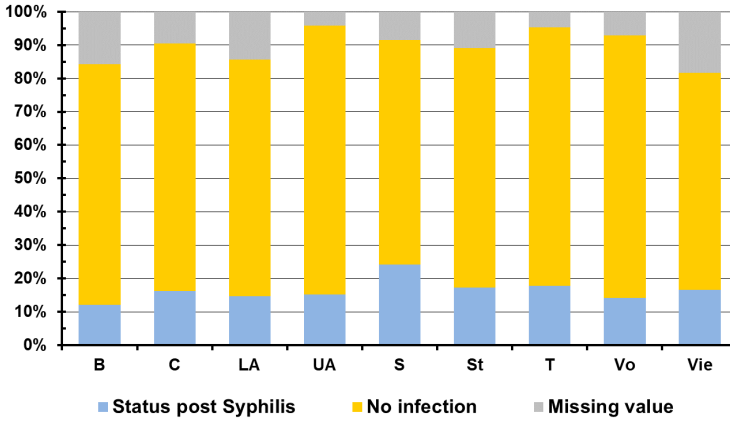
7.1.2 Syphilis at time of HIV diagnosis
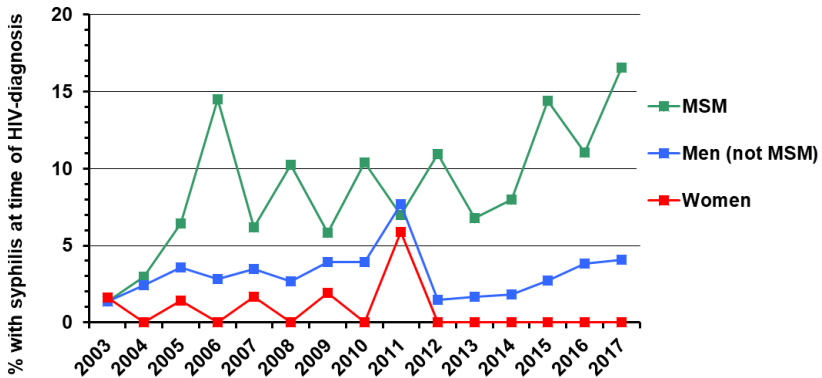
7.1.3 Stages of syphilis among HIV-infected MSM
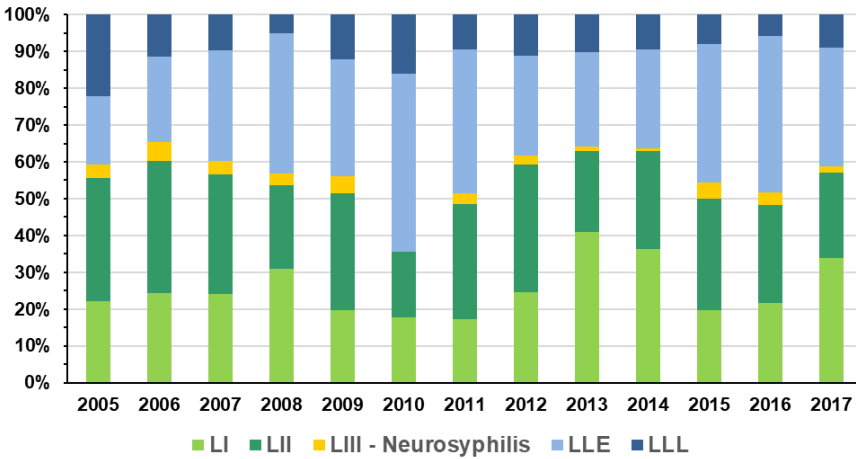
7.1.4 „Recent" syphilis infections: Incidence

This analysis only includes new "recent" syphilis infections defined as follows: patients with a former syphilis result that was either negative or a status post treatment and who now presented with active syphilis (= new „recent" syphilis infections).
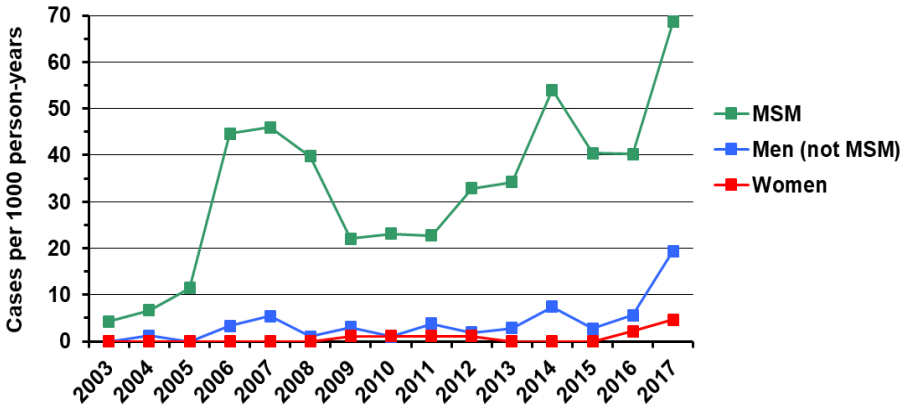
	MSM with incident syphilis		MSM without syphilis		Odds ratio	± 95% C.I.	
N	533	(100.0%)	1825	(100.0%)			
Patients not on ART	105	(19.7%)	313	(17.2%)			
Patients on ART	428	(80.3%)	1512	(82.8%)	0.84	0.66 to	1.08
ART interruptions	95	(22.2%)	274	(18.1%)	1.29	0.99 to	1.68
Mean duration of ART in months (± SD)	34.4	(± 66.5)	61.6	(± 67.9)	p<0.001		
Patients on ART since 2.5 m	339	(63.6%)	1372	(75.2%)	0.43	0.32 to	0.58
HIV RNA <50 copies/ml	299	(88.2%)	1223	(89.1%)	0.77	0.51 to	1.15
Chronic hepatitis B	22	(4.1%)	42	(2.3%)	1.83	1.08 to	3.09
Chronic hepatitis C	20	(3.8%)	25	(1.4%)	2.81	1.55 to	5.09
Resistance							
Any (on ART)	86	(20.1%)	206	(13.6%)	1.51	1.15 to	1.99
Any transmitted	34	(6.4%)	97	(5.3%)	1.21	0.81 to	1.82
Mean CD4 nadir (± SD)	283.2	(± 175.3)	308.9	(± 219.9)	p=0.014		
Mean age (± SD)	40.6	(± 10.0)	44.3	(± 12.6)	p<0.001		

Incident cases of syphilis among HIV-infected MSM
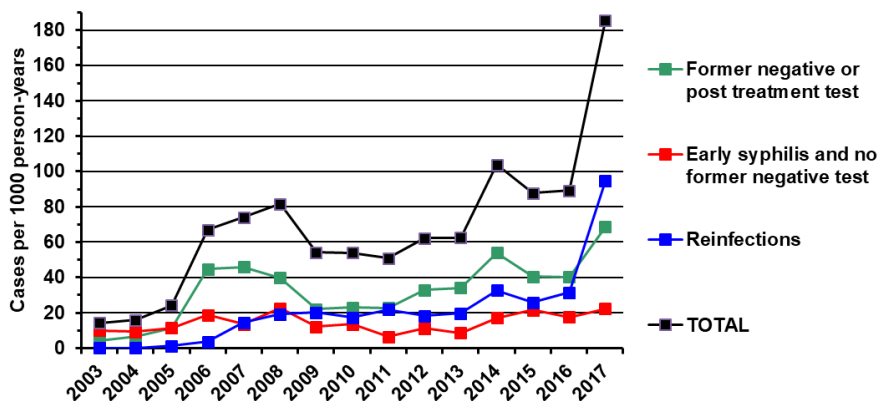
7.2 Tuberculosis in patients seen since 1.1.2010

Tuberculosis is incompletely recorded in the *HIV Patient Management System*.

Tuberculosis
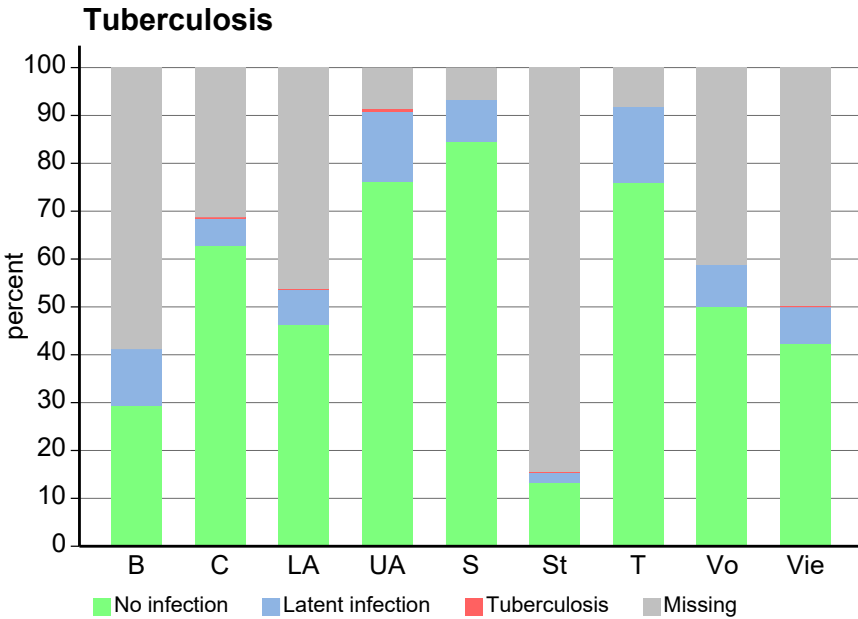
7.3 Hepatitis C

HCV co-infection was defined by a positive result on a qualitative or quantitative RNA test result.

Hepatitis C-All patients since 2010
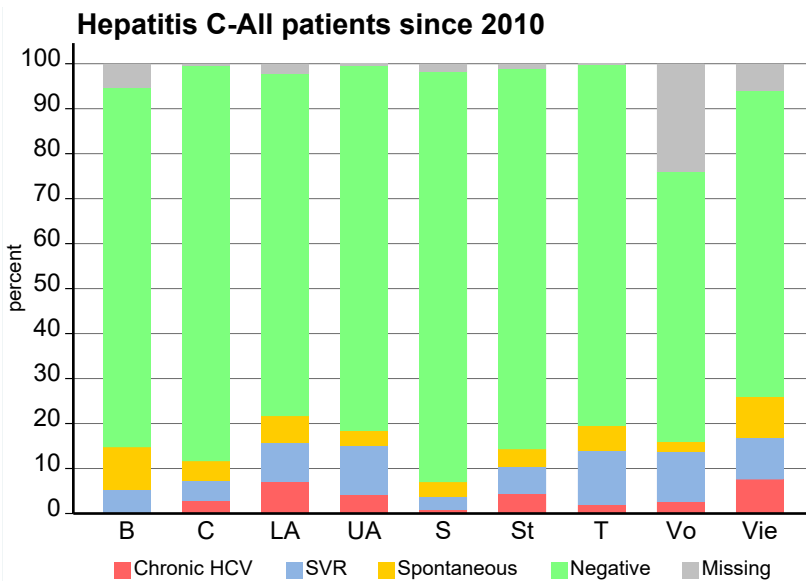
7.3.1 Cascade of Care in patients seen since 1.1.2014

Stage	Definition
Stage1: anti-HCV +ve	Either anti-HCV positive test, HCV-RNA positive test, HCV genotyped or received HCV treatment before index date
Stage 2: HCV-RNA tested	Either HCV-RNA tested, HCV genotyped or received HCV treatment before index date
Stage 3: Ever HCV-RNA +ve	Either HCV-RNA positive test, received HCV treatment or HCV genotyped before index date
Stage 4: Remaining HCV-RNA +ve	HCV-RNA ever positive and no spontaneous clearance
Stage 5: Ever received treatment	Started HCV treatment on or before index date
Stage 6: Cured (SVR) and ongoing therapy	HCV-RNA test after completing treatment (HCV-RNA test data included for duration of FU to allow for assessment of SVR); Ongoing therapy if still on treatment or end of therapy less than 12 weeks before 01.09.2017
Stage 8: Cured (SVR)	HCV-RNA negative test at least 12 or 24 weeks post-treatment (for IFN-free and IFN-based therapy, respectively)
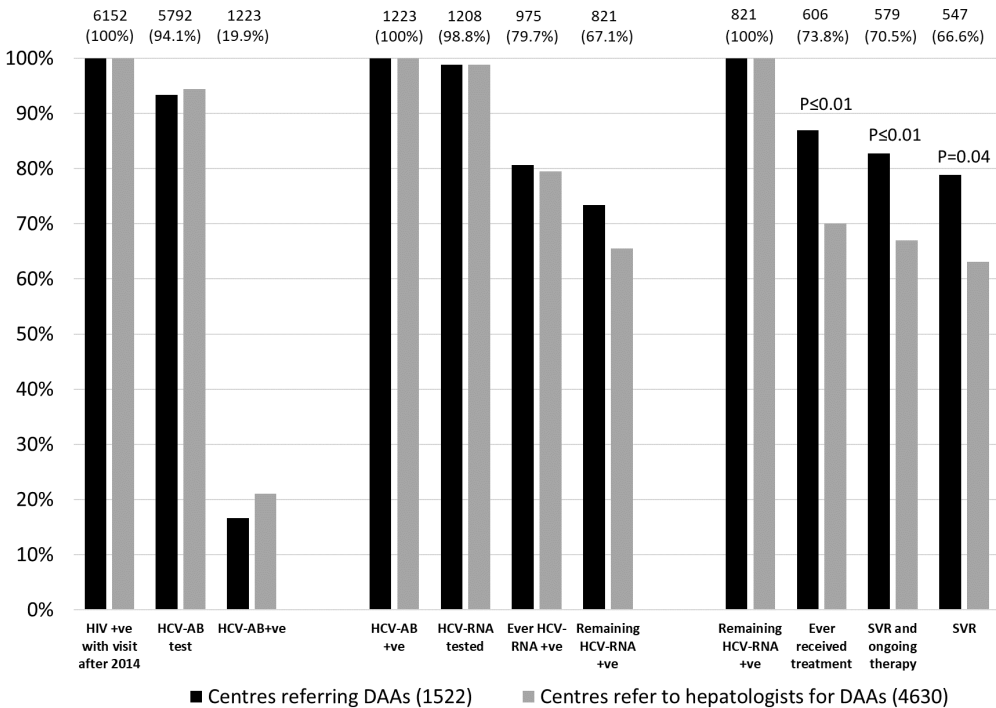
7.4　　　Hepatitis B in patients seen since 1.1.2010

Chronic HBV was defined by a positive result on a hepatitis B surface antigen (HBsAg) test or by a positive HBV DNA test result.

Hepatitis B-All patients since 2010
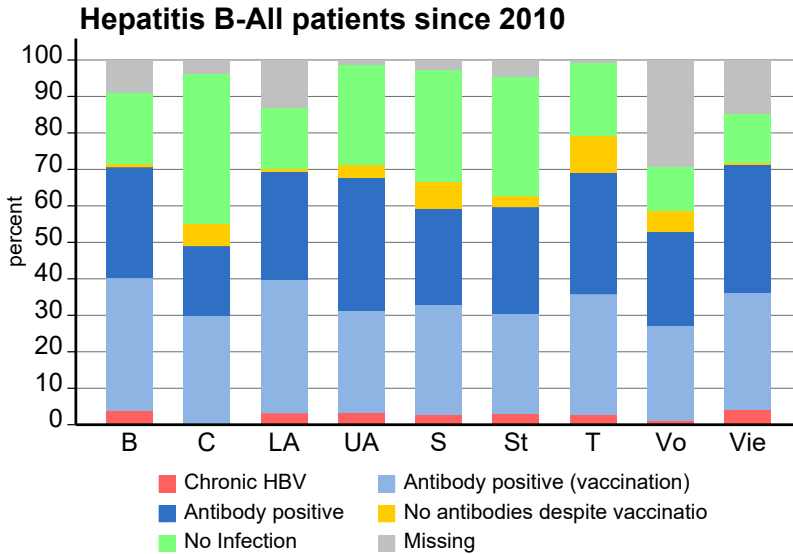
Therapy for hepatitis B (patients currently in care)

Current guidelines recommend the use of tenofovir and emtricitabine or tenofovir and lamivudine as the NRTI-backbones in cART combinations for HBV-HIV co-infected patients. Most of the HBV-HIV co-infected patients in care at one of the Austrian HIV treatment centres received an NRTI-backbone to help control the HBV infection.
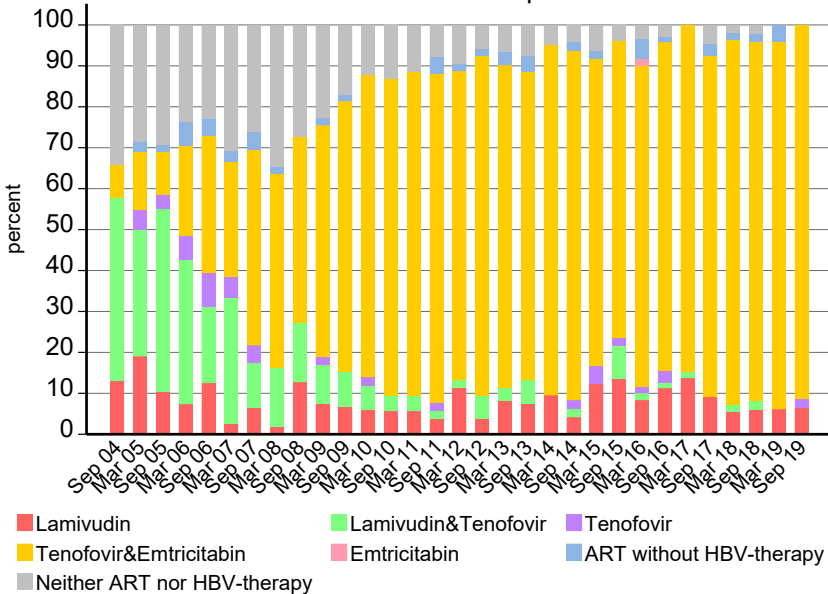
8   Transmission of drug resistant HIV

8.1   Abstract

Prevalence of Transmitted Drug Resistance is Stabilising at a Low Rate in Austria

Objective: To determine the prevalence of transmitted drug resistance (TDR), temporal trends in resistance, and predictors for TDR.

Method: Newly diagnosed patients from 2003 to December 2018 from nine centres were analyzed. Mutations were judged as resistant according to Bennett et al. (WHO 2009 mutation list). For patients with acute or recent infection the year of infection was obtained by the date of primary HIV infection or the median point in time between negative and positive HIV test. For patients with chronic infection the rate of resistance was plotted against the year of the HIV diagnosis.

Results: Overall 3454 of 5249 patients had an amplifiable resistance test. The overall prevalence of TDR was 7.2 (248 of 3454 patients; 95% CI: 6.4%-8.1%). The prevalence of NRTI resistance was 3.0% (2.5%-3.7%), the prevalence of NNRTI resistance was 2.8% (2.3%-3.4%), and the prevalence of PI resistance was 1.8% (1.4%-2.3%). The relative risk of TDR in men who have sex with men compared to heterosexual contacts was 1.8 (95% CI: 1.3-2.3). The prevalence rate of TDR in the 1014 patients with acute/recent infection was 8.1% (63 of 776 patients; 6.4%-10.3%). One patient (0.1%) showed TDR against 3 drug classes (K70R; K103N; L90M). The prevalence rate of TDR in the 4212 patients with chronic infection was 6.9% (185 of 2678 patients; 6.0%-7.9%).

Conclusions: The prevalence of TDR among newly diagnosed patients was found to be stabilizing. No difficult to treat cases of TDR has been observed

8.2   Introduction

Number of cohort participants:
Only patients with HIV diagnosis between 2003-2018 have been analyzed because extensive documentation of resistance testing started at this time.

HIV test	OWS Vienna	AKH Vienna	KFJ Vienna	Linz	Salz-burg	Inns-bruck	Feld-kirch	Graz	Klagen-furt	Total
until 2003	1581	1192	29	600	121	808	12	234	64	**4641**
2003-2018	1105	1818	164	499	342	550	75	489	207	**5249**

The rate of transmission of drug resistant HIV („percent with resistance") corresponds to the number of patients with resistance mutations in relation to the number of patients with a genotypic resistance test before antiretroviral therapy. For this, the genomes of the reverse transcriptase (RT) and the protease (P) were sequenced. The resistance mutations have been classified according to Bennett DE et al. Drug resistance mutations for surveillance of transmitted HIV-1 drug-resistance: 2009 update. PLoS One 2009;4(3):e4724.

Patients were either analysed according to the time of the infection („recent infection"), or, if this was not known, patients were analysed according to the year of the HIV diagnosis.

The following codons and amino acids were classified as resistance:

Reverse Transkriptase				Protease	
NRTI		**NNRTI**			
M41	L	L100	I	L23	I
K65	R	K101	E, P	L24	I
D67	N, G, E	K103	N, S	D30	N
T69	D, ins	V106	M, A	V32	I
K70	R, E	V179	F	M46	I, L
L74	V, I	Y181	C, I, V	I47	V, A
V75	T, M, A, S	Y188	L, H, C	G48	V, M
F77	L	G190	A, S, E	I50	V, L
Y115	F	P225	H	F53	L, Y
F116	Y	M230	L	I54	V, L, M, A, T, S
Q151	M			G73	S, T, C, A
M184	V, I			L76	V
L210	W			V82	A, T, F, S, C, M, L
T215	Y, F, I, S, C, D, V, E			N83	D
K219	Q, E, N, R			I84	V, A, C
				I85	V
				N88	D, S
				L90	M

8.3 Number of patients with "recent"or chronic HIV infection

	Number of HIV diagnoses	"Recent" infections	Unknown time of infection
Year	**Year of HIV diagnosis**	**Year of HIV infection**	**Year of HIV diagnosis**
2001	-	2	-
2002	-	21	-
2003	297	61	246
2004	349	64	277
2005	350	77	281
2006	362	56	301
2007	382	82	310
2008	394	66	316
2009	345	64	282
2010	357	98	272
2011	360	98	256
2012	364	62	294
2013	308	68	232
2014	296	46	243
2015	315	45	280
2016	285	52	235
2017	294	50	229
2018	191	25	158
Total	**5249**	**1037**	**4212**

8.4 „Recent" infection (time of infection known or estimated)

„Recent" infection means:

- Acute HIV infection (westernblot pattern or antigen/HIV RNA with clinical symptoms)
- Documented seroconversion with a negative HIV test not more than 3 years before the first positive test

Calculation of the time of infection (year of the HIV infection):

- Time point of the acute HIV infection or
- Midpoint between last negative and first positive HIV test

	Number of "recent" HIV infections	Available resistance tests before ART	Any resistance
Year of "recent" HIV infection			
2003	61	50	5
2004	64	52	3
2005	77	57	3
2006	56	43	3
2007	82	63	8
2008	66	52	6
2009	64	51	7
2010	98	73	8
2011	98	80	5
2012	62	45	3
2013	68	52	4
2014	46	34	2
2015	45	34	3
2016	52	39	1
2017	50	34	1
2018	25	17	1
Sex/ mode of transmission			
MSM	640	496	48
Male IDU	109	78	3
Female IDU	43	28	2
Male heterosexual	103	86	7
Female heterosexual	97	77	2
Other	22	11	1
Total	**1014**	**776**	**63**

Overall rate of transmitted drug resistance in recent infection was 8.1% (63 of 776).
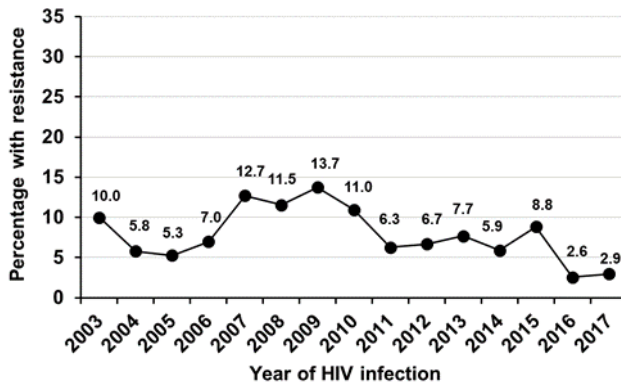
The year 2018 is not shown in the graph, as because of the definition of recent infection only a limited number of patients can be defined.

	Number of HIV infections	Available resistance tests	Wild type	Any resistance	Resistance to						
					NRTI	NNRTI	PI	NRTI and PI	NRTI and NNRTI	NNRTI and PI	3-class resistance
Year of HIV infection											
2003	61	50	45	5	4	1	-	-	-	-	-
2004	64	52	49	3	-	3	-	-	-	-	-
2005	77	57	54	3	1	2	-	-	-	-	-
2006	56	43	40	3	1	2	-	-	-	-	-
2007	82	63	55	8	4	4	3	1	2	1	1
2008	66	52	46	6	3	1	3	1	-	-	-
2009	64	51	44	7	2	3	4	1	-	1	-
2010	98	73	65	8	1	6	1	-	-	-	-
2011	98	80	75	5	1	4	1	-	-	1	-
2012	62	45	42	3	3	-	-	-	-	-	-
2013	68	52	48	4	1	2	1	-	-	-	-
2014	46	34	32	2	2	-	-	-	-	-	-
2015	45	34	31	3	1	2	-	-	-	-	-
2016	52	39	38	1	-	1	-	-	-	-	-
2017	50	34	33	1	-	-	1	-	-	-	-
2018	25	17	16	1	-	1	-	-	-	-	-
Population size of area of residence											
Rural areas	427	337	308	29	11	16	6	1	1	3	1
Capital cities	156	129	117	12	3	5	5	1	-	-	-
Vienna	424	306	284	22	10	11	3	1	1	-	-
Missing value	7	4	4	-	-	-	-	-	-	-	-
Sex/ mode of transmission											
MSM	640	496	448	48	18	25	12	3	2	3	1
Male IDU	109	78	75	3	2	1	-	-	-	-	-
Female IDU	43	28	26	2	-	2	-	-	-	-	-
Male heterosexual	103	86	79	7	2	3	2	-	-	-	-
Female heterosexual	97	77	75	2	2	-	-	-	-	-	-
Others	22	11	10	1	-	1	-	-	-	-	-
Age at time of HIV-test											
< 35 years	585	436	392	44	16	24	7	1	1	1	-
≥ 35 years	429	340	321	19	8	8	7	2	1	2	1
Total	**1014**	**776**	**713**	**63**	**24**	**32**	**14**	**3**	**2**	**3**	**1**

Younger patients (<35 years) had a higher risk for transmitted resistance (OR=2.2, 95% CI: 1.2-4.1).

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8.5   Unknown time of infection (not "recent")

Men who had been infected through intravenous drug use (OR=0.3, 95% CI: 0.2-0.7) or heterosexually (OR=0.5, 95% CI: 0.3-0.9) had a lower risk of transmitted resistance.

	Number of HIV diagnoses	Available resistance tests before ART	Any resistance
Year of HIV diagnosis			
2003	246	142	8
2004	277	177	11
2005	281	186	9
2006	301	185	13
2007	310	194	13
2008	316	193	9
2009	282	190	19
2010	272	189	14
2011	256	170	13
2012	294	190	9
2013	232	149	12
2014	243	147	12
2015	280	169	14
2016	235	159	14
2017	229	147	9
2018	158	91	6
Mode of transmission			
MSM	1725	1126	99
Male IDU	447	290	9
Female IDU	128	77	5
Male heterosexual	842	548	24
Female heterosexual	767	507	39
Other	303	130	9
Total	**4212**	**2678**	**185**

	Number of HIV diagnoses	Available resistance tests	Wild type	Any resistance	NRTI	NNRTI	PI	NRTI and PI	NRTI and NNRTI	NNRTI and PI	3-class-resistance
							Resistance to				
Year of HIV diagnosis											
2003	246	142	134	8	4	3	1	-	-	-	-
2004	277	177	166	11	6	2	4	1	-	-	-
2005	281	186	177	9	7	1	4	3	-	-	-
2006	301	185	172	13	6	2	5	-	-	-	-
2007	310	194	181	13	8	2	3	-	-	-	-
2008	316	193	184	9	4	2	3	-	-	-	-
2009	282	190	171	19	7	4	9	-	1	-	-
2010	272	189	175	14	4	7	4	1	-	-	-
2011	256	170	157	13	3	6	4	-	-	-	-
2012	294	190	181	9	7	2	1	-	1	-	-
2013	232	149	137	12	7	5	-	-	-	-	-
2014	243	147	135	12	3	5	4	-	-	-	-
2015	280	169	155	14	5	6	4	-	-	1	-
2016	235	159	145	14	3	10	1	-	-	-	-
2017	229	147	138	9	3	6	-	-	-	-	-
2018	158	91	85	6	4	1	2	1	-	-	-
Population size of area of residence											
Rural areas	1493	1015	941	74	36	21	17	-	-	-	-
Capital cities	562	422	388	34	8	18	10	-	2	-	-
Vienna	2069	1214	1141	73	36	23	21	6	-	1	-
Missing value	88	27	23	4	1	2	1	-	-	-	-
Sex/ mode of transmission											
MSM	1725	1126	1027	99	37	38	27	2	-	1	-
Male IDU	447	290	281	9	2	7	-	-	-	-	-
Female IDU	128	77	72	5	2	2	1	-	-	1	-
Male heterosexual	842	548	524	24	12	4	9	1	-	-	-
Female heterosexual	767	507	468	39	24	10	10	3	2	-	-
Others	303	130	121	9	4	3	2	-	-	-	-
Age at time of HIV-test											
< 35 years	2187	1323	1225	98	43	38	24	6	1	-	-
≥ 35 years	2025	1355	1268	87	38	26	25	-	1	1	-
Total	**4212**	**2678**	**2493**	**185**	**81**	**64**	**49**	**6**	**2**	**1**	**0**

9 Antiretroviral therapy (ART)

9.1 Patients currently in care regarding treatment status

On September 1st, 2019 4758 (98.6%) patients were on antiretroviral therapy in the 9 HIV treatment centres. Of the 66 patients not on treatment on September 1st, 2019, 23 had received antiretroviral treatment at an earlier point in time.
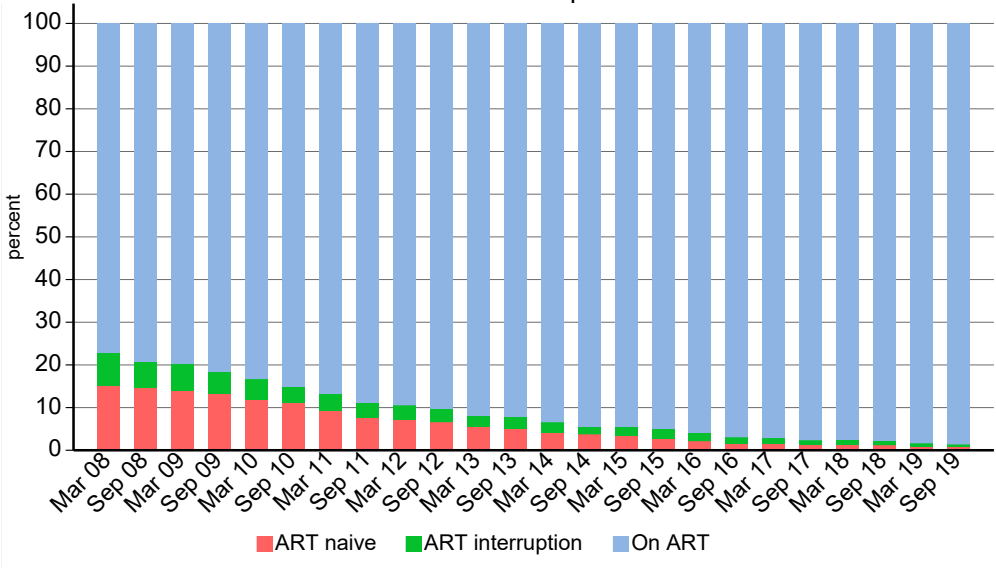
9.2 Regimens of antiretroviral therapy

4 patients have currently PI monotherapy.

Use of therapy regimens over time
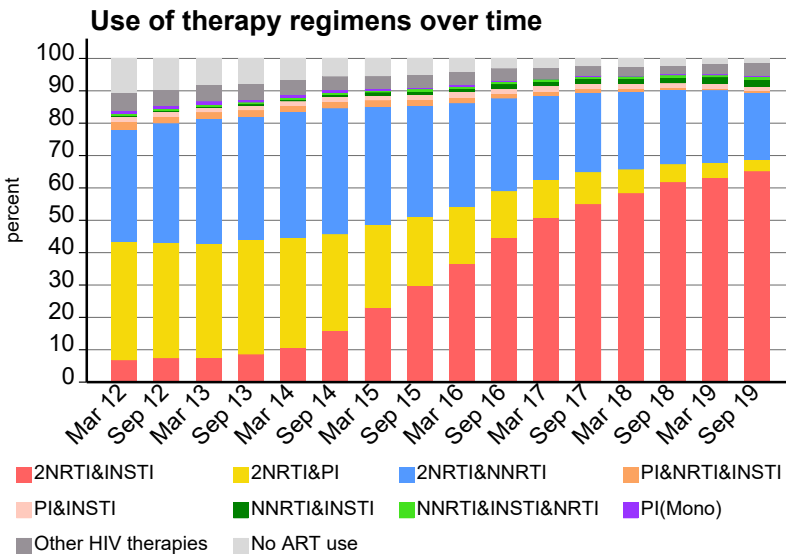
Therapy regimens on September 1st

Bar chart categories: 2NRTI&INSTI, 2NRTI&PI, 2NRTI&NNRTI, PI&NRTI&INSTI, PI&INSTI, NNRTI&INSTI, NNRTI&INSTI&NRTI, PI(Mono), Other HIV therapies, No ART use
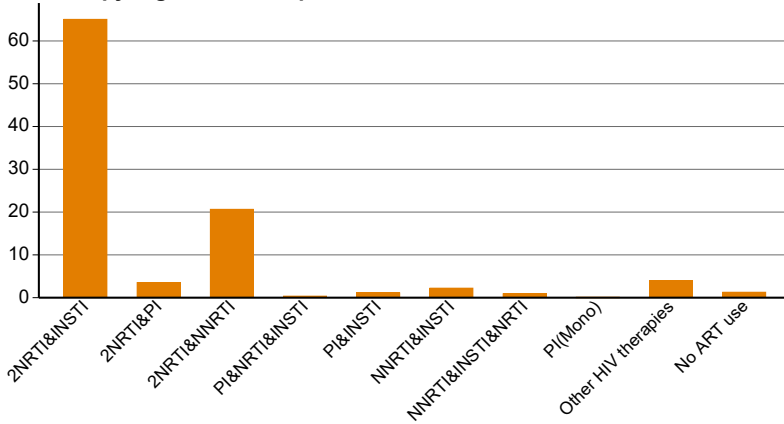
Therapy regimens in the patients currently in care

x-axis (percent): B, C, LA, UA, S, St, T, Vo, Vie

x-axis (percent): Male IDU, Female IDU, Male hetero, Female hetero, MSM, Other

Legend:
- 2NRTI&INSTI
- 2NRTI&PI
- 2NRTI&NNRTI
- PI&NRTI&INSTI
- PI&INSTI
- NNRTI&INSTI
- NNRTI&INSTI&NRTI
- PI(Mono)
- Other HIV therapies
- No ART use

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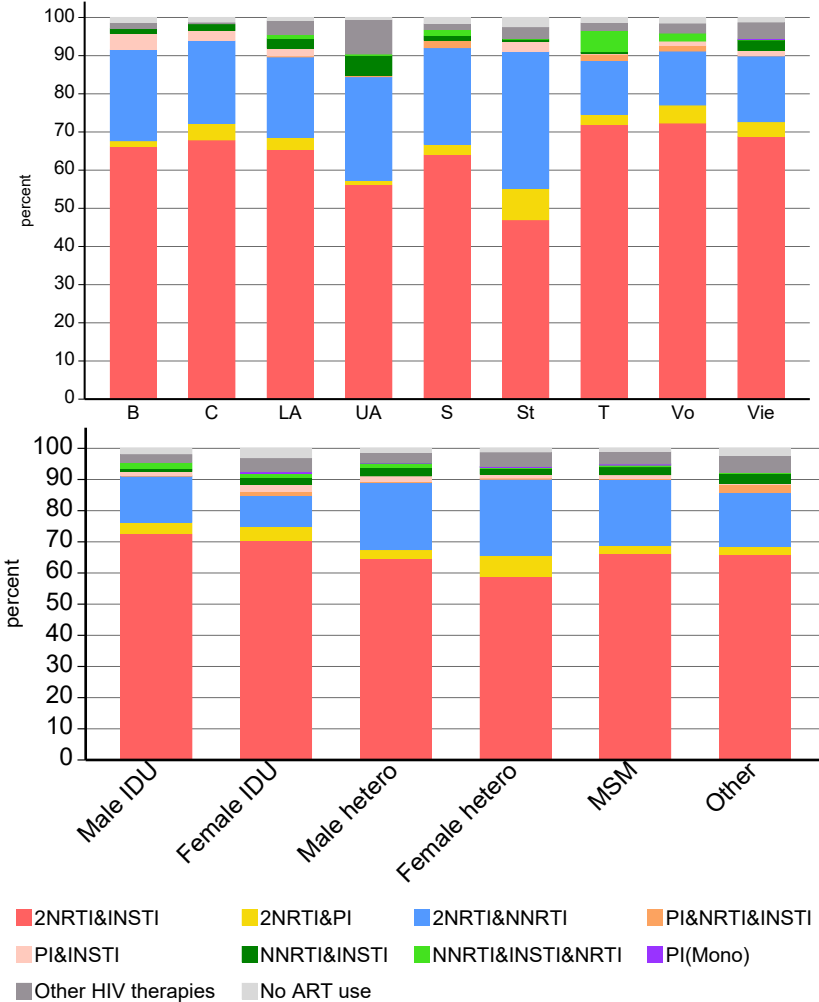
9.3   CD4 cell counts at initiation of ART

9.3.1   CD4 cell counts at initiation of ART

Median CD4 cell count-last measurement before ART start
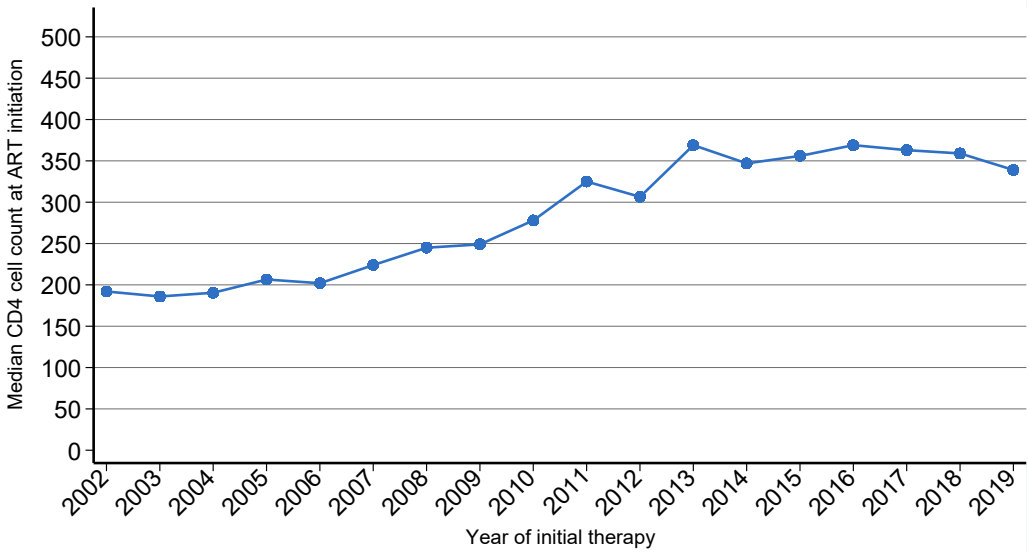
9.3.2   Median CD4 count at ART initiation

Median CD4 cell count-last measurement before ART start
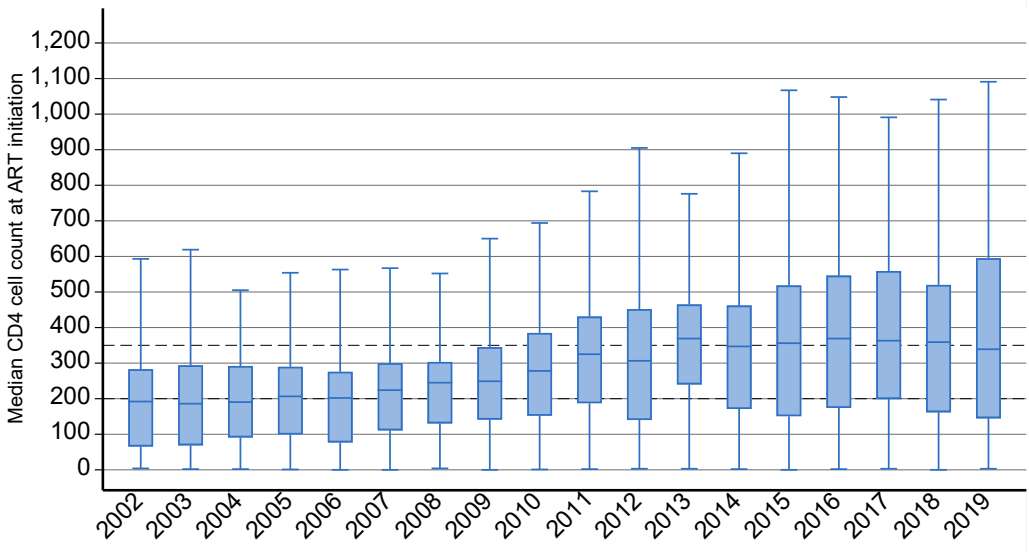
Transmission category
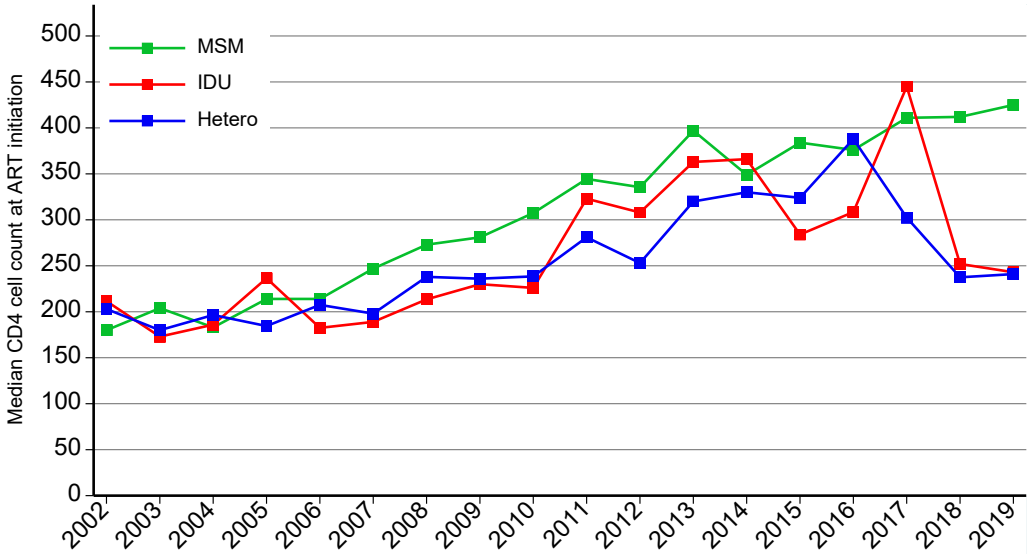
Level of education
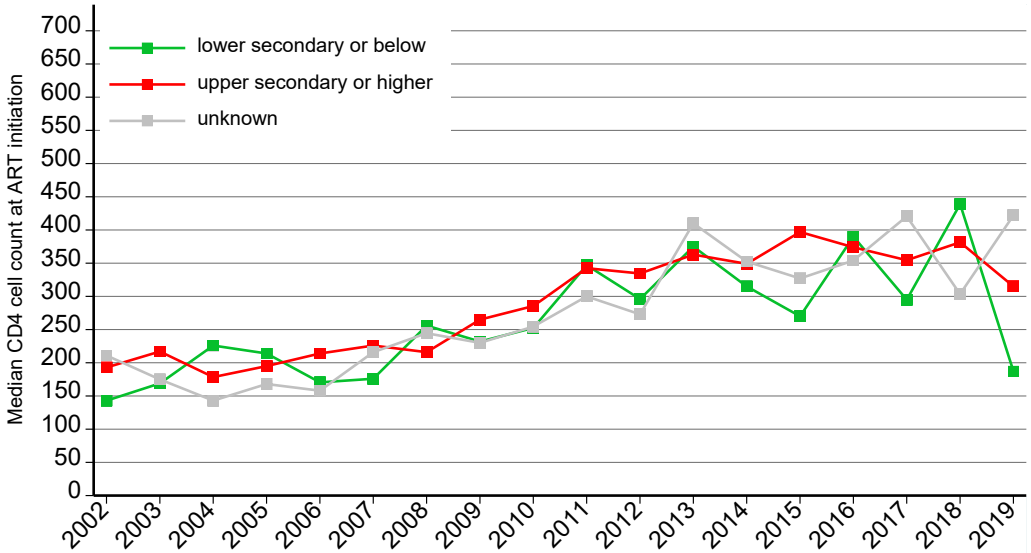
Status of employment
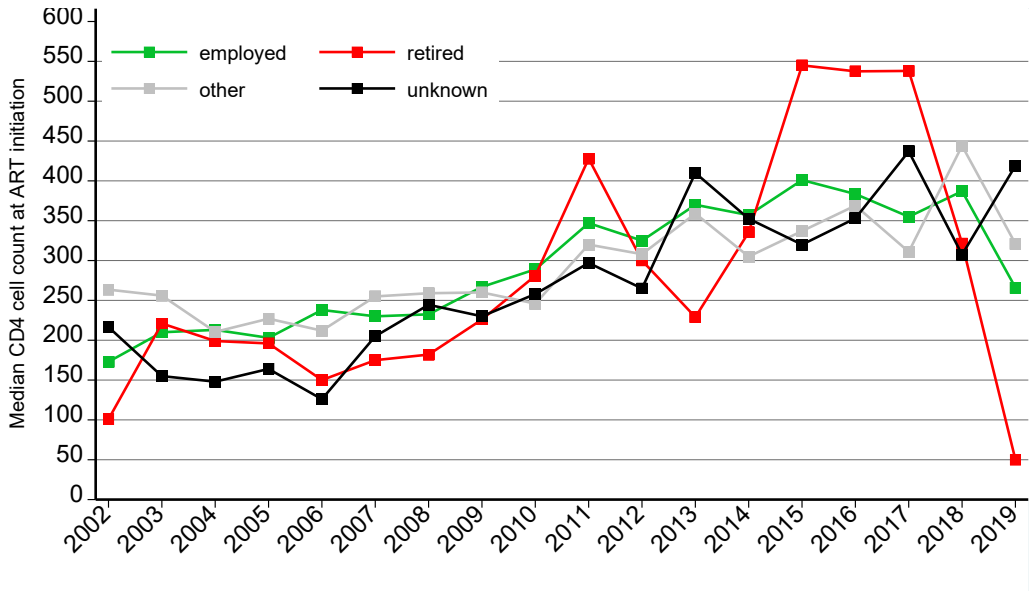
9.4 Initial therapy

9.4.1 Number of persons who started ART in the respective year
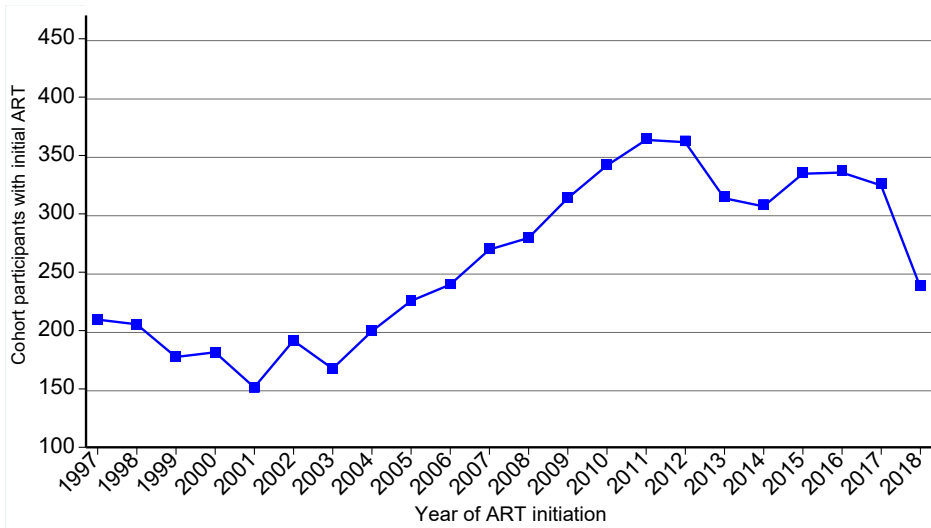
9.4.2 Regimens of the initial therapy

After March 1st, 2019, 119 patients started antiretroviral therapy. 99 of them also had their first measurement of CD4 cell count within this period.

Initial therapy by transmission category and sex

percent (y-axis): 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100

Categories (x-axis): Male IDU, Female IDU, Male hetero, Female hetero, MSM, Other

Legend: ■ 2NRTI&INSTI ■ 2NRTI&PI ■ 2NRTI&NNRTI ■ Other HIV therapies

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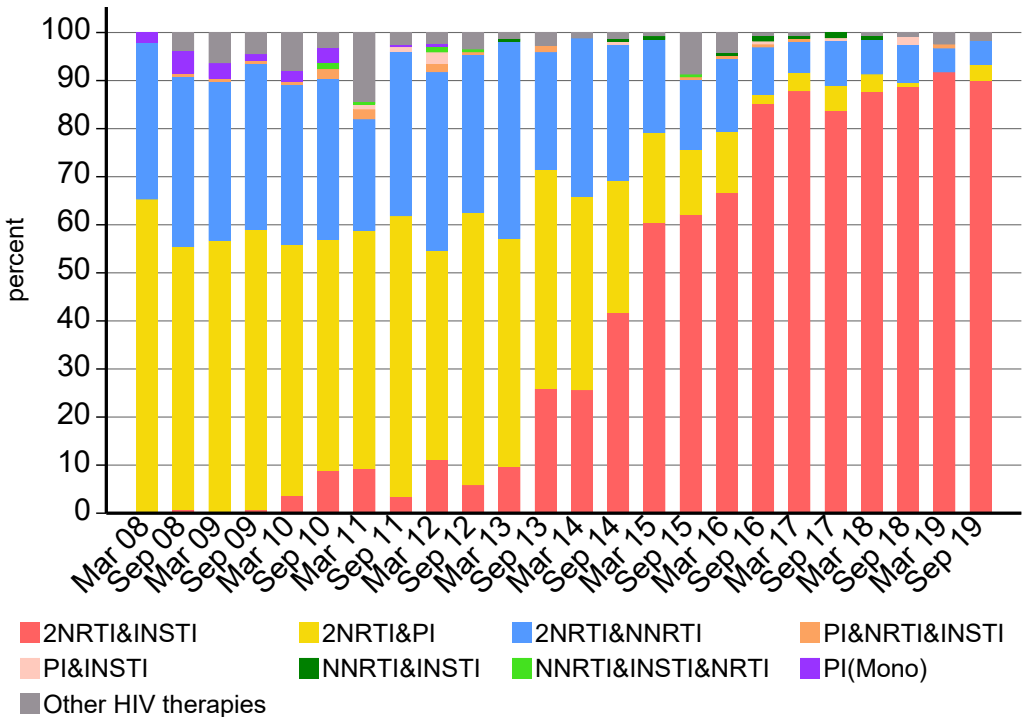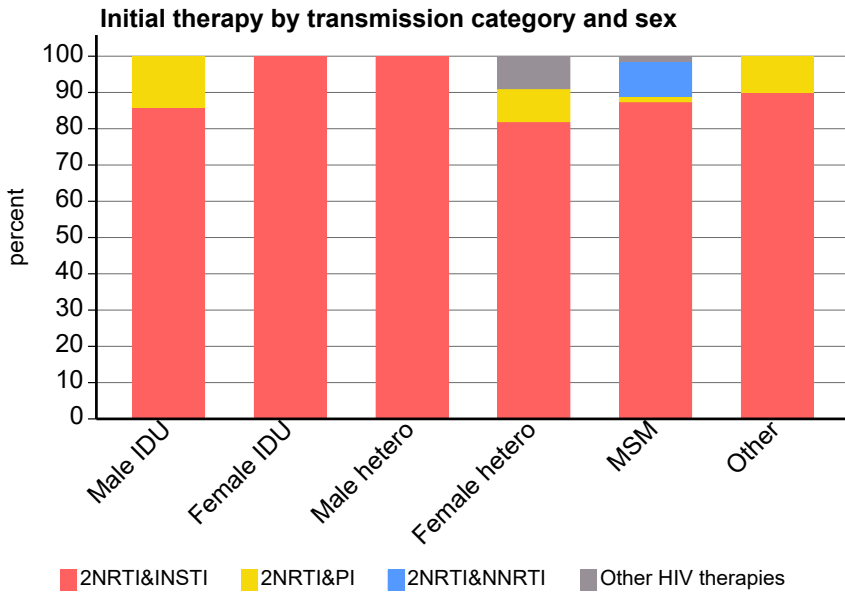
9.5 ART switches and interruptions

9.5.1 Switches and interruptions of ART during the first year of treatment

9.5.1.1 All switches, excluding switches from TDF to TAF containing regimens

Percentage of patients with ART switches and interruptions during the first year of treatment

Year of ART initiation	% of patients with ART switches	% of patients with ART interruptions
2004	36.2	23.7
2005	36.1	18.0
2006	22.4	14.3
2007	28.8	13.7
2008	25.2	14.0
2009	30.3	9.3
2010	21.8	7.0
2011	24.1	7.3
2012	26.6	5.4
2013	21.9	5.9
2014	25.1	7.0
2015	22.4	5.7
2016	23.0	3.2
2017	13.8	2.7
2018	22.0	2.4
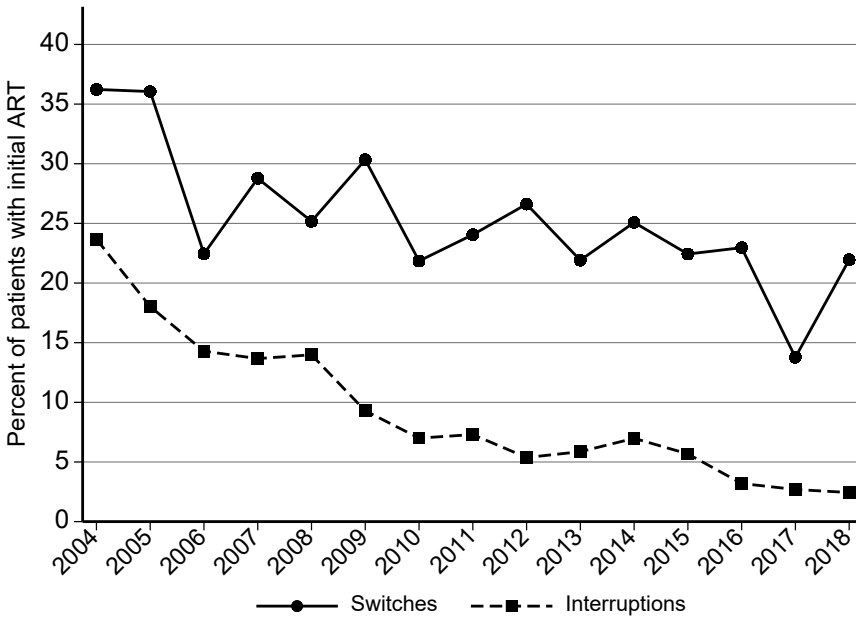
9.5.2 ART switches and interruptions per calendar year

9.5.2.1 All switches, excluding switches from TDF to TAF containing regimens

Percentage of patients with ART switches and interruptions in the respective year

Year of ART initiation	% of patients with ART switches	% of patients with ART interruptions
2004	28.2	8.7
2005	27.6	10.9
2006	24.2	7.0
2007	22.0	6.0
2008	22.8	4.9
2009	19.3	4.9
2010	20.2	3.8
2011	16.8	3.9
2012	18.1	3.6
2013	15.8	2.9
2014	21.7	2.9
2015	22.2	2.6
2016	23.2	2.1
2017	17.9	1.7
2018	13.3	1.1
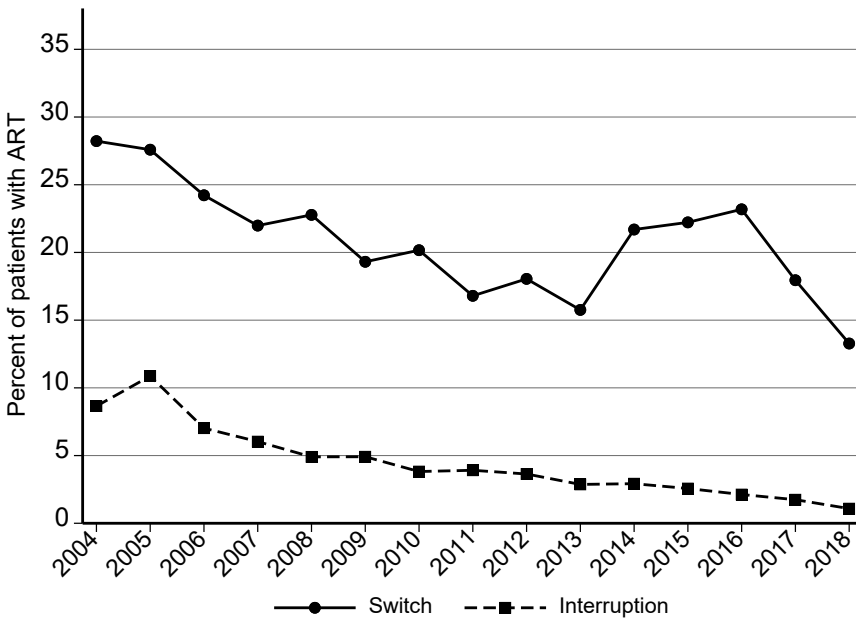
9.5.4 Risk factors for treatment switches during the first year of treatment, excluding switches from TDF to TAF containing regimens

	Switch	All		Univariable logistic regression			Multivariable logistic regression		
	1142	4604	24.80%	OR	[95% CI]	p value	OR	[95% CI]	p value
HIV transmission category									
Male IDU	121	525	23.05%	1.03	[0.82,1.29]	0.798	0.94	[0.74,1.19]	0.594
Female IDU	40	191	20.94%	0.91	[0.63,1.31]	0.616	0.87	[0.60,1.27]	0.481
Male heterosexual	210	846	24.82%	1.14	[0.94,1.37]	0.183	0.93	[0.77,1.13]	0.486
Female heterosexual	260	783	33.21%	1.71	[1.43,2.05]	0.000	1.52	[1.26,1.83]	0.000
Other	457	2029	22.52%	1.06	[0.76,1.46]	0.743	0.90	[0.65,1.26]	0.550
MSM	54	230	23.48%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Age at baseline									
< 30 years	267	1169	22.84%	0.76	[0.61,0.94]	0.011	0.81	[0.64,1.01]	0.060
30-50 years	678	2734	24.80%	0.84	[0.70,1.02]	0.073	0.84	[0.69,1.02]	0.073
≥ 50	197	701	28.10%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
AIDS at baseline									
Yes	253	693	36.51%	1.95	[1.65,2.32]	0.000			
No	889	3911	22.73%	1.00	[1.00,1.00]	.			
CD4 count at baseline									
< 50	184	509	36.15%	2.29	[1.84,2.85]	0.000	2.12	[1.69,2.67]	0.000
50-199	275	928	29.63%	1.70	[1.41,2.06]	0.000	1.57	[1.29,1.92]	0.000
200-349	275	1242	22.14%	1.15	[0.96,1.38]	0.134	1.07	[0.88,1.29]	0.507
Missing	102	381	26.77%	1.48	[1.14,1.92]	0.003	1.59	[1.22,2.07]	0.001
≥ 350	306	1544	19.82%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
HIV-RNA at baseline									
10.000-99.999	340	1643	20.69%	0.87	[0.71,1.08]	0.207			
≥ 100.000	473	1642	28.81%	1.36	[1.11,1.66]	0.003			
Missing	158	575	27.48%	1.27	[0.99,1.63]	0.062			
≤ 9.999	171	744	22.98%	1.00	[1.00,1.00]	.			
Nationality									
High prevalence countries	179	621	28.82%	1.27	[1.05,1.53]	0.013			
Low prevalence countries	963	3983	24.18%	1.00	[1.00,1.00]	.			
Population size of area of residence									
Rural areas	435	1711	25.42%	1.16	[1.01,1.35]	0.042	1.15	[0.99,1.35]	0.065
Capital cities	196	637	30.77%	1.52	[1.25,1.84]	0.000	1.53	[1.25,1.87]	0.000
Vienna	511	2256	22.65%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Year of ART Initiation									
2004-2007	294	963	30.53%	1.83	[1.48,2.26]	0.000	1.63	[1.30,2.05]	0.000
2008-2011	337	1336	25.22%	1.40	[1.14,1.72]	0.001	1.38	[1.12,1.71]	0.003
2012-2015	332	1381	24.04%	1.32	[1.07,1.62]	0.008	1.31	[1.07,1.61]	0.011
2016-2018	179	924	19.37%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.

9.5.5 Risk factors for treatment interruptions (TI) during the first year of treatment

	TI	All		Univariable logistic regression			Multivariable logistic regression		
	394	4604	8.56%	OR	[95% CI]	p value	OR	[95% CI]	p value
HIV transmission category									
Male IDU	86	525	16.38%	4.90	[3.55,6.77]	0.000	3.70	[2.64,5.18]	0.000
Female IDU	50	191	26.18%	8.87	[5.98,13.15]	0.000	6.65	[4.39,10.07]	0.000
Male heterosexual	70	846	8.27%	2.26	[1.62,3.15]	0.000	1.88	[1.31,2.69]	0.001
Female heterosexual	100	783	12.77%	3.66	[2.69,4.99]	0.000	2.58	[1.82,3.66]	0.000
Other	10	230	4.35%	1.14	[0.58,2.23]	0.709	1.11	[0.56,2.22]	0.758
MSM	78	2029	3.84%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Age at baseline									
< 30 years	160	1169	13.69%	2.49	[1.75,3.54]	0.000	1.80	[1.22,2.65]	0.003
30-50 years	192	2734	7.02%	1.19	[0.84,1.67]	0.334	0.94	[0.65,1.35]	0.737
≥ 50	42	701	5.99%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
AIDS at baseline									
Yes	63	693	9.09%	1.08	[0.82,1.43]	0.586			
No	331	3911	8.46%	1.00	[1.00,1.00]	.			
CD4 count at baseline									
< 50	45	509	8.84%	1.11	[0.78,1.59]	0.564			
50-199	85	928	9.16%	1.15	[0.86,1.54]	0.329			
200-349	107	1242	8.62%	1.08	[0.82,1.41]	0.579			
Missing	33	381	8.66%	1.09	[0.73,1.62]	0.687			
≥ 350	124	1544	8.03%	1.00	[1.00,1.00]	.			
HIV-RNA at baseline									
10.000-99.999	136	1643	8.28%	0.86	[0.63,1.16]	0.309			
≥ 100.000	132	1642	8.04%	0.83	[0.61,1.12]	0.223			
Missing	55	575	9.57%	1.00	[0.69,1.45]	0.989			
≤ 9.999	71	744	9.54%	1.00	[1.00,1.00]	.			
Nationality									
High prevalence countries	84	621	13.53%	1.85	[1.43,2.40]	0.000	1.31	[0.96,1.79]	0.094
Low prevalence countries	310	3983	7.78%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Population size of area of residence									
Rural areas	105	1711	6.14%	0.63	[0.49,0.80]	0.000	0.78	[0.60,1.01]	0.060
Capital cities	76	637	11.93%	1.30	[0.98,1.72]	0.065	1.64	[1.22,2.21]	0.001
Vienna	213	2256	9.44%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Year of ART Initiation									
2004-2007	164	963	17.03%	7.09	[4.64,10.84]	0.000	5.04	[3.26,7.78]	0.000
2008-2011	122	1336	9.13%	3.47	[2.25,5.35]	0.000	2.67	[1.72,4.15]	0.000
2012-2015	82	1381	5.94%	2.18	[1.39,3.42]	0.001	1.92	[1.22,3.02]	0.005
2016-2018	26	924	2.81%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.

9.6 Frequency of drug dosing

9.6.1 Overview

23 of 4824 (0.5%) patients do not take any drugs at all and 43 (0.9%) patients have no ART but take other drugs. 753 (15.6%) patients are receiving ART only.

Dosing frequency	Number of patients					
	0	**1**	**2**	**3**	**4**	**Total**
Antiretrovirals (ARVs)	66	4420	330	8	0	4824
Drugs other than ARVs	776	1558	1270	790	430	4824
Overall dosing frequency	23	1449	1856	995	501	4824
Overall dosing frequency in patients with once daily ARVs	0	1435	1689	868	428	4420
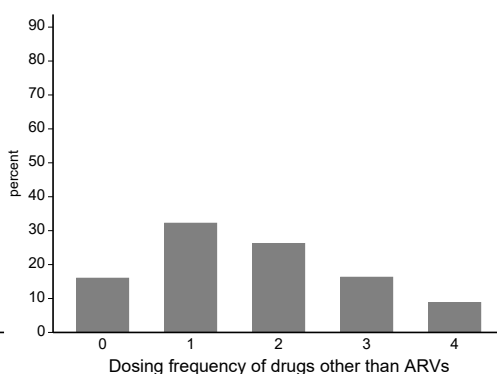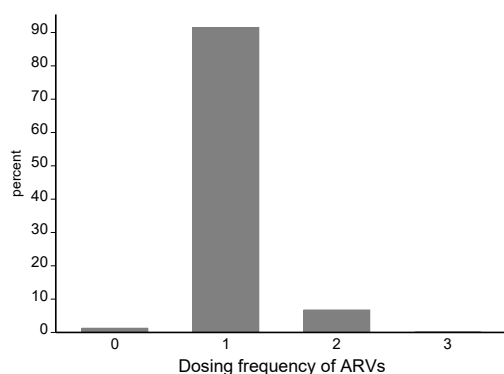
9.6.2 Most frequent used regimen to treat HIV (September 2019)

Regimen	Frequency	Percent
DGV 3TC ABC	886	18.62
DGV FTC TAF	866	18.20
RPV FTC TAF	586	12.32
BGV FTC TAF	515	10.82
EVG FTC TAF	493	10.36
RAL FTC TAF	151	3.17
NVP FTC TAF	108	2.27
DGV FTC TDF	102	2.14
DGV RPV	94	1.98
NVP 3TC ABC	92	1.93
DGV 3TC	89	1.87
EFV FTC TDF	75	1.58
RAL 3TC ABC	66	1.39
DRV/r FTC TAF	60	1.26
RAL FTC TDF	53	1.11
RPV FTC TDF	48	1.01
Remaining regimen	474	9.96
Total	**4758**	**100.00**

10 Disease progression and Response to ART

10.1 Mortality of patients with AIDS since 1985

The documentation of death is partially incomplete in the HIV Patient Management System (e.g. considerable proportion of patients without follow-up since 2001 are not documented dead but presumed dead, see chapter 4).

A   Survival after the diagnosis AIDS

C   Death rate (all-cause mortality) of patients with AIDS
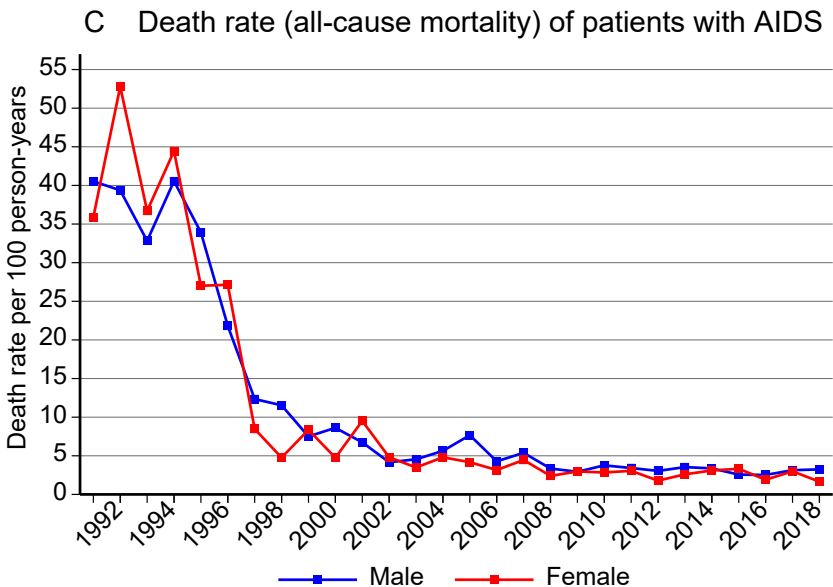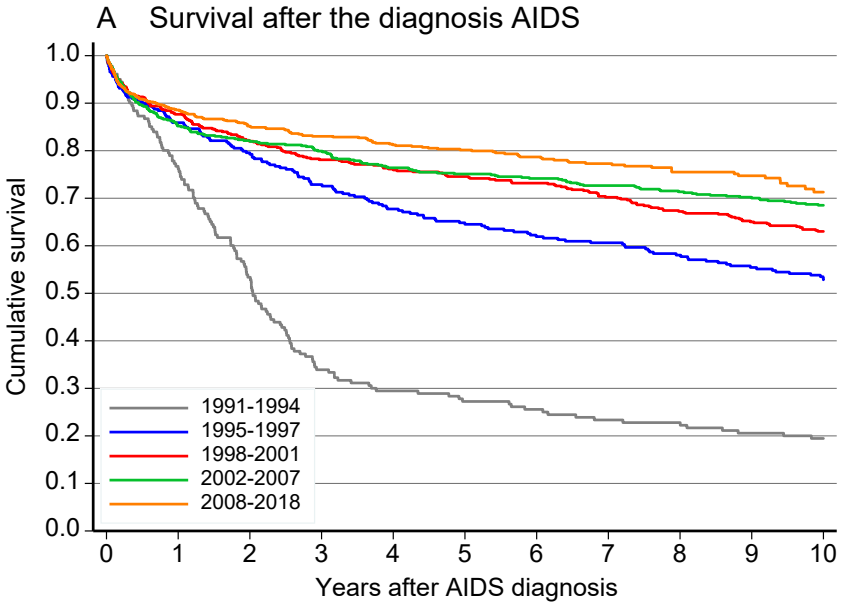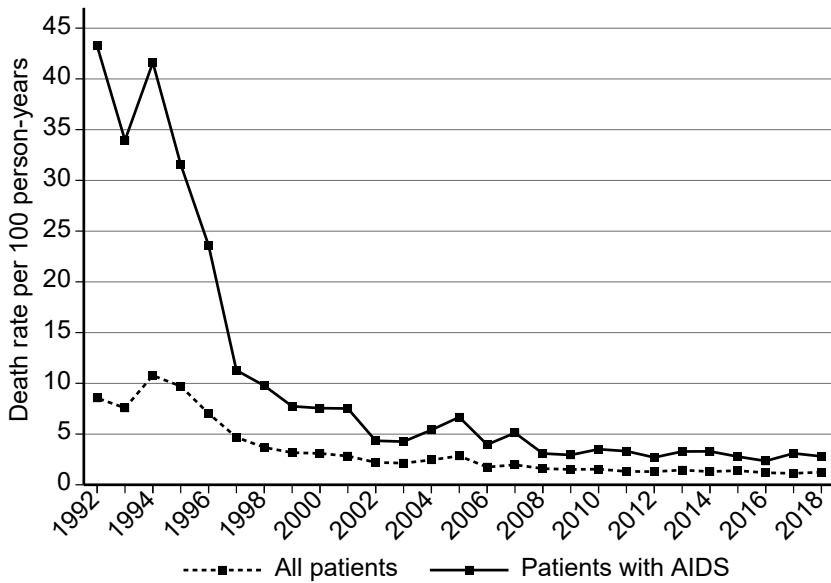
10.2   Mortality in combination ART era (years 1997-2017)

Death rates in different age groups
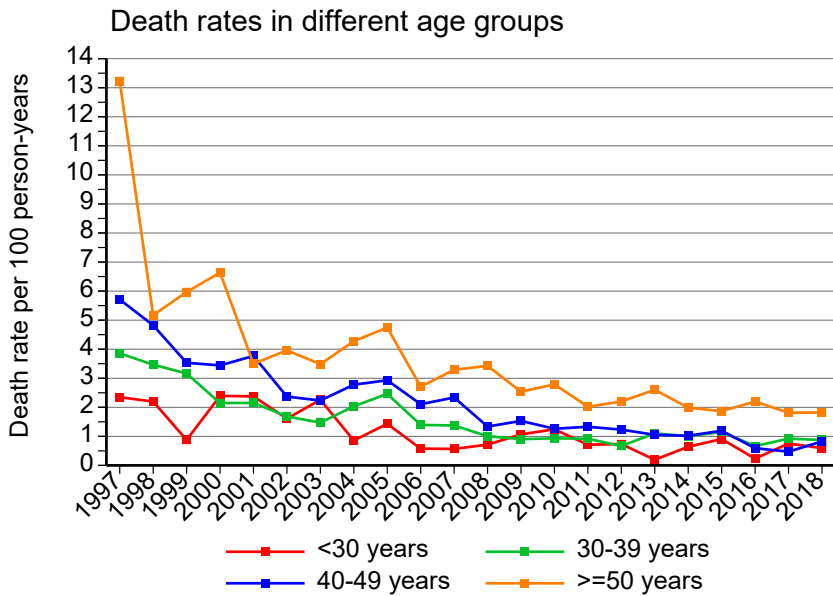
Death rates according to causes of death

Legend: AIDS-related, Non-AIDS-defining malignancies, Liver-related, Cardiovascular, Other/Unknown
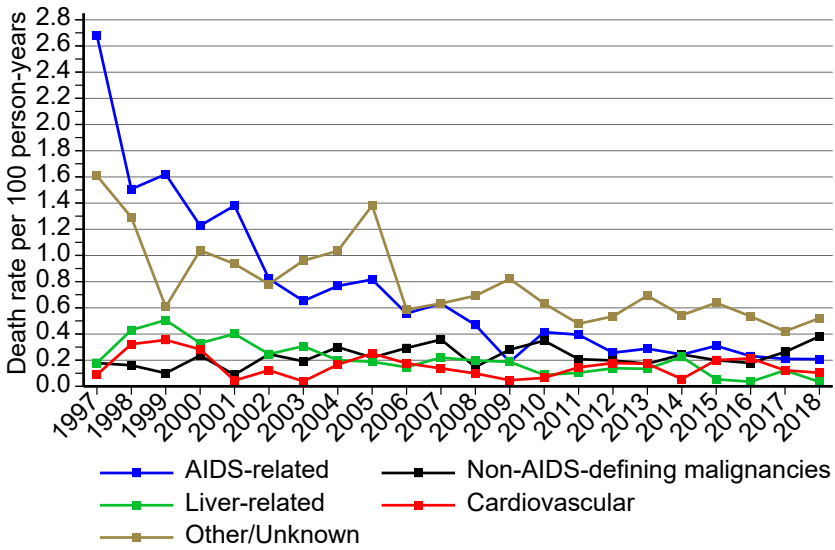
Death rates according to transmission category

Legend: IDU, Hetero, MSM
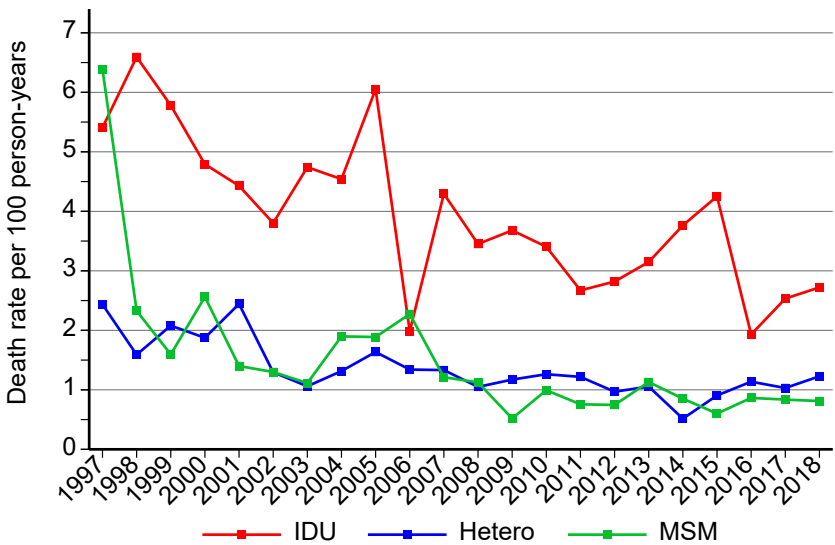
10.3 CD4 cell counts

10.3.1 CD4 cell counts: nadir and most recent

Median CD4 cell counts

CD4 Nadir

Recent CD4 cell count
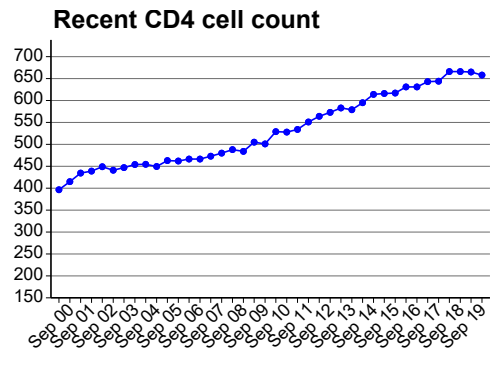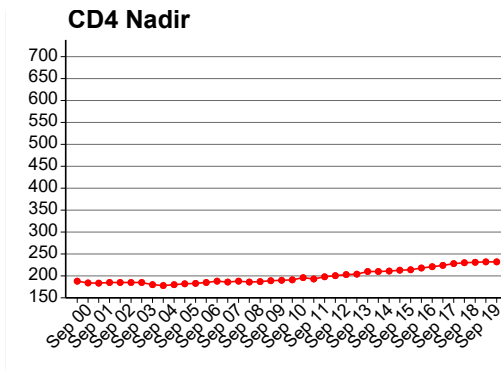
CD4 nadir (last 12 months)
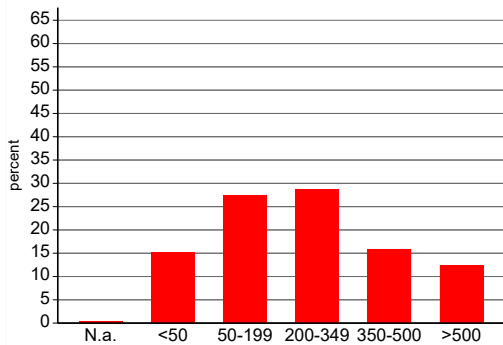
Recent CD4 cell count (last 12 months)
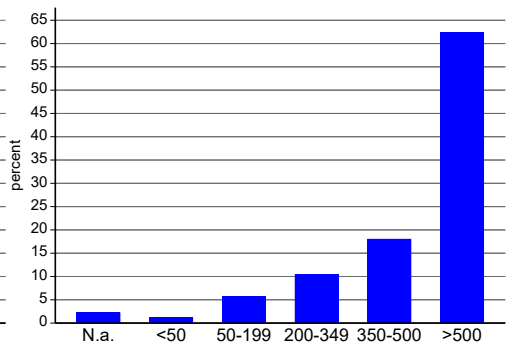
Most recent CD4 cell count
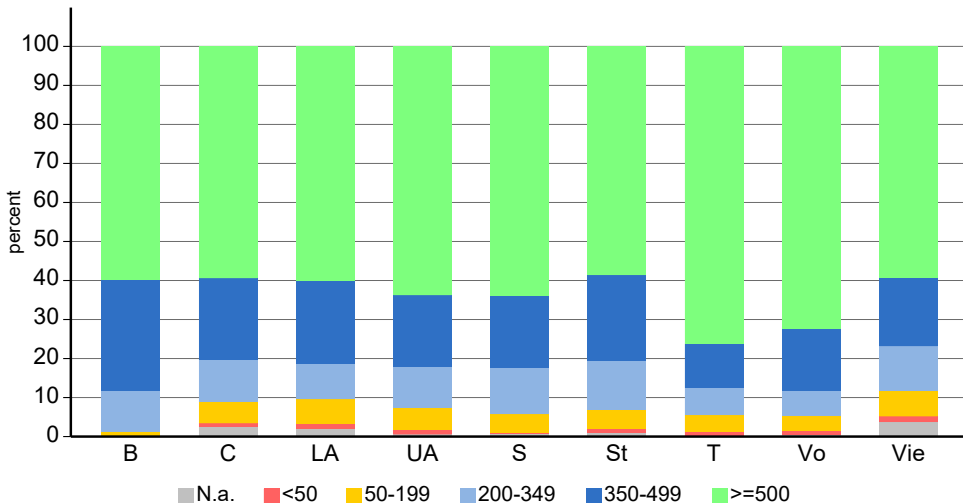
10.3.2   Median CD4 cell counts after initiating ART

The analyses include only patients who initiated ART after January 1, 1997.

a)   Interruptions of ART

Number of ART interruptions

Zero   1   2-3   >3
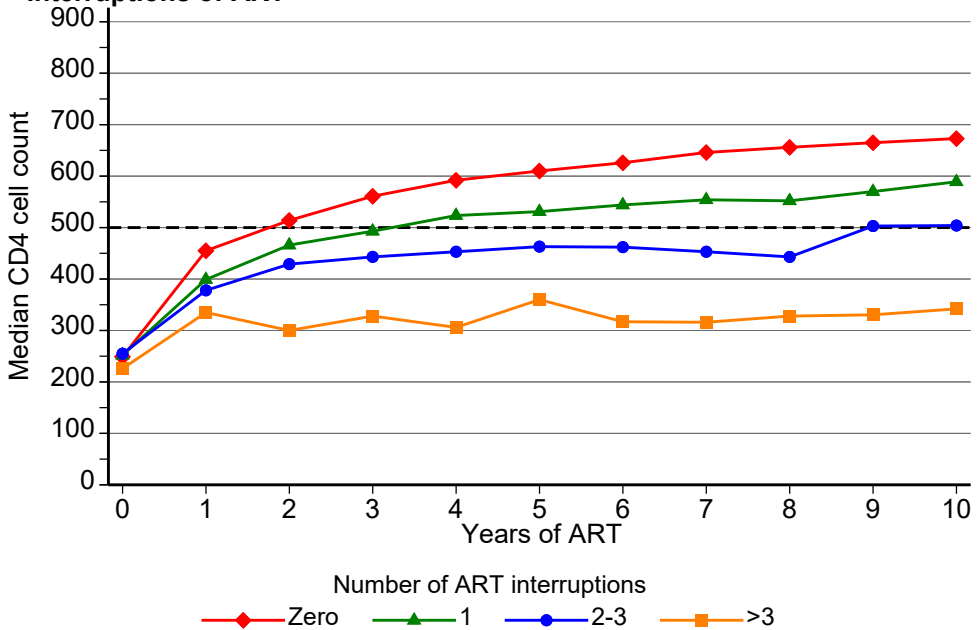
b)   Baseline CD4 count

Patients were included until treatment interruption.

CD4 count (cells/µL)

<=50   51-199   200-349   >=350
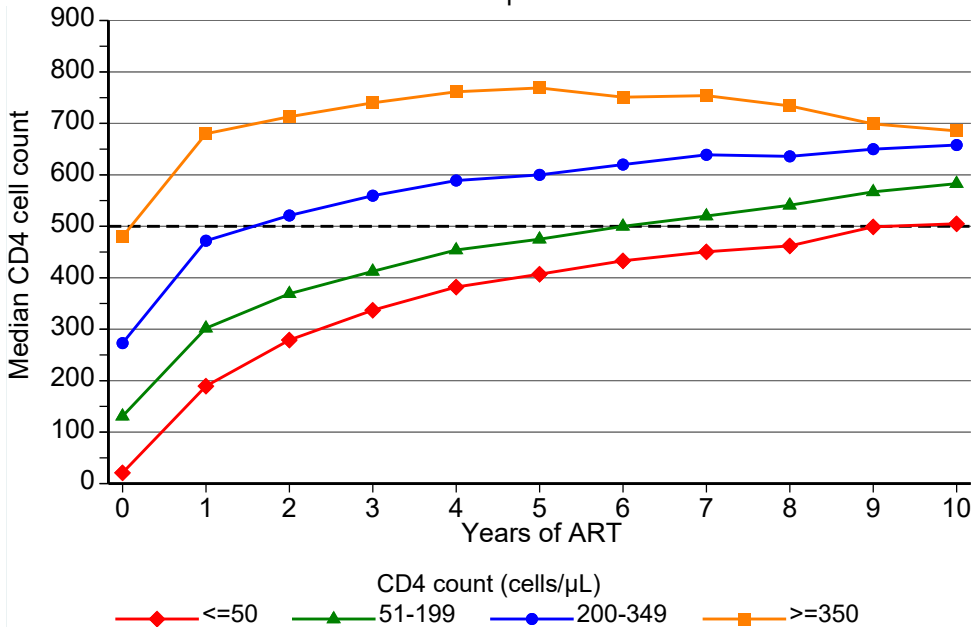
10.4   HIV RNA (viral load)

10.4.1   Last HIV RNA in patients currently in care regardless of ART

94.2% of the patients currently in care (4545 of 4824) have a current HIV RNA below 400 copies/ml.

Last HIV RNA Measurement

Proportion of patients with HIV RNA =50 <200 and <1000 in different periods
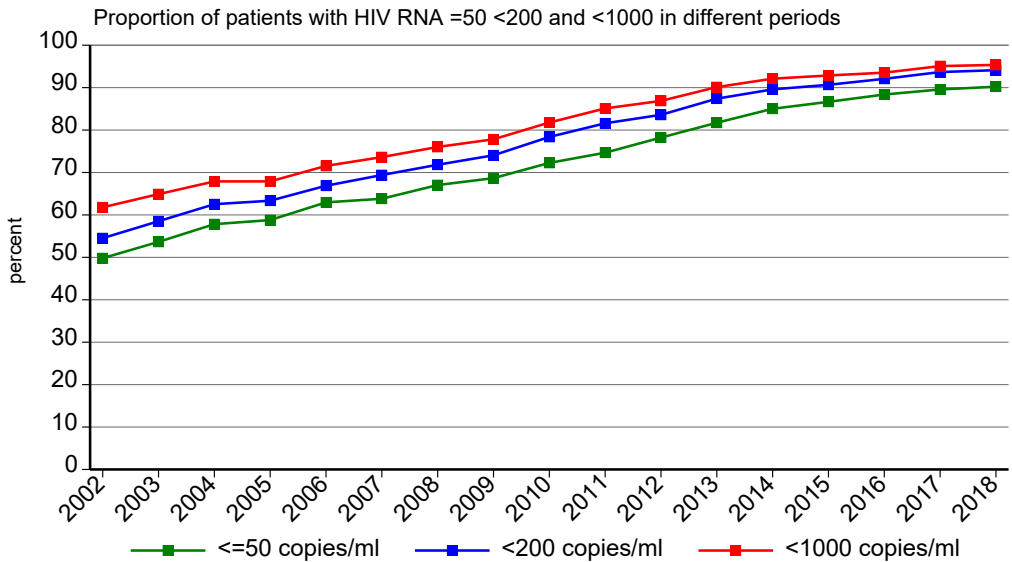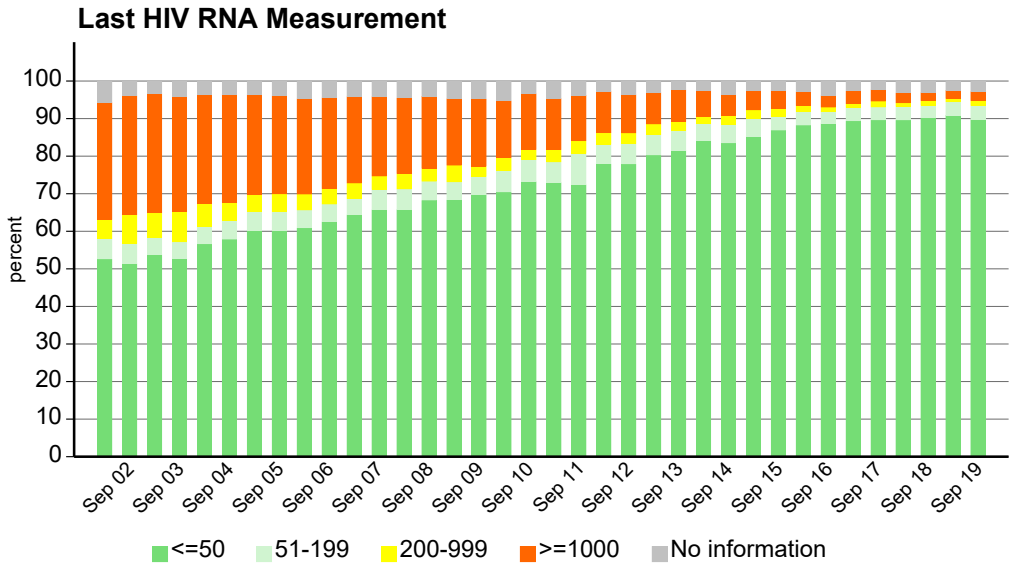
RNA-measurement and visit in the last 12 months
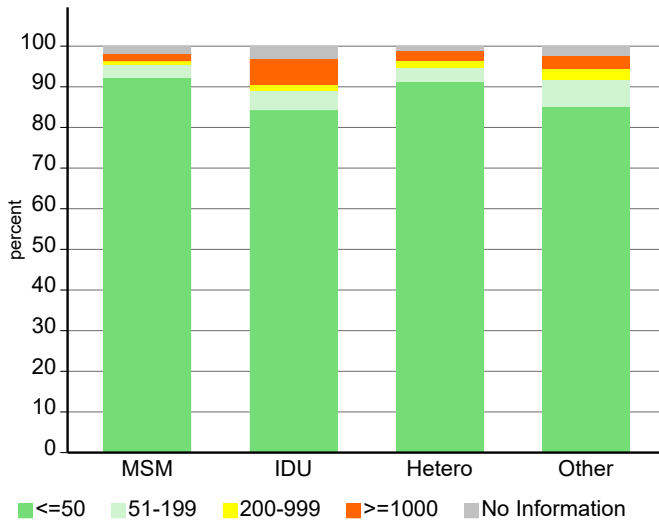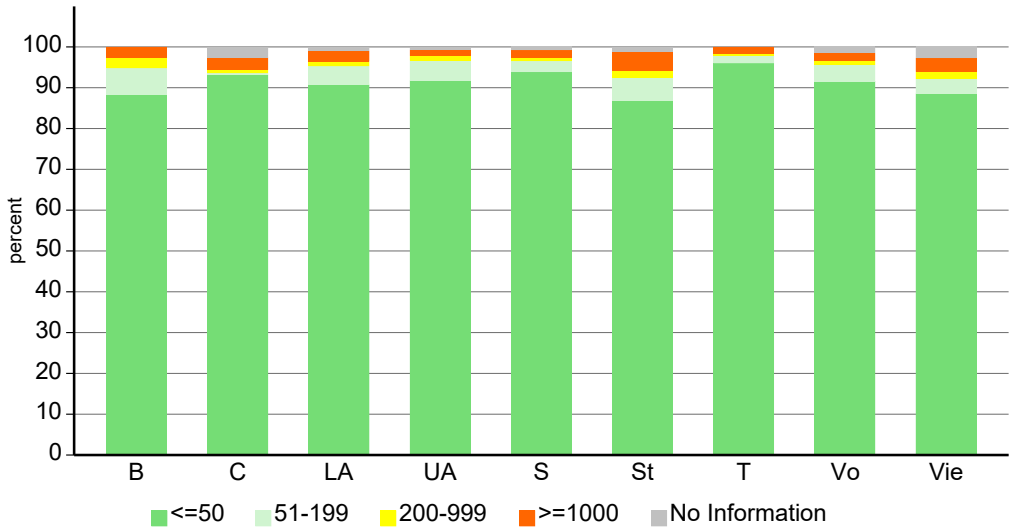
10.4.2 The continuum of care in Austria

Data from AHIVCOS were used to derive the four-stage continuum of HIV care and assessed for all patients and for men who have sex with men (MSM) for the years 2010 to 2016.

a. People living with HIV (PLHIV) estimates were obtained using back-calculation models (ECDC tool 1.3.0) to estimate HIV incidence and the undiagnosed fraction.
b. Proportion ever diagnosed
c. Proportion ever diagnosed who ever initiated ART
d. Proportion of them who were virally-suppressed (≤200 c/mL)
e. Proportion suppressed of all PLHIV (e) for all patients in Austria

For high estimates patients lost to follow-up (LTFU, no contact 1.5 years before the end of the respective year) were excluded and for low estimates they were included. The preferred estimate was the mid-point between the high and low estimate.
Missing HIV-RNA was considered as unsuppressed.

Year	(a) PLHIV	(b) Diagnosed [estimated range]	(c) On ART Mean [low, high estimate]	(d) Suppressed Mean [low, high estimate]	(e) Suppressed of all PLHIV
2010	6254	84% [80%,86%]	83% [76%,89%]	79% [71%,86%]	55%
2011	6432	86% [82%,88%]	85% [79%,91%]	80% [72%,88%]	59%
2012	6594	88% [84%,90%]	87% [81%,93%]	81% [73%,89%]	62%
2013	6734	89% [85%,91%]	89% [83%,94%]	83% [74%,91%]	66%
2014	6864	90% [86%,92%]	91% [85%,96%]	84% [75%,92%]	69%
2015	6975	91% [88%,94%]	92% [87%,97%]	84% [75%,93%]	70%
2016	7079	92% [89%,94%]	94% [89%,98%]	85% [77%,93%]	74%

We conclude that Austria is nearing the 90-90-90 target of UNAIDS. Viral suppression was comparatively low and maybe explained substantially by transfer of care in Vienna and out-migration. This and the decrease in HIV incidence supports the hypothesis that the high estimate of being on ART and virally-suppressed is the more likely scenario. For more reliable nationwide estimates data from private physicians have to be included.

10.4.3 Last HIV RNA in patients on ART

Patients were included if there were at least 75 days between ART initiation and HIV RNA measurement.
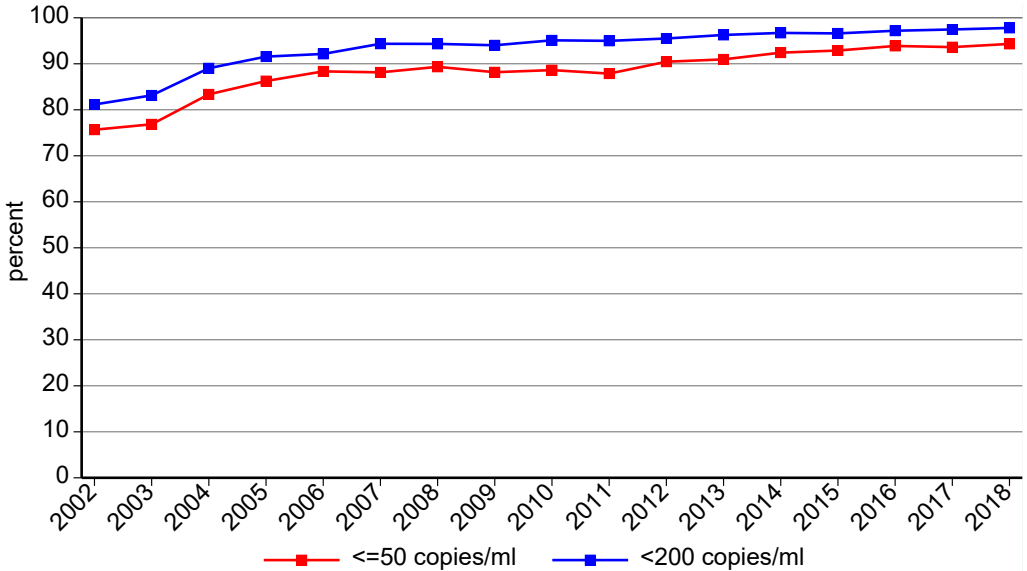
10.4.3.1 Last HIV RNA of patients on ART at different points in time

Patients currently in care, currently on ART and measurement of viral load at least 2.5 months after ART initiation
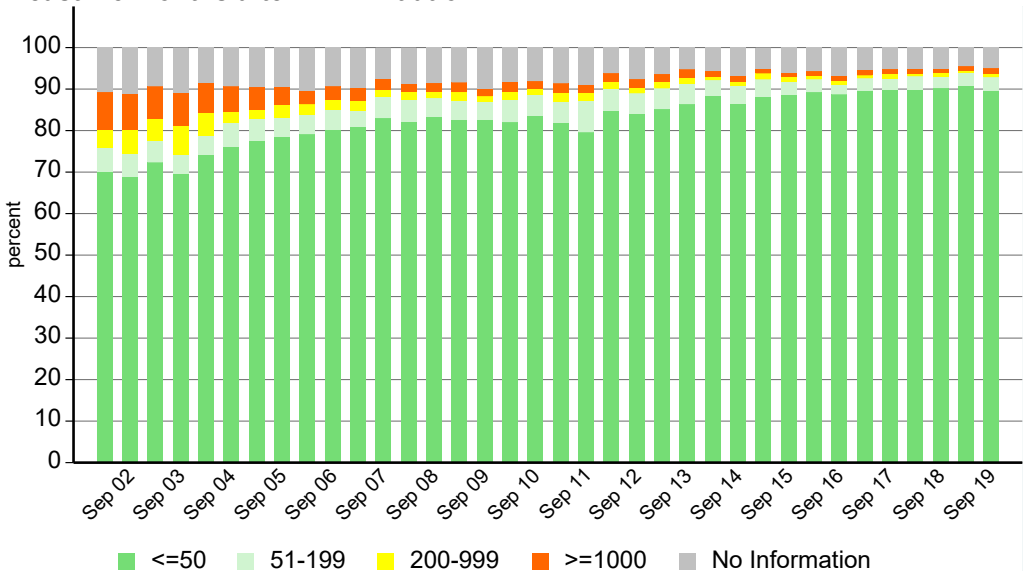
10.4.3.2 Last HIV RNA of patientst on ART according to transmission category

Patients in care and on ART within the last 12 months and measurement of viral load at least 2.5 months after ART initiation
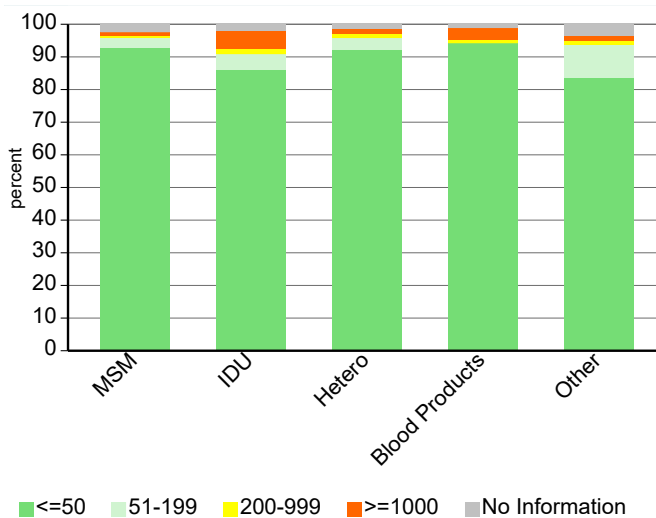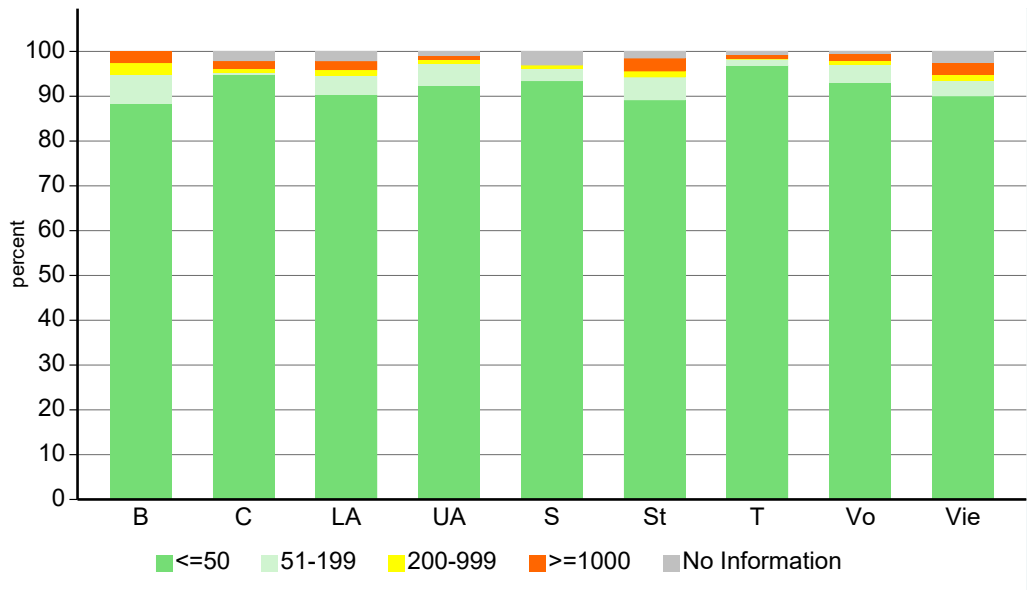
10.4.4 Risk factors for viral replication

Risk factors for HIV RNA ≥200 copies/ml on ART

The analyses in this chapter include all patients with a visit in the last 12 months who have been on ART for at least 75 days before the measurement of the viral load.

	151	4897	3.08%	Univariable logistic regression			Multivariable logistic regression		
				OR	[95% CI]	p value	OR	[95% CI]	p value
Age									
< 30 years	7	252	2.78%	1.26	[0.56,2.81]	0.574	1.74	[0.74,4.11]	0.204
30-50 years	94	2392	3.93%	1.80	[1.27,2.55]	0.001	1.87	[1.27,2.75]	0.001
≥ 50	50	2253	2.22%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
HIV transmission category									
Male IDU	32	450	7.11%	4.19	[2.59,6.78]	0.000	2.20	[1.31,3.69]	0.003
Female IDU	18	225	8.00%	4.76	[2.67,8.49]	0.000	2.23	[1.20,4.14]	0.011
Male heterosexual	23	899	2.56%	1.44	[0.85,2.43]	0.175	1.36	[0.79,2.35]	0.273
Female heterosexual	31	948	3.27%	1.85	[1.14,2.99]	0.012	1.29	[0.76,2.19]	0.345
Other	9	257	3.50%	1.99	[0.95,4.16]	0.068	1.75	[0.82,3.76]	0.149
MSM	38	2118	1.79%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Nationality									
Missing/unknown	0	11	0.00%						
High prevalence	18	417	4.32%	1.38	[0.83,2.30]	0.210	1.13	[0.63,2.02]	0.682
Low prevalence	18	827	2.18%	0.68	[0.41,1.13]	0.136	0.80	[0.47,1.35]	0.402
Austria	115	3642	3.16%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Population size of area of residence									
Rural areas	47	1999	2.35%	0.59	[0.41,0.84]	0.004			
Capital cities	20	763	2.62%	0.66	[0.40,1.08]	0.096			
Vienna	84	2135	3.93%	1.00	[1.00,1.00]	.			
AIDS									
Yes	25	778	3.21%	1.05	[0.68,1.63]	0.819			
No	126	4119	3.06%	1.00	[1.00,1.00]	.			
CD4 Nadir									
<50	37	770	4.81%	2.36	[1.55,3.60]	0.000	1.86	[1.19,2.90]	0.006
50-199	56	1353	4.14%	2.02	[1.39,2.93]	0.000	1.60	[1.08,2.39]	0.020
≥200	58	2772	2.09%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
ART initiation									
Before 1.1.1997	12	443	2.71%	0.86	[0.48,1.57]	0.633	0.43	[0.22,0.83]	0.012
After 1.1.1997	139	4454	3.12%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Ever ART interruptions									
None	59	3600	1.64%	0.17	[0.12,0.25]	0.000	0.16	[0.11,0.26]	0.000
1	41	726	5.65%	0.61	[0.40,0.93]	0.023	0.61	[0.39,0.96]	0.032
≥2	51	571	8.93%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Art duration									
< 9 months	5	98	5.10%	1.73	[0.69,4.32]	0.240	3.45	[1.33,8.93]	0.011
9-18 months	6	153	3.92%	1.31	[0.57,3.02]	0.521	2.48	[1.04,5.95]	0.041
> 18 months	140	4646	3.01%	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.

11 Development of resistance to ART

11.1 Abstract

Objective: To determine the prevalence of development of drug resistance, predictors and temporal trends in resistance.

Method: Patients currently in care in one of eight centres who have ever been on antiretroviral therapy (ART) were analyzed. Mutations were judged as resistant according to "2017 Update of the Drug Resistance Mutations in HIV-1" from the International Antiviral-Society-USA (http://iasusa.org/resistance_mutations/mutations_figures.pdf).

Results: Overall 4625 patients have ever received ART, 4607 of them currently. 1263 had a resistance test after ART (27.3%). The overall prevalence of development of drug resistance was 74.7% (943 of 1263 patients), the prevalence of NRTI resistance was 36.3%, the prevalence of NNRTI resistance was 28.0%, and the prevalence of PI resistance was 67.5%. The prevalence of 3-class-resistance was 18.2% (230 of 1263 patients). The risk factors for developing a 3-class-resistance were a CD4 nadir <50 (OR=3.4; 95% CI: 2.3-5.1), a CD4 nadir between 50 and 200 (OR=2.2; 95% CI: 1.5-3.2) and initial therapy before 1997 (OR=27.2; 95% CI: 18.1-40.9) as well as from 1997 to 2003 (OR=9.1; 95% CI: 6.0-13.8) and an age at ART-start <30 (OR=2.3; 95% CI: 1.2-4.7). The risk to develop a 3-class-resistance was lower in patients with a low viral load (for <50 copies/ml OR=0.2; 95% CI: 0.1-0.4) and in female patients infected through intravenous drug use (OR=0.4; 95% CI: 0.2-0.9).

Conclusions: The overall prevalence of development of drug resistance is at a rather high level, while the prevalence of 3-class-resistance was found to be stabilizing at a low level. The risk for developing resistance is small in those who initiated therapy in recent years.

11.2 Definition of resistance under ART

The rate of resistance development during antiretroviral therapy („percent with resistance") corresponds to the number of patients with resistance mutations in relation to the number of patients on ART (see also chapter 5).

"Cumulative resistance" includes any mutation ever found in a particular patient.

The resistance mutations have been classified according to the "2017 Update of the Drug Resistance Mutations in HIV-1" from the International AIDS-Society-USA (http://iasusa.org/resistance_mutations/mutations_figures.pdf).

The following codons and amino acids have been classified as resistance (IAS):

Reverse transcriptase				Protease	
NRTI		**NNRTI**			
M41	L	V90	I	L10	F, R, I, V, C
A62	V	A98	G	V11	I
K65	R, E, N	L100	I	G16	E
D67	N	K101	H, E, P	K20	R, M, I, T, V
T69	ins	K103	N, S	L24	I
K70	R, E	V106	A, M, I	D30	N
L74	V	V108	I	V32	I
V75	I	E138	A, G, K, Q, R	L33	I, F, V
F77	L	V179	D, F, T, L	E34	Q
Y115	F	Y181	C, I, V	M36	I, L, V
F116	Y	Y188	L, H, C	K43	T
Q151	M	G190	A, S	M46	I, L
M184	V, I	H221	Y	I47	V, A
L210	W	P225	H	G48	V
T215	Y, F	F227	C	I50	V, L
K219	Q, E	M230	I, L	F53	L, Y
				I54	V, M, L, T, S, A
				Q58	E
				D60	E
				I62	V
				L63	P
				I64	L, M, V
				H69	K, R
				A71	V, I, T, L
				G73	S, T, C, A
				T74	P
				L76	V
				V77	I
				V82	A, T, F, S, I, L
				N83	D
				I84	V
				I85	V
				N88	D, S
				L89	V, I, M
				L90	M
				I93	L, M

11.3 Frequency of resistance

11.3.1 Frequency of NRTI-associated resistance mutations

11.3.1.1 Overview

The table shows the numbers of patients with NRTI-associated resistance mutations among all patients who have ever been treated with Nucleoside Reverse Transcriptase Inhibitors („NRTI").

All centers	Deceased since 1997, NRTI use	Patients currently in care and NRTI use ever
	N = 1067	N = 4610
Resistance to NRTI	190 (17.8%)	458 (9.9%)
Codon 41	71 (6.7%)	170 (3.7%)
Codon 62	8 (0.7%)	23 (0.5%)
Codon 65	9 (0.8%)	30 (0.7%)
Codon 67	63 (5.9%)	152 (3.3%)
Codon 69	2 (0.2%)	4 (0.1%)
Codon 70	45 (4.2%)	122 (2.6%)
Codon 74	26 (2.4%)	36 (0.8%)
Codon 75	5 (0.5%)	6 (0.1%)
Codon 77	1 (0.1%)	7 (0.2%)
Codon 115	5 (0.5%)	12 (0.3%)
Codon 116	2 (0.2%)	4 (0.1%)
Codon 151	2 (0.2%)	6 (0.1%)
Codon 184	145 (13.6%)	319 (6.9%)
Codon 210	48 (4.5%)	89 (1.9%)
Codon 215	79 (7.4%)	184 (4.0%)
Codon 219	42 (3.9%)	75 (1.6%)

11.3.1.2 Risk factors for the resistance mutation K65R of the RT

Recruitment for this analysis has been in agreement to entry criteria of COHERE. Additionally, patients who died before 1.1.2000 have been excluded.

All centres							Model 1 (N = 7321)		
	Frequencies N=			Univariable regression			Multivariable regression*		
Variable	45 /	7321	(0.6%)	OR (95% CI)		p-value	OR (95% CI)		p-value
Demographic characteristics									
Age at ART start									
<30 years	12 /	1989	(0.6%)	1.9	0.5 – 6.6	0.333			
30-50 years	30 /	4405	(0.7%)	2.1	0.6 – 6.9	0.218			
>50 years	3 /	927	(0.3%)	1					
Sex/ mode of transmission									
Male IDU	7 /	924	(0.8%)	2.3	0.9 – 6.0	0.099			
Female IDU	6 /	403	(1.5%)	4.5	1.6 – 12.4	0.004			
Male heterosexual	10 /	1294	(0.8%)	2.3	1.0 – 5.6	0.062			
Female heterosexual	11 /	1274	(0.9%)	2.6	1.1 – 6.1	0.031			
Other	1 /	453	(0.2%)	0.7	0.1 – 5.1	0.688			
MSM	10 /	2973	(0.3%)	1					
Population size of area of residence									
Missing value	0 /	86	(0.0%)	-	-	-			
Rural areas	15 /	2599	(0.6%)	0.8	0.4 – 1.6	0.558			
Capital cities	5 /	1056	(0.5%)	0.7	0.3 – 1.8	0.426			
Vienna	25 /	3580	(0.7%)	1					
Stage of disease									
AIDS									
Yes	26 /	2162	(1.2%)	3.3	1.8 – 6.0	<0.001			
No	19 /	5159	(0.4%)	1					
CD4 nadir									
Missing value	0 /	65	(0.0%)	-	-	-	-	-	-
<50 cells/µl	20 /	1343	(1.5%)	8.1	3.4 – 19.1	<0.001	**6.9**	**2.8 – 16.7**	**<0.001**
50-199 cells/µl	18 /	2174	(0.8%)	4.5	1.9 – 10.7	0.001	**3.8**	**1.5 – 9.2**	**0.004**
≥200 cells/µl	7 /	3739	(0.2%)	1			**1**		
ART									
Abacavir use ever									
Yes	19 /	3048	(0.6%)	1.0	0.6 – 1.9	0.936			
No	26 /	4273	(0.6%)	1					
Tenofovir use ever									
Yes	42 /	5434	(0.8%)	4.9	1.5 – 15.8	0.008	**4.6**	**1.4 – 14.9**	**0.012**
No	3 /	1887	(0.2%)	1			**1**		
ART initiation									
Before 1.1.1997	9 /	812	(1.1%)	2.0	1.0 – 4.2	0.061			
After 1.1.1997	36 /	6509	(0.6%)	1					

* adjusted for the variables: age, sex/ mode of transmission, population size of area of residence, Abacavir use ever, ART initiation

11.3.2 Frequency of NNRTI-associated resistance mutations

The table shows the numbers of NNRTI-associated resistance mutations among patients who have ever been treated with Non-Nucleoside Reverse Transcriptase Inhibitors („NNRTI").

All centers	Deceased since 1997, NNRTI use	Patients currently in care and NNRTI use ever
	N = 639	N = 2658
Resistance to NNRTI	135 (21.1%)	320 (12.0%)
Codon 90	4 (0.6%)	26 (1.0%)
Codon 98	16 (2.5%)	18 (0.7%)
Codon 100	2 (0.3%)	13 (0.5%)
Codon 101	22 (3.4%)	40 (1.5%)
Codon 103	69 (10.8%)	167 (6.3%)
Codon 106	14 (2.2%)	22 (0.8%)
Codon 108	20 (3.1%)	35 (1.3%)
Codon 138	3 (0.5%)	28 (1.1%)
Codon 179	5 (0.8%)	23 (0.9%)
Codon 181	56 (8.8%)	104 (3.9%)
Codon 188	9 (1.4%)	19 (0.7%)
Codon 190	33 (5.2%)	57 (2.1%)
Codon 221	7 (1.1%)	19 (0.7%)
Codon 225	3 (0.5%)	12 (0.5%)
Codon 227	0 (0.0%)	2 (0.1%)
Codon 230	3 (0.5%)	4 (0.2%)

11.3.3 Frequency of PI-associated resistance mutations

The table shows the numbers of the PI-associated resistance mutations among patients who have ever been treated with Protease Inhibitors („PI").

Minor mutations:

All centers	Deceased since 1997, PI use	Patients currently in care and PI use ever
	N = 873	N = 2714
Any minor resistance to PI	317 (36.3%)	789 (29.1%)
Codon 10	82 (9.4%)	218 (8.0%)
Codon 11	4 (0.5%)	6 (0.2%)
Codon 16	6 (0.7%)	39 (1.4%)
Codon 20	59 (6.8%)	140 (5.2%)
Codon 24	5 (0.6%)	14 (0.5%)
Codon 33	18 (2.1%)	59 (2.2%)
Codon 34	1 (0.1%)	0 (0.0%)
Codon 36	129 (14.8%)	338 (12.5%)
Codon 43	2 (0.2%)	7 (0.3%)
Codon 53	7 (0.8%)	18 (0.7%)
Codon 60	8 (0.9%)	25 (0.9%)
Codon 62	25 (2.9%)	105 (3.9%)
Codon 63	213 (24.4%)	416 (15.3%)
Codon 64	16 (1.8%)	76 (2.8%)
Codon 69	19 (2.2%)	104 (3.8%)
Codon 71	116 (13.3%)	200 (7.4%)
Codon 73	16 (1.8%)	21 (0.8%)
Codon 77	102 (11.7%)	238 (8.8%)
Codon 85	0 (0.0%)	3 (0.1%)
Codon 89	17 (1.9%)	111 (4.1%)
Codon 93	36 (4.1%)	130 (4.8%)

Major mutations: All centers	Deceased since 1997, PI use N = 873		Patients currently in care and PI use ever N = 2714	
Any major resistance to PI	102	(11.7%)	188	(6.9%)
Codon 30	10	(1.1%)	29	(1.1%)
Codon 32	9	(1.0%)	9	(0.3%)
Codon 46	51	(5.8%)	82	(3.0%)
Codon 47	6	(0.7%)	10	(0.4%)
Codon 48	4	(0.5%)	10	(0.4%)
Codon 50	1	(0.1%)	6	(0.2%)
Codon 54	32	(3.7%)	54	(2.0%)
Codon 58	5	(0.6%)	13	(0.5%)
Codon 74	0	(0.0%)	2	(0.1%)
Codon 76	1	(0.1%)	0	(0.0%)
Codon 82	38	(4.4%)	73	(2.7%)
Codon 83	1	(0.1%)	1	(0.0%)
Codon 84	17	(1.9%)	22	(0.8%)
Codon 88	11	(1.3%)	25	(0.9%)
Codon 90	52	(6.0%)	82	(3.0%)

11.3.4 Resistance to single or multiple drug classes

All centres	Deceased since 1997, ever ART N = 1074		Patients currently in care and ever ART N = 4625	
Resistance test available	438	(40.8%)	1263	(27.3%)
Wild type	69	(6.4%)	320	(6.9%)
"Any" resistance	369	(34.4%)	943	(20.4%)
NRTI	191	(17.8%)	458	(9.9%)
NNRTI	154	(14.3%)	354	(7.7%)
PI	340	(31.7%)	852	(18.4%)
NRTI and PI	168	(15.6%)	391	(8.5%)
NRTI and NNRTI	109	(10.1%)	257	(5.6%)
NNRTI and PI	143	(13.3%)	303	(6.6%)
3-class-resistance	104	(9.7%)	230	(5.0%)

11.3.5 Resistance according to demographic characteristics

All patients	Number of patients	Resistance test available	Wild type	Any resistance	Resistance to						
					NRTI	NNRTI	PI	NRTI and PI	NRTI and NNRTI	NNRTI and PI	3-class-resistance
Year of ART initiation											
Up to 1995	278	216	13	203	167	96	182	146	89	91	84
1996	171	111	14	97	69	39	91	65	36	36	35
1997	139	86	16	70	33	30	64	29	23	26	21
1998	126	61	5	56	22	16	50	16	12	13	9
1999	122	62	8	54	19	22	46	13	10	19	9
2000	110	59	7	52	21	14	50	19	11	14	11
2001	97	45	12	33	14	12	33	14	10	12	10
2002	113	52	13	39	21	16	38	20	14	16	14
2003	120	46	17	29	4	7	25	4	1	3	1
2004	136	46	15	31	9	11	29	7	3	11	3
2005	157	57	17	40	14	14	36	12	8	10	6
2006	177	43	10	33	9	11	32	8	7	10	6
2007	193	54	22	32	8	7	30	7	4	5	3
2008	200	46	20	26	7	11	22	5	4	8	3
2009	249	52	24	28	10	12	24	8	7	8	5
2010	268	45	19	26	5	8	21	3	3	4	2
2011	286	41	18	23	7	7	20	4	5	4	2
2012	282	44	18	26	9	12	21	5	7	7	3
2013	264	33	16	17	1	3	15	-	-	2	-
2014	265	25	13	12	4	-	11	3	-	-	-
2015	296	22	12	10	3	4	8	2	2	3	2
2016	271	9	7	2	1	1	2	1	1	1	1
2017	305	8	4	4	1	1	2	-	-	-	-
Federal state											
Burgenland	72	18	5	13	7	5	11	5	4	4	3
Carinthia	191	37	9	28	12	8	26	10	5	7	4
Lower Austria	445	110	16	94	49	47	85	41	33	43	30
Upper Austria	520	184	47	137	88	53	121	75	50	43	43
Salzburg	263	86	30	56	26	32	49	22	19	27	17
Styria	416	107	40	67	29	24	64	28	18	22	18
Tyrol	493	155	27	128	72	32	120	65	24	30	23
Vorarlberg	129	41	8	33	13	7	29	9	5	6	4
Vienna	2007	515	136	379	156	140	342	133	93	118	85
Foreign countries	84	9	2	7	6	6	4	3	6	3	3
Missing value	5	1	0	1	-	-	1	-	-	-	-
Total	**4625**	**1263**	**320**	**943**	**458**	**354**	**852**	**391**	**257**	**303**	**230**

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Patients who initiated ART after 2000	Number of patients	Resistance test available	Wild type	Any resistance	Resistance to						
					NRTI	NNRTI	PI	NRTI and PI	NRTI and NNRTI	NNRTI and PI	3-class-resistance
Year of ART initiation											
2001	97	45	12	33	14	12	33	14	10	12	10
2002	113	52	13	39	21	16	38	20	14	16	14
2003	120	46	17	29	4	7	25	4	1	3	1
2004	136	46	15	31	9	11	29	7	3	11	3
2005	157	57	17	40	14	14	36	12	8	10	6
2006	177	43	10	33	9	11	32	8	7	10	6
2007	193	54	22	32	8	7	30	7	4	5	3
2008	200	46	20	26	7	11	22	5	4	8	3
2009	249	52	24	28	10	12	24	8	7	8	5
2010	268	45	19	26	5	8	21	3	3	4	2
2011	286	41	18	23	7	7	20	4	5	4	2
2012	282	44	18	26	9	12	21	5	7	7	3
2013	264	33	16	17	1	3	15	-	-	2	-
2014	265	25	13	12	4	-	11	3	-	-	-
2015	296	22	12	10	3	4	8	2	2	3	2
2016	271	9	7	2	1	1	2	1	1	1	1
2017	305	8	4	4	1	1	2	-	-	-	-
Population size of area of residence											
Missing value	14	-	-	-	-	-	-	-	-	-	-
Rural areas	1446	250	98	152	57	55	138	48	34	42	26
Capital cities	576	124	45	79	24	24	72	20	14	18	11
Vienna	1643	294	114	180	46	58	159	35	28	44	24
Sex/ mode of transmission											
MSM	1640	193	89	104	23	40	90	19	17	26	13
Male IDU	318	93	29	64	17	22	61	15	11	20	10
Female IDU	135	49	14	35	6	8	34	6	2	7	2
Male heterosexual	701	122	49	73	33	23	66	28	17	18	14
Female heterosexual	696	186	66	120	41	39	105	30	25	29	19
Others	189	25	10	15	7	5	13	5	4	4	3
Age at time of HIV-test											
< 35 years	1966	443	160	283	83	100	259	68	55	81	45
≥ 35 years	1713	225	97	128	44	37	110	35	21	23	16
Total	**3679**	**668**	**257**	**411**	**127**	**137**	**369**	**103**	**76**	**104**	**61**

11.3.6 Cumulative resistance related to different time periods of ART initiation

		Initial therapy before 1.1.1997		Initial therapy between 1.1.1997 and 31.12.2002		Initial therapy after 1.1.2003	
		N	%	N	%	N	%
Ever HIV RNA ≥ 200 copies/ml		418	93.7%	507	71.9%	960	27.8%
At least 5 HIV RNA ≥ 200 copies/ml		349	78.3%	290	41.1%	286	8.3%
No resistance test after ART		122	27.4%	341	48.4%	2893	83.7%
Resistance test after ART		324	72.6%	364	51.6%	563	16.3%
Total		**446**	**100%**	**705**	**100%**	**3456**	**100%**
Number of NRTI-associated resistance mutations							
0	mutations	89	20.0%	235	33.3%	472	13.7%
1	mutation	42	9.4%	64	9.1%	64	1.9%
2	mutations	32	7.2%	27	3.8%	14	0.4%
3	mutations	41	9.2%	12	1.7%	9	0.3%
4	mutations	52	11.7%	15	2.1%	3	0.1%
5	mutations	34	7.6%	11	1.6%	0	0.0%
6	mutations	21	4.7%			1	0.0%
7	mutations	10	2.2%				
8	mutations	2	0.4%				
9	mutations	1	0.2%				
Number of NNRTI-associated resistance mutations							
0	mutations	189	42.4%	255	36.2%	456	13.2%
1	mutation	62	13.9%	52	7.4%	61	1.8%
2	mutations	41	9.2%	43	6.1%	31	0.9%
3	mutations	19	4.3%	11	1.6%	11	0.3%
4	mutations	5	1.1%	3	0.4%	4	0.1%
5	mutations	3	0.7%				
6	mutations	2	0.4%				
7	mutations	3	0.7%				
Number of PI-associated resistance mutations							
0	mutations	53	11.9%	83	11.8%	269	7.8%
1	mutation	59	13.2%	71	10.1%	66	1.9%
2	mutations	62	13.9%	84	11.9%	53	1.5%
3	mutations	42	9.4%	44	6.2%	47	1.4%
4	mutations	20	4.5%	42	6.0%	62	1.8%
5	mutations	20	4.5%	21	3.0%	39	1.1%
6	mutations	18	4.0%	8	1.1%	17	0.5%
7	mutations	16	3.6%	3	0.4%	6	0.2%
8	mutations	7	1.6%	1	0.1%	1	0.0%
9	mutations	4	0.9%	3	0.4%	2	0.1%
10	mutations	5	1.1%	1	0.1%	0	0.0%
11	mutations	3	0.7%	2	0.3%	1	0.0%
12	mutations	3	0.7%	0	0.0%		
13	mutations	1	0.2%	0	0.0%		
14	mutations	6	1.3%	1	0.1%		
15	mutations	3	0.7%				
16	mutations	1	0.2%				
17	mutations	0	0.0%				
21	mutations	1	0.2%				

11.3.7 Probability of development of resistance

11.3.7.1 Any ART regimen

„Any" resistance

R² = 0.91

3-class-resistance

R² = 0.64
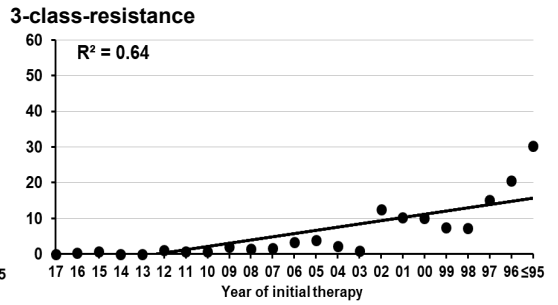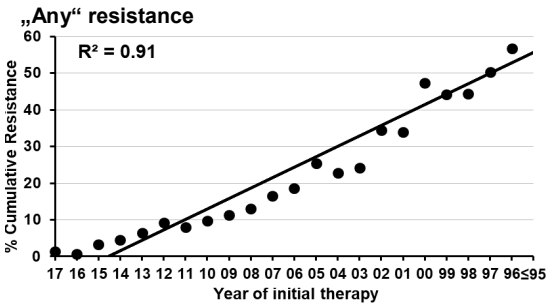
11.3.7.2 Any ART regimen and initial ART after January 1, 1997

„Any" resistance

R² = 0.93

3-class-resistance

R² = 0.66
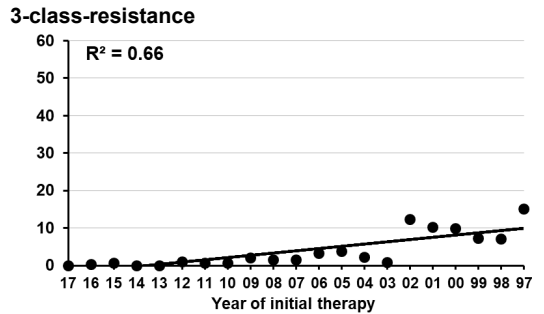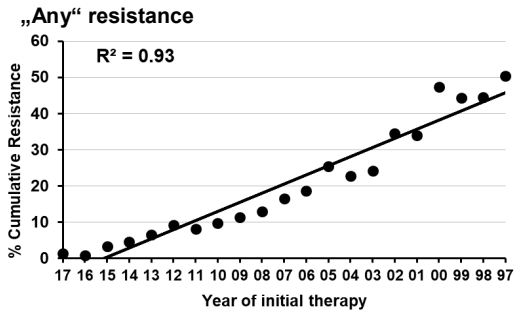
11.3.7.3 Initial ART with 2 NRTI + 1 NNRTI

Resistance to NNRTI

R² = 0.80

Resistance to NRTI

R² = 0.49
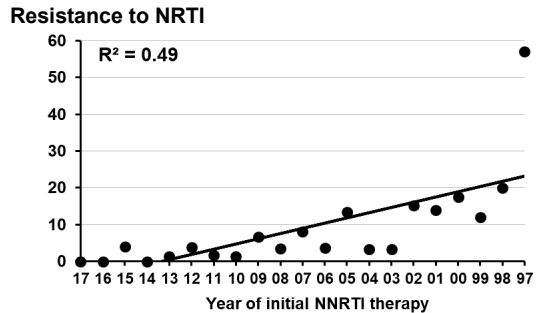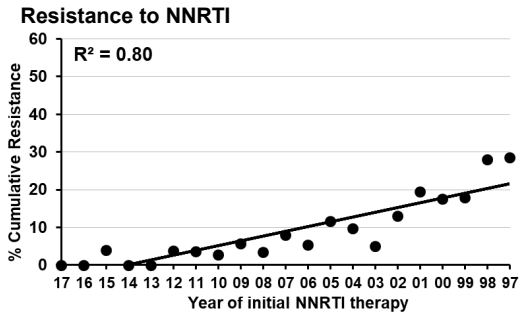
11.3.7.4 Initial ART with 2 NRTI + 1 PI

Resistance to PI

R² = 0.90

Resistance to NRTI

R² = 0.67

94
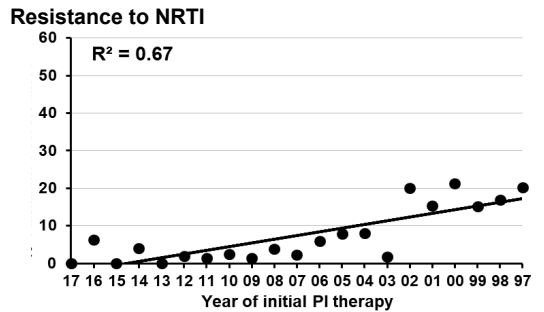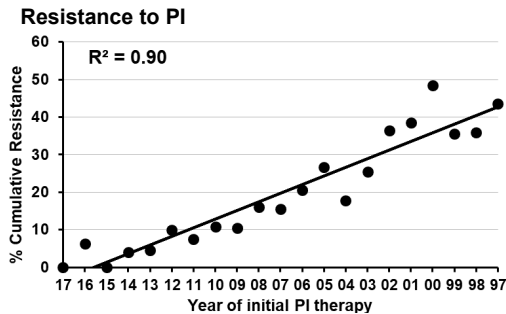
11.3.8 Risk factors for the development of resistance

11.3.8.1 Patients with 3-class-resistance

All centres	All deaths after 1996		AIDS related deaths after 1996		AIDS related deaths after 1996 and ART > 6 months		Patients currently in care and ART use ever	
	N = 1420		N = 435		N = 371		N = 4625	
3-class-resistance	104	(7.3%)	31	(7.1%)	31	(8.4%)	230	(5.0%)

3-class-resistance	Patients currently in care and ART use ever		
	N	=	230
Age (years; mean ± S. D.)	52.9	±	10.6
Federal states			
Carinthia	4		(1.7%)
Upper Austria	43		(18.7%)
Salzburg	17		(7.4%)
Styria	18		(7.8%)
Tyrol	23		(10.0%)
Vienna	85		(37.0%)
Other federal states	37		(16.1%)
Foreign countries	3		(1.3%)
Sex/ Mode of transmission			
MSM	81		(35.2%)
Male IDU	22		(9.6%)
Female IDU	10		(4.3%)
Male heterosexual	46		(20.0%)
Female heterosexual	52		(22.6%)
Others	19		(8.3%)
AIDS	118		(51.3%)
CD4 nadir (cells/µl; mean ± S. D.)	118.7	±	109.1
Current CD4 cell counts (cells/µl; mean ± S. D.)	651.0	±	350.2
Last HIV-RNA			
≤50 copies/ml	197	±	(85.7%)
51-199 copies/ml	13		(5.2%)
≥200 copies/ml	20		(9.1%)
Duration of ART (months; mean ± S. D.)	226.1	±	64.9

Risk factors for the development of 3-class-resistance

All centres — Variable	Frequencies N= 230 / 4625 (5.0%)	Univariable regression OR (95% CI)	p-value	Model 1 (N = 4625) Multivariable regression OR (95% CI)	p-value
Demographic characteristics					
Age at ART start					
<30 years	82 / 1221 (6.7%)	4.1 · 2.1 – 7.9	<0.001	2.3 · 1.2 – 4.7	0.018
30-50 years	138 / 2829 (4.9%)	2.9 · 1.5 – 5.5	0.001	2.0 · 1.0 – 4.0	0.043
>50 years	10 / 575 (1.7%)	1		1	
Sex / mode of transmission					
Male IDU	22 / 419 (5.3%)	1.3 · 0.8 – 2.1	0.292	0.7 · 0.4 – 1.2	0.160
Female IDU	10 / 207 (4.8%)	1.2 · 0.6 – 2.3	0.616	0.4 · 0.2 – 0.9	0.026
Male heterosexual	46 / 865 (5.3%)	1.3 · 0.9 – 1.9	0.148	1.1 · 0.7 – 1.7	0.585
Female heterosexual	52 / 905 (5.7%)	1.4 · 1.0 – 2.0	0.051	1.1 · 0.8 – 1.7	0.528
Other	19 / 252 (7.5%)	1.9 · 1.1 – 3.2	0.014	1.1 · 0.6 – 2.0	0.792
MSM	81 / 1977 (4.1%)	1		1	
Population size of area of residence					
Missing value	0 / 14 (0.0%)	- · -	-	- · -	-
Rural areas	92 / 1842 (5.0%)	1.2 · 0.9 – 1.6	0.237	1.1 · 0.8 – 1.6	0.520
Capital cities	53 / 744 (7.1%)	1.8 · 1.2 – 2.5	0.002	1.8 · 1.2 – 2.7	0.003
Vienna	85 / 2025 (4.2%)	1		1	
Stage of disease					
AIDS					
Yes	118 / 1141 (10.3%)	3.5 · 2.7 – 4.5	<0.001		
No	112 / 3484 (3.2%)	1			
CD4 nadir					
Missing value	0 / 13 (0.0%)	- · -	-	- · -	-
<50 cells/µl	79 / 721 (11.0%)	6.4 · 4.4 – 9.2	<0.001	3.4 · 2.3 – 5.1	<0.001
50-199 cells/µl	102 / 1303 (7.8%)	4.4 · 3.1 – 6.2	<0.001	2.2 · 1.5 – 3.2	<0.001
≥200 cells/µl	49 / 2588 (1.9%)	1		1	
Current HIV RNA					
Missing value	0 / 17 (0.0%)	- · -	-	- · -	-
≤50 copies/ml	197 / 4299 (4.6%)	0.3 · 0.2 – 0.5	<0.001	0.2 · 0.1 – 0.4	<0,001
51-199 copies/ml	13 / 165 (7.9%)	0.5 · 0.3 – 1.1	0.092	0.5 · 0.2 – 1.2	0.121
≥200 copies/ml	20 / 144 (13.9%)	1		1	
ART					
ART initiation					
Before 1.1.1997	119 / 449 (26.5%)	33.4 · 22.7 – 49.2	<0.001	27.2 · 18.1 – 40.9	<0.001
1.1.1997 to 31.12.2002	74 / 707 (10.5%)	10.8 · 7.2 – 16.2	<0.001	9.1 · 6.0 – 13.8	<0.001
Since 1.1.2003	37 / 3469 (1.1%)	1		1	

11.3.8.2 Patients with any resistance (ART start since 1.1.1997)

All centres	All deaths after 1996		AIDS related deaths after 1996		AIDS related deaths after 1996 and ART > 6 months		Patients currently in care and ART use ever after 1996	
	N = 1120		N = 354		N = 291		N = 4176	
Any resistance	218	(19.5%)	70	(19.8%)	70	(24.1%)	643	(15.4%)

Any resistance	Patients currently in care and ART use ever after 1996		
	N = 643		
Age (years; mean ± S. D.)	34.3	±	9.5
Federal states			
Carinthia	24		(3.7%)
Upper Austria	89		(13.8%)
Salzburg	47		(7.3%)
Styria	50		(7.8%)
Tyrol	68		(10.6%)
Vienna	274		(42.6%)
Other federal states	86		(13.4%)
Foreign countries/ missing	5		(0.8%)
Sex/ Mode of transmission			
MSM	182		(28.3%)
Male IDU	95		(14.8%)
Female IDU			
Male heterosexual	115		(17.9%)
Female heterosexual	177		(27.5%)
Others	21		(3.3%)
AIDS	234		(36.4%)
CD4 nadir (cells/µl; mean ± S. D.)	115.8	±	141.1
Current CD4 cell counts (cells/µl; mean ± S. D.)	625.5	±	333.0
Last HIV-RNA			
≤50 copies/ml	570		(88.6%)
51-199 copies/ml	25		(3.9%)
≥200 copies/ml	48		(7.5%)
Duration of ART (months; mean ± S. D.)	151.8	±	64.2

Risk factors for the development of any resistance

All centres	Frequencies N=		Univariable regression		Model 1 (N = 4176) Multivariable regression	
Variable	643 / 4176	(15.4%)	OR (95% CI)	p-value	OR (95% CI)	p-value
Demographic characteristics						
Age at ART start						
<30 years	225 / 1059	(21.2%)	3.3 2.3 - 4.6	<0.001	2.8 1.9 - 4.0	<0.001
30-50 years	376 / 2567	(14.6%)	2.1 1.5 - 2.9	<0.001	1.7 1.2 - 2.4	0.004
>50 years	42 / 550	(7.6%)	1		1	
Sex / mode of transmission						
Male IDU	95 / 365	(26.0%)	3.1 2.4 - 4.2	<0.001	2.5 1.8 - 3.4	<0.001
Female IDU	53 / 168	(31.5%)	4.1 2.9 - 5.9	<0.001	2.6 1.8 - 4.0	<0.001
Male heterosexual	115 / 804	(14.3%)	1.5 1.2 - 1.9	0.002	1.2 0.9 - 1.6	0.140
Female heterosexual	177 / 818	(21.6%)	2.5 2.0 - 3.1	<0.001	2.0 1.6 - 2.5	<0.001
Other	21 / 211	(10.0%)	1.0 0.6 - 1.6	0.963	0.8 0.5 - 1.3	0.384
MSM	182 / 1810	(10.1%)	1		1	
Population size of area of residence						
Missing value	0 / 14	(0.0%)	-	-	-	-
Rural areas	244 / 1658	(14.7%)	1.0 0.8 - 1.2	0.869	1.0 0.8 - 1.2	0.930
Capital cities	125 / 667	(18.7%)	1.3 1.0 - 1.7	0.021	1.5 1.1 - 1.9	0.003
Vienna	274 / 1837	(14.9%)	1		1	
Stage of disease						
AIDS						
Yes	234 / 937	(25.0%)	2.3 1.9 - 2.8	<0.001		
No	409 / 3239	(12.6%)	1			
CD4 nadir						
Missing value	0 / 13	(0.0%)	-	-	-	-
<50 cells/µl	163 / 612	(26.6%)	3.2 2.6 - 4.0	<0.001	2.4 1.9 - 3.1	<0.001
50-199 cells/µl	230 / 1096	(21.0%)	2.3 1.9 - 2.8	<0.001	1.6 1.3 - 2.0	<0.001
≥200 cells/µl	250 / 2455	(10.2%)	1		1	
Current HIV RNA						
Missing value	0 / 17	(0.0%)	-	-	-	-
≤50 copies/ml	570 / 3884	(14.7%)	0.3 0.2 - 0.4	<0.001	0.3 0.2 - 0.4	<0.001
51-199 copies/ml	25 / 147	(17.0%)	0.3 0.2 - 0.6	<0.001	0.4 0.2 - 0.8	0.009
≥200 copies/ml	48 / 128	(37.5%)	1		1	
ART						
ART initiation						
1.1.1997 to 31.12.2002	304 / 707	(43.0%)	7.0 5.8 - 8.4	<0.001	6.4 5.2 - 7.8	<0.001
Since 1.1.2003	339 / 3469	(9.8%)	1		1	

12 Co-morbidities and Co-medication
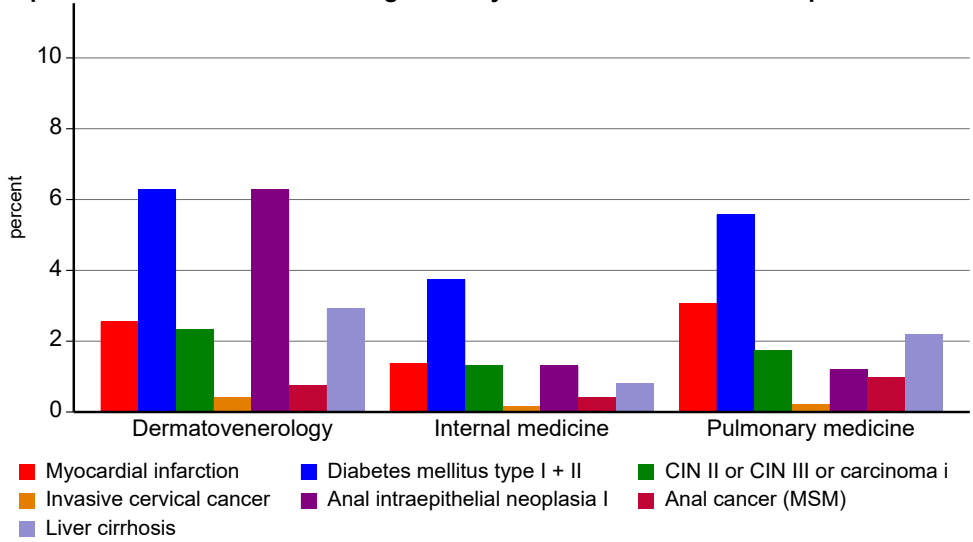
12.1 Co-morbidities

One aim of the Austrian HIV Cohort Study is to document co-morbidities and adverse drug reactions, as well as to investigate possible associations with ART. As a first step, important co-morbidities are illustrated.

Cumulative incidence in patients with a follow-up in the last 12 months (co-morbidities ever documented)

< 50 years	Male IDU	%	Female IDU	%	Male hetero	%	Female hetero	%	MSM	%
Number of patients	284	%	141	%	348	%	577	%	1318	%
Hypertension	27	9.5	7	5	55	15.8	67	11.6	108	8.2
Coronary heart disease	4	1.4	2	1.4	7	2	2	0.3	8	0.6
Myocardial infarction	1	0.4	1	0.7	4	1.1	1	0.2	12	0.9
Stroke	1	0.4	1	0.7	3	0.9	6	1	3	0.2
Diabetes mellitus type I + II	7	2.5	3	2.1	17	4.9	15	2.6	19	1.4
CIN II or CIN III or carcinoma in situ			9	6.4			46	8		
Invasive cervical cancer							4	0.7		
St. p. hysterectomy			3	2.1			8	1.4		
Anal intraepithelial neoplasia II, III	1	0.4	1	0.7	8	2.3	4	0.7	117	8.9
Anal cancer	1	0.4							5	0.4
Osteoporosis	8	2.8	2	1.4	4	1.1	16	2.8	22	1.7
Liver cirrhosis	13	4.6	3	2.1	1	0.3	1	0.2	6	0.5
Attempted suicide or suicide	9	3.2	2	1.4	4	1.1	4	0.7	11	0.8
Drug overdose (mainly opiates)	15	5.3	6	4.3	1	0.3	1	0.2	4	0.3
Renal failure stage 3, 4, 5	6	2.1	8	5.7	18	5.2	19	3.3	20	1.5

≥ 50 years	Male IDU	%	Female IDU	%	Male hetero	%	Female hetero	%	MSM	%
Number of patients	182	%	98	%	573	%	395	%	872	%
Hypertension	48	26.4	13	13.3	194	33.9	103	26.1	290	33.3
Coronary heart disease	25	13.7	12	12.2	58	10.1	22	5.6	98	11.2
Myocardial infarction	12	6.6	6	6.1	21	3.7	9	2.3	45	5.2
Stroke	10	5.5	3	3.1	19	3.3	13	3.3	19	2.2
Diabetes mellitus type I + II	13	7.1	4	4.1	80	14	35	8.9	68	7.8
CIN II or CIN III or carcinoma in situ			13	13.3			31	7.8		
Invasive cervical cancer			4	4.1			7	1.8		
St. p. hysterectomy			9	9.2			25	6.3		
Anal intraepithelial neoplasia II, III	2	1.1	3	3.1	13	2.3	5	1.3	93	10.7
Anal cancer			3	3.1	3	0.5	2	0.5	31	3.6
Osteoporosis	40	22	32	32.7	64	11.2	80	20.3	92	10.6
Liver cirrhosis	28	15.4	21	21.4	12	2.1	8	2	16	1.8
Attempted suicide or suicide	10	5.5	5	5.1	4	0.7	2	0.5	11	1.3
Drug overdose (mainly opiates)	5	2.7	4	4.1	2	0.3	1	0.3	3	0.3
Renal failure stage 3, 4, 5	4	2.2	24	24.5	37	6.5	55	13.9	37	4.2

Comparison of "co-morbidities" diagnosed by the different medical subspecialities

- ■ Myocardial infarction
- ■ Invasive cervical cancer
- ■ Liver cirrhosis
- ■ Diabetes mellitus type I + II
- ■ Anal intraepithelial neoplasia I
- ■ CIN II or CIN III or carcinoma i
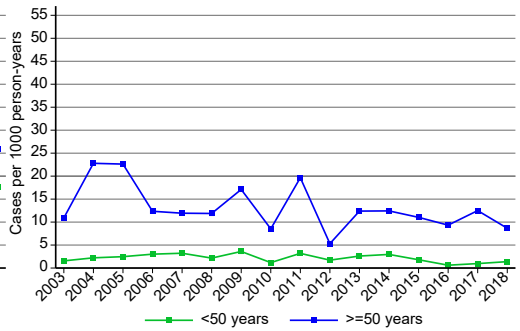- ■ Anal cancer (MSM)
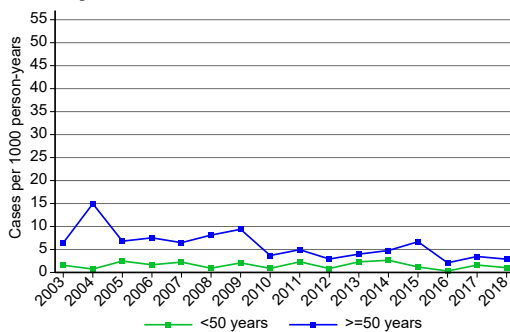
12.2 Incidence of Co-morbidities related to age

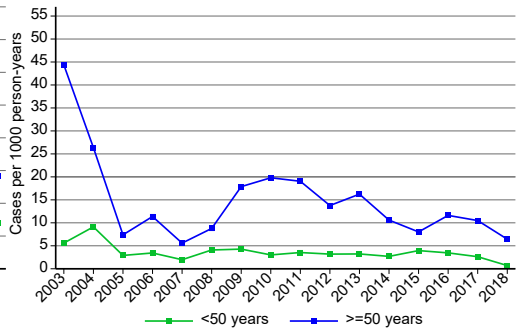### Hypertension
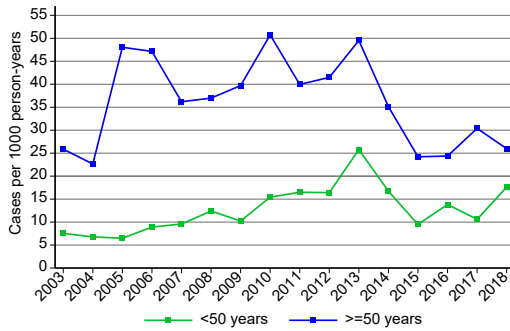
Coronary heart disease

Myocardial infarction

Stroke

100

Diabetes mellitus type I+II

Cases per 1000 person-years

—■— <50 years   —■— >=50 years

Osteoporosis

Cases per 1000 person-years

—■— <50 years   —■— >=50 years

Liver cirrhosis

Cases per 1000 person-years
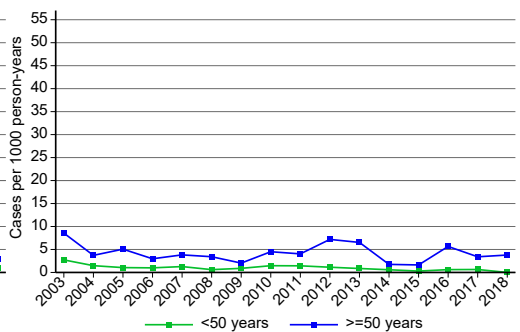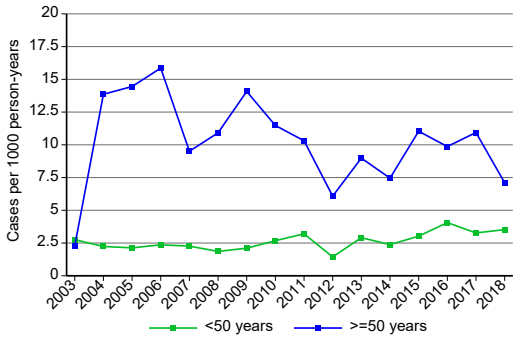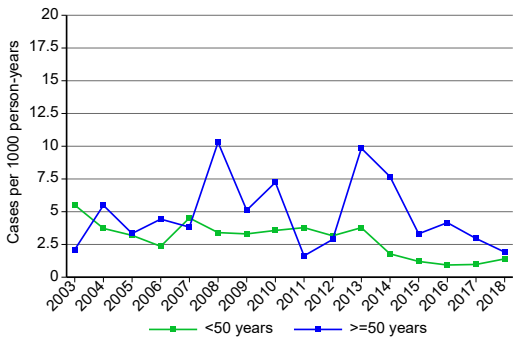
—■— <50 years   —■— >=50 years

Renal failure stage 3 or 4 or 5

Cases per 1000 person-years

—■— <50 years   —■— >=50 years

Attempted suicide or suicide

Cases per 1000 person-years

—■— <50 years   —■— >=50 years

Drug overdose (mainly opiates)

Cases per 1000 person-years
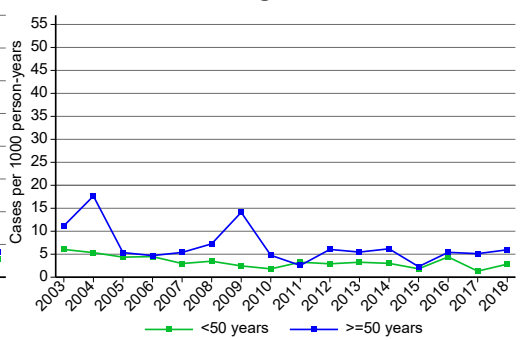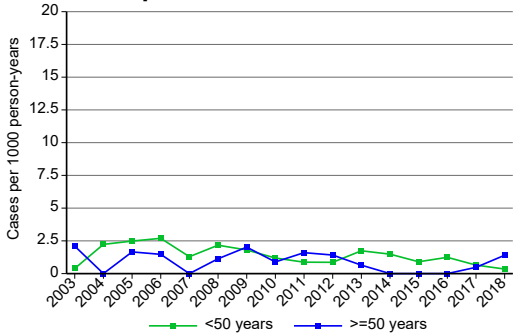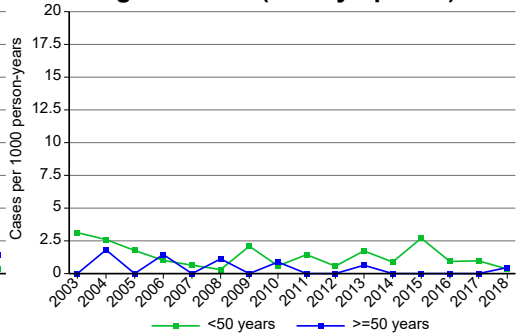
—■— <50 years   —■— >=50 years

12.3   Co-medication related to age

< 50 years	Male IDU		Female IDU		Male hetero		Female hetero		MSM	
Current therapies	284	%	141	%	348	%	577	%	1318	%
Acetylsalicylic acid	8	2.8	5	3.5	12	3.4	9	1.6	32	2.4
ACE inhibitors/angiotensin antagonists	20	7.0	4	2.8	48	13.8	46	8.0	96	7.3
Beta blocker	15	5.3	4	2.8	18	5.2	20	3.5	64	4.9
Statin	15	5.3	4	2.8	35	10.1	37	6.4	103	7.8
Fibrate	4	1.4			1	0.3	2	0.3	9	0.7
Insulin	3	1.1	1	0.7	5	1.4	2	0.3	3	0.2
Oral antidiabetic drugs	5	1.8	2	1.4	13	3.7	9	1.6	17	1.3
Proton pump inhibitors	70	24.6	36	25.5	37	10.6	71	12.3	87	6.6
Bisphosphonates	2	0.7	1	0.7	1	0.3	6	1.0	9	0.7
Thyroid hormones	7	2.5	10	7.1	10	2.9	38	6.6	26	2.0
Opiate substitution	172	60.6	101	71.6	18	5.2	19	3.3	16	1.2
Psychotropic drugs	209	73.6	118	83.7	65	18.7	99	17.2	230	17.5
Anxiolytics, hypnotics, sedatives	90	31.7	48	34.0	9	2.6	20	3.5	40	3.0
Antidepressants	64	22.5	36	25.5	24	6.9	63	10.9	131	9.9
Antipsychotics	51	18.0	24	17.0	12	3.4	21	3.6	46	3.5

| ≥ 50 years	Male IDU		Female IDU		Male hetero		Female hetero		MSM	
Current therapies	182	%	98	%	573	%	395	%	872	%
Acetylsalicylic acid	47	25.8	15	15.3	105	18.3	45	11.4	161	18.5
ACE inhibitors/angiotensin antagonists	43	23.6	13	13.3	219	38.2	97	24.6	302	34.6
Beta blocker	24	13.2	15	15.3	95	16.6	59	14.9	148	17.0
Statin	55	30.2	23	23.5	227	39.6	113	28.6	315	36.1
Fibrate	2	1.1			23	4.0	5	1.3	27.0	3.1
Insulin	7	3.8			21	3.7	9	2.3	24.0	2.8
Oral antidiabetic drugs	4	2.2	2	2.0	54	9.4	23	5.8	44	5.0
Proton pump inhibitors	47	25.8	29	29.6	106	18.5	67	17.0	161	18.5
Bisphosphonates	6	3.3	6	6.1	21	3.7	23	5.8	29	3.3
Thyroid hormones	20	11.0	19	19.4	24	4.2	58	14.7	55	6.3
Opiate substitution	106	58.2	59	60.2	22	3.8	16	4.1	30	3.4
Psychotropic drugs	128	70.3	75	76.5	126	22.0	127	32.2	268	30.7
Anxiolytics, hypnotics, sedatives	50	27.5	38	38.8	30	5.2	29	7.3	52	6.0
Antidepressants	43	23.6	35	35.7	62	10.8	68	17.2	162	18.6
Antipsychotics	28	15.4	17	17.3	27	4.7	19	4.8	52	6.0

12.4   Co-medication

Comparison of "co-medications" used by the different medical subspecialities
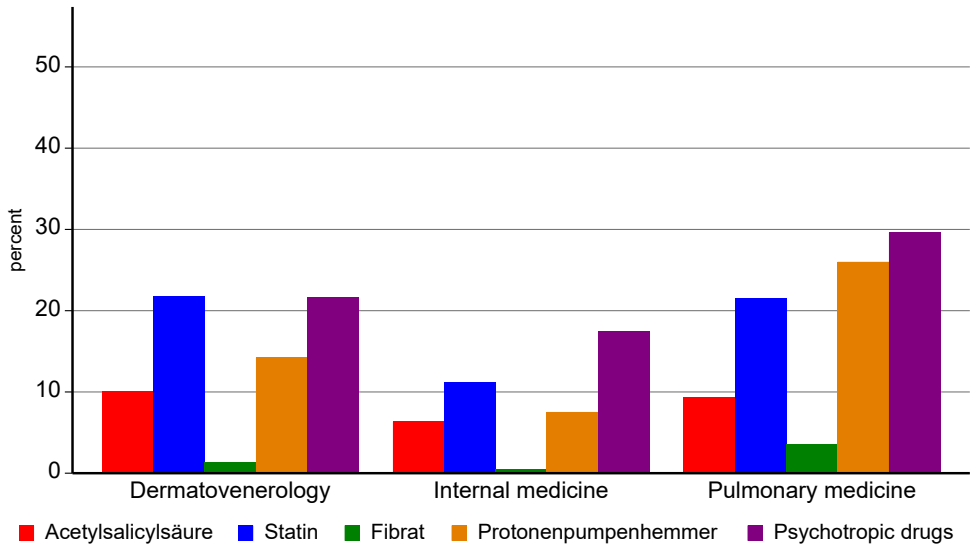
12.5   Examples of quality assurance

"Quality assurance"			
LDL cholesterol not documented within the last 12 months (1)	628	5056	12.4
LDL cholesterol documented	4416	5056	87.3
LDL > 160 mg/dl	480	4416	10.9
Smoking never documented (2)	411	5056	8.1
Smoking documented	4645	5056	91.9
Smoking	2357	4645	50.7
LDL > 160 mg/dl and smoking (> 50 years)	95	941	10.1
LDL > 160 mg/dl and smoking and no statin (> 50 years)	75	95	78.9
Blood pressure not documented within the last 12 months (3)	512	5056	10.1
Blood pressure documented	4544	5056	89.9
Arterial hypertension	954	4544	21.0
Arterial hypertension and smoking	355	954	37.2
Blood pressure documented (> 50 years)	2035	2227	91.4
Arterial hypertension (> 50 years)	678	2035	33.3
Arterial hypertension and smoking (> 50 years)	239	678	35.3
Arterial hypertension and smoking and no statin (> 50 years)	115	239	48.1
Coronary heart disease (CHD)	252	5056	5.0
CHD and no statin	66	252	26.2
CHD and LDL cholesterol documented	245	252	97.2
CHD and LDL > 130 mg/dl	37	245	15.1
Diabetes	280	5056	5.5
Diabetes and HbA1c > 8	26	280	9.3
Diabetes and no HbA1c within the last 12 months (4)	18	280	6.4
Hepatitis C and visit within the last 12 months	159	5056	3.1
Hepatitis C and elastography never documented (5)	142	159	89.3
No syphilis screening in the last 6 months within MSM (6)	242	1948	12.4
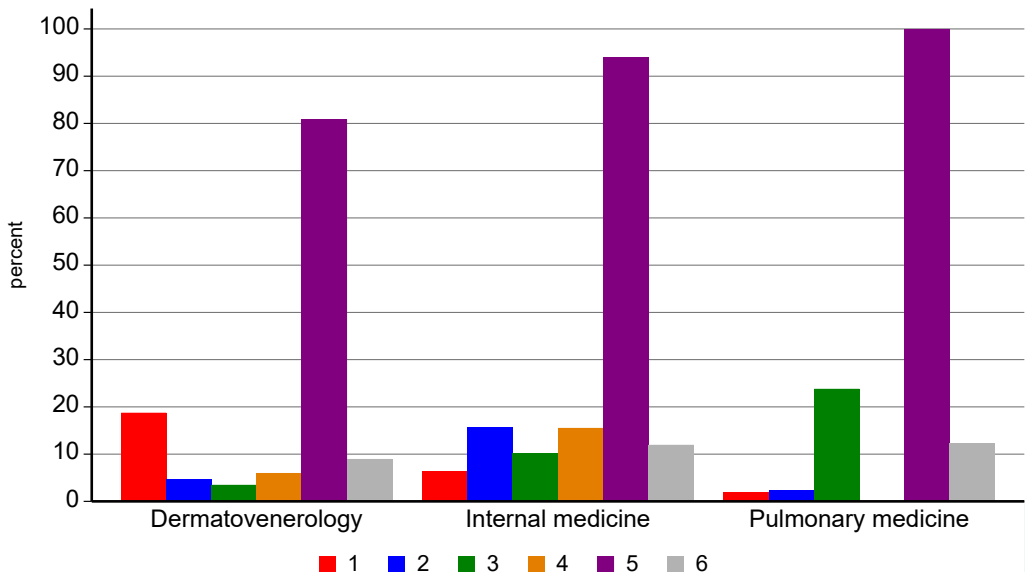
13   Summary

HIV Patient Management System

The Austrian HIV Cohort Study uses its own electronic health record, the *HIV Patient Management System,* which is the common tool for the HIV Cohort. The data input is done decentralized in the HIV centres. The input of laboratory results is done mostly electronically, and in every centre various professional groups are involved in data entry. Before data sets are merged, the cohort participants have been made anonymous. Therefore, it is very laborious to identify cohort participants who are/ were treated in more than just one treatment centre. This cannot be done by using personal data such as initials, date of birth or postal code, but with HIV specific data (date of the HIV test, CD4 cell counts etc.).

On the one hand, the *HIV Patient Management System* fulfills complex tasks for the clinical management of HIV infected patients, and on the other hand it allows queries and analyses to be performed by the users without restrictions. However, to allow both individual patient management and scientific queries is an enormous challenge which scientific HIV cohorts in other countries have not had to deal with. While for the clinical patient management the focus is on readability of diagnoses and therapies, creation of medical reports, prescriptions (trade names!), print-out of results etc., scientific queries need precise coding and categorization. Furthermore, the optimization of individual patient management requires an ongoing adjustment to the progress of information technology, whereas purely scientific data bases do not have such technological renewal pressure. However, in Austria, there was no acceptance for a purely scientific data base.

Patients with a follow-up in the last 12 months

The highest number of cohort participants are seen at the AKH Vienna (32.0%), followed. by the OWS Vienna (18.1%), Innsbruck (14.1%), Linz (11.4%), Graz (9.2%), Salzburg (5.9%), Klagenfurt (4.2%), KFJ Vienna (3.6%) and Feldkirch (1.5%). However, a considerable proportion (27.6%) of patients did not have a follow-up within the last 12 months. Reasons for this „loss of follow-up" could be a change to health-care providers outside the HIV-centres of AHIVCOS, lack of knowledge of death and many individuals might have left the country.

Who and how many are infected with HIV in Austria?

The cohort study records the number of the included patients, the number of patients on ART (approximately 80% of all patients on ART in Austria are included in the cohort), the proportion of "late" presenters and finally the number of the patients who died with or without AIDS.

The median age at diagnosis has been between 30 and 40 years since 1990. 25.1% of the patients with a follow-up in the last 12 months are female. The rate is highest in Upper Austria (33.2%), Burgenland (32.5%) and Vorarlberg (27.6%).

In the subgroup of heterosexually acquired infections, the rate of the women is 51.4%. It is highest in Upper Austria (56.9%), Styria (56.6%), Tyrol (52.9%) and Burgenland (52.8%). Among patients newly diagnosed in 2019, 29.9% have been infected through heterosexual contacts. Since 2000, 35.3% of all newly diagnosed HIV infections were transmitted through heterosexual contacts.

Most of the cohort participants are Austrian nationals (70.7%). 8.6% come from high prevalence countries and 17.7% from low prevalence countries outside Austria. Information on the nationality of the remaining patients is missing.

As of January 1st 2017, the modelling tool of ECDC reveals a number of 9440 PLHIV, assuming that AHIVCOS is representative for the whole of Austria. This is likely an overestimation, since the ascertainment of patients who left the country is incomplete.

According to Hauptverband der Sozialversicherungsträger, 6847 persons received cART in 2018. An analysis within AHIVCOS, based on the same method, revealed 4945 persons with cART in 2017 representing 75% of all patients in Austria receiving cART. Overall, we estimate, according to the ECDC tool, that about 80-85% of PLHIV are receiving cART (no major change for 2017 expected). Thus the estimate for PLHIV, based on the number given by the Hauptverband and the calculation of 80-85% receiving cART, add up to 8055-8560 PLHIV for end of 2018.

Is the HIV test used efficiently?

Austria has one of the highest rates of HIV tests per capita in Europe. Nevertheless, a substantial number of patients (~25%) is already immune deficient (CD4 cell count <200/µl) at the time of the first contact with an HIV centre.

Therefore, risk factors for an "early" and a "late" diagnosis have been evaluated. Patients who have been diagnosed with HIV between 2001 and 2019 were analysed. During this period, 6042 HIV infections were newly diagnosed. The infections occurred in 35.1% through heterosexual transmission, in 43.9% through MSM and in 14.8% through IDU.

An "early" diagnosis is defined by: a seroconversion illness (westernblot pattern or antigen/HIV RNA with corresponding clinical symptoms) or documented seroconversion with negative test not more than 3 years before the first positive HIV test.

A "late" diagnosis is defined by: CD4<350 at time of HIV diagnosis and/or AIDS within 3 months of HIV diagnosis.

18.0% of the examined patients had an "early" diagnosis and 42.4% a "late" diagnosis.

A higher risk to be diagnosed "late" was found in older patients (>50), in those who have been infected heterosexually and male IDU compared to MSM and in persons originating not from Austria.

An „early" diagnosis was found more frequently in younger patients (<50), MSM, in patients originating from Austria and in persons residing in places with less than 1 million inhabitants.

Transmission of drug resistant HIV

In all centres, 248 (7.2%) of 3454 patients were identified who had at least one resistance mutation before their first antiretroviral therapy. One patient had a 3-class resistance to NRTI, NNRTI and PI before starting ART. Nine patients had a resistance to NRTI and PI, four patients had a resistance to NRTI and NNRTI, and four patients had a resistance to NNRTI and PI. The transmission of drug resistant HI viruses has decreased in the last years. However, not all centres did resistance tests before ART initiation or at diagnosis, but most have implemented the routine testing in 2003.

Stage of HIV disease

The cohort participants represent all stages of HIV infection. Half of the patients have a CD4 nadir <200/μl. The median of the CD4 nadir of the patients with a visit in the last 12 months is 233/μl. The current CD4 cell count is 664/μl (median at the last measurement). As of September 1st, 2019, about 4.6% of the patients with a visit in the last 12 months had a current CD4 cell count below 200/μl and only 28 (0.6%) of them had a CD4 cell count <50/μl. The mean CD4 cell count is currently 691/μl. Therefore, the number of patients with an opportunistic infection will remain low in the following years.

Mortality

The reduction of mortality after the implementation of antiretroviral combination therapies is impressive (see items 10.1 and 10.2). In 1994, the death rate of patients

with AIDS was 40.6 per 100 person-years for men and 44.4 for women. Over the last years the rate decreased to below 5 for men and for women. From 2005 to 2018 (except for the year 2006), injecting drug users had a higher death rate than homosexual men. Only in 2006 the death rate of homosexual men was higher than for IDU.

Viral suppression under antiretroviral therapy

The rate of viral suppression under antiretroviral therapy in Austria is similar to figures from other countries. However, it has to be considered that the rate of viral suppression has been measured with the patients currently in care and that patients with "loss of follow-up" are not included.

Increase of CD4 cell counts during antiretroviral therapy

The CD4 cells during antiretroviral therapy have continuously increased, and the increase continues after 5 and 7.5 years of ART initiation. The increase is faster in patients on continuous ART compared to patients with treatment interruptions (see item 10.3.2).

Access to antiretroviral therapy

The Austrian HIV Cohort Study cannot evaluate whether access to the HIV centres differs by sex, mode of transmission, nationality, or other factors.

The nine HIV centres have to care for an increasing number of patients on antiretroviral treatment. This was a natural development, there was no public health policy which pushed the treatment into the HIV-centres. One might say, "the market wants it that way".

Development of resistances during antiretroviral therapy

The probability of developing resistance to antiretroviral drugs seems to be decreasing (chapter 11.3.7). So, the risk of „any" resistance after more than 10 years of ART is about 45%, for NRTI-associated resistance about 25% and for 3-class resistance 10%. The probability of NNRTI-associated resistance after more than 10 years is about 20% in patients who started ART with NNRTIs. The probability of PI-associated resistance after 10 years is 40% in patients who had a PI-based antiretroviral combination therapy as their initial therapy. The results are about the same if transmitted resistances are excluded.

The strongest risk factor for the development of 3-class-resistance during antiretroviral therapy is initiation of ART before 1997, followed by low CD4 nadir and younger age (<30 years). Persons with a current HIV RNA below 400 copies/ml seem to have a lower risk of developing 3-class-resistance during ART.

In our cohort, 45 patients of 7694 (0.6%) have a mutation of the codon 65 of the RT (K65R). The occurrence of the mutation K65R was more frequent in regimens including Tenofovir compared with Abacavir and could be found more often in patients with advanced immune deficiency (low CD4 nadir/ AIDS; chapter 11.3.1.2).

Co-infections

Co-infections with syphilis, hepatitis B, and hepatitis C are common. Like in other European countries, an enormous increase of new syphilis infections, especially among MSM, is apparent. This indicates a lack of prevention and "Safer Sex" practices. However, it is necessary to note that an increased "*sero-sorting*" behaviour (sexual contacts with partners with the same HIV status) could have substantially contributed to this increase.

In Austria, infection with hepatitis C is still uncommon in MSM. Not all patients are offered vaccination against hepatitis B, although it is recommended for all HIV infected persons.

Co-morbidities

Improved survival has shifted the health care towards more individuals older than 50 years. The medical needs of older HIV-infected patients may differ from those of younger patients. Older individuals, with new or longstanding HIV infection, are at greater risk for non-HIV-related morbidities. Of special concern are cardiovascular diseases, osteoporosis, liver and neuropsychiatric disorders. Thus, aging of the HIV-infected population under care will lead to more complex medical management and increased costs of care. Health care agencies need to be aware of the impact of this important change in near future.

Outlook

The report of the Austrian HIV Cohort Study is very representative of the epidemiology of HIV/AIDS in Austria and therefore serves as source of data for the ECDC in Stockholm. It has become more comprehensive in recent years and can now be well compared with other reports from Austria, such as the report of renal replacement therapy of the Austrian Society for Nephrology and Austrotransplant. Moreover, the

establishment of the *HIV Patient Management System* has played an important role to improve clinical care for persons with HIV/AIDS *("Good Clinical Chronic Disease Practice")*.

Some remaining problems are mainly due to inconsistent use of the *HIV Patient Management System* with the corollary of inconsistent data entry into this software. Regular updates and improvements of the *HIV Patient Management System* should help to face these challenges.

The development of the HIV Patient Management System incorporated the international standard format, the HIV Cohorts Data Exchange Protocol (HICDEP). Therefore, data merging with international networks of cohorts like RESPOND and ART-CC has been and will be greatly facilitated.

14   Glossary

A   Austria
Ab   Antibody
ACE   Angiotensin-converting enzyme
AGES   Austrian Agency for Health and Food Safety
AHIVCOS   Austrian HIV Cohort Study
ART   Antiretroviral therapy (HIV-therapy)
ARVs   Antiretrovirals
ATC-Code   Anatomical therapeutic-chemical code
B   Burgenland
betw.   between
BMG   Federal Ministry of Health
C   Carinthia
cART   Combination antiretroviral therapy
CDC   Centers for Disease Control
CHD   Coronary heart disease
CIN   Cervical intraepithelial neoplasia
CIS   Commonwealth of Independent States
ECDC   European Centre for Disease Prevention and Control
EuroHIV   European Centre for the Epidemiological Monitoring of AIDS
GP   General practitioner
HBA1c   Hemoglobin A1c
HBV   Hepatitis B virus
HCV   Hepatitis C virus
HDL   High density lipoprotein
Hetero   Heterosexually acquired infection
HIP   HIV-Patient-Management-System
IAS   International AIDS-Society
ICD   International Classification of Diseases (WHO)
IDU   Injecting drug users
INSTI   Integrase strand transfer inhibitor
Interm.   Intermediate
KFJ   Kaiser-Franz-Josef-Spital Wien/Kaiser-Franz-Josef-Hospital Vienna
LA   Lower Austria
LDL   Low density lipoprotein
m.   month(s)
MI   Myocardial infarction
MSM   Men who have sex with men
N.a.   Not available/ not applicable
n.s.   not significant
neg.   negative
NNRTI   Non Nucleoside Reverse Transcriptase Inhibitor
NRTI   Nucleoside Reverse Transcriptase Inhibitor
OWS   Otto-Wagner-Spital Wien/Otto-Wagner Hospital Vienna
P   Protease
PI   Protease inhibitor
RNA   Ribonucleic acid
RT   Reverse transcriptase
S   Salzburg
SD/ s.d.   Standard deviation
St   Styria
St. p.   Status post
T   Tyrol
UA   Upper Austria
UK   United Kingdom
Vertical   Vertical transmission
Vie   Vienna
Vo   Vorarlberg
WHO   World Health Organization
ys.   years

15   Austrian HIV Cohort Study Group

As of November 2019

Steering committee members: Alexander Egle, Manfred Kanatschnig, Angela Öllinger, Armin Rieger, Brigitte Schmied, Elmar Wallner, Robert Zangerle

Coordinating Centre: Medical University of Innsbruck (Robert Zangerle)

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HIV treatment centres, *site coordinating physicians: (LKH Innsbruck) Diyani Dewasurendra, Martin Gisinger, Maria Kitchen, Alexander Plattner, Elisabeth Rieser, Mario Sarcletti*. (LKH Salzburg) Alexander Egle, Richard Greil*, Michaela Schachner. (Kepler Universitätsklinikum Med Campus III. Linz) Angela Öllinger*, Matthias Skocic, Monika Müller. (AKH Vienna) Regina Aichwalder, David Chromy, Katharina Grabmeier-Pfistershammer, Armin Rieger*, Michael Skoll, Veronique Touzeau. (Otto-Wagner Hospital Vienna) Piotr Cichon, Brigitte Schmied*, Sonja Wolf-Nussmüller. (Kaiser-Franz-Josef Hospital Vienna) Hermann Laferl, Alexander Zoufaly*. (LKH Graz II, Standort West) Christina Genger-Hackl, Andreas Kapper, Thomas Schneeberger, Elisabeth Trattner, Elmar Wallner*. (LKH Klagenfurt) Manfred Kanatschnig*, Georg Schober. (Feldkirch) Michele Atzl*, Bernd Hartmann

Virology: Elisabeth Puchhammer-Stöckl (Vienna), Jörg Berg (Kepler Universitätsklinikum Med Campus III. Linz)

Data management: Heinz Appoyer (IT-related), Gisela Leierer (AHIVCOS), Michaela Rappold (AHIVCOS), Stefanie Strickner (AHIVCOS), Robert Zangerle (Medical University of Innsbruck)

Data safety and protection: Klaus Schindelwig (Innsbruck)

Scientific advisory board: Bruno Ledergerber (Zurich), Gerd Fätkenheuer (Cologne

Verein Österreichische HIV-Kohortenstudie
c/o Univ.-Prof. Dr. Robert Zangerle
HIV-Bereich
Universitätsklinik für Dermatologie und Venerologie
Anichstraße 35
6020 Innsbruck

Tel.:   +43/(0)512/504-23021
E-Mail: lki.ha.hiv-kohorte@tirol-kliniken.at

AUTHORS:
Gisela Leierer
Michaela Rappold
Stefanie Strickner
Robert Zangerle