In the beginning of the AIDS epidemic, many people living with HIV were told that they may have only 6 months to live.
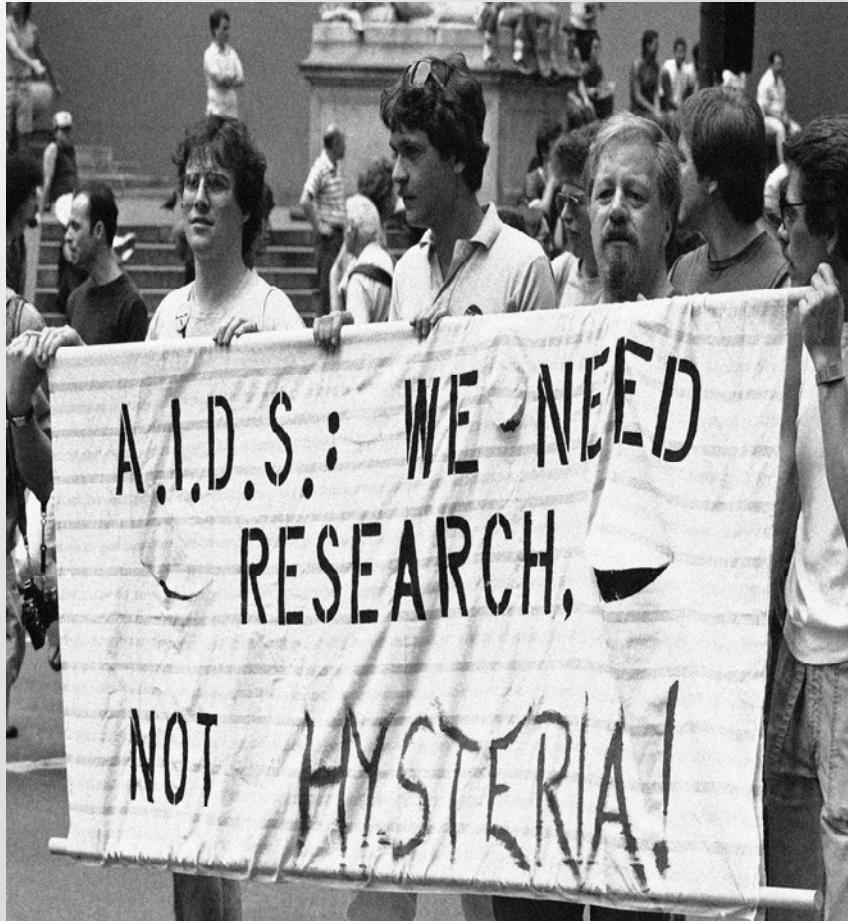
Through the advent of therapies, the lives of people with HIV/AIDS changed.

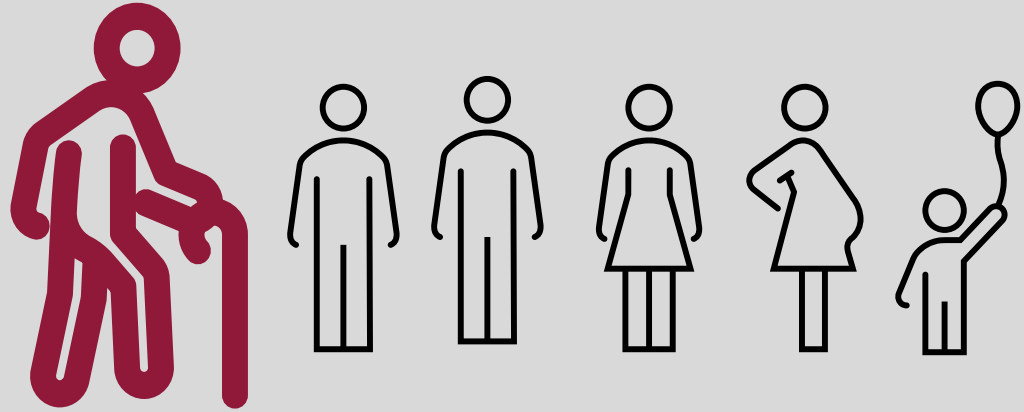**The trajectory of HIV research is changing as the population with HIV/AIDS is aging.**

51%
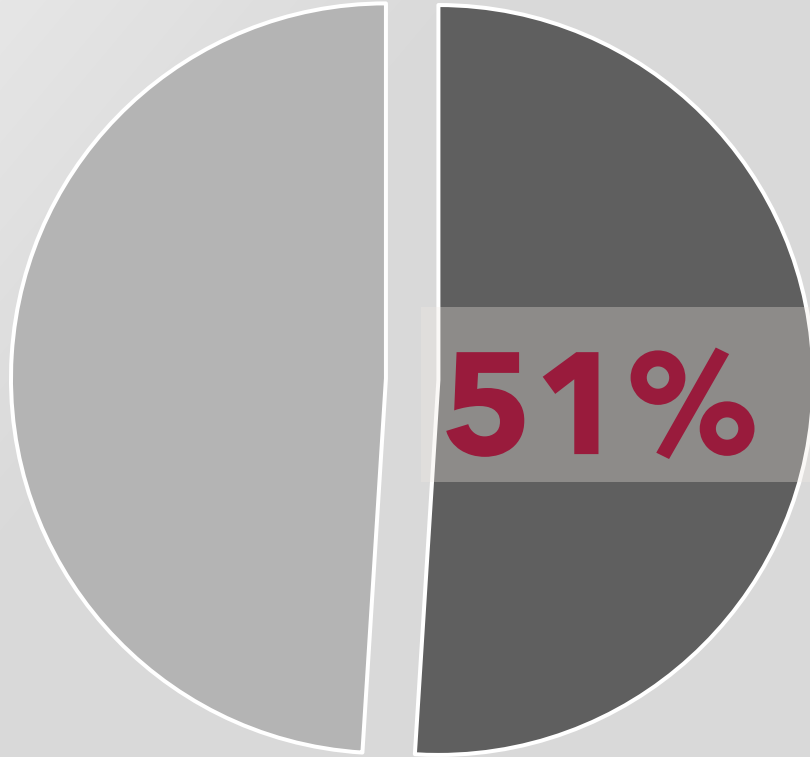
In 2018, half of **people with HIV** in the US are **50 years and above.**

1 in 6 people diagnosed with HIV is aged 50+

MW CS
MACS/WIHS COMBINED COHORT STUDY

In 2019 two longstanding cohorts, the MACS and WIHS merged into the MWCCS

MACS MULTICENTER AIDS COHORT STUDY — Established 1983

+

WIHS Women's Interagency HIV Study — Established 1993

=

MWCCS MACS/WIHS COMBINED COHORT STUDY — **Merged 2019**

MACS, a cohort study of men with and without HIV, and
WIHS, a cohort study of women with and without HIV
have merged to form **MWCCS,** a combined cohort study with more participants representing a
broader, more diverse population with a *harmonized database*
to study a wider range of HIV/AIDS focus areas and other co-morbidities.

MWCCS has (as of 5/2/23):
- **>4500 Active Participants**
- **>3000 Publications**
- **Increased focus on Aging and Co-morbidities**

MACS/WIHS Timelines

1984   1989   1994   1999   2004   2009   2014   2019

Enrollment Waves

| 1984-85 | 1987-90 | | 1995 admin censoring of some HIV-¹ | 2001-3 (Add subsites; Focus: minority) | | 2010+ (Focus: early stage HIV) |

MACS was ongoing for 35 years

Enrollment Waves
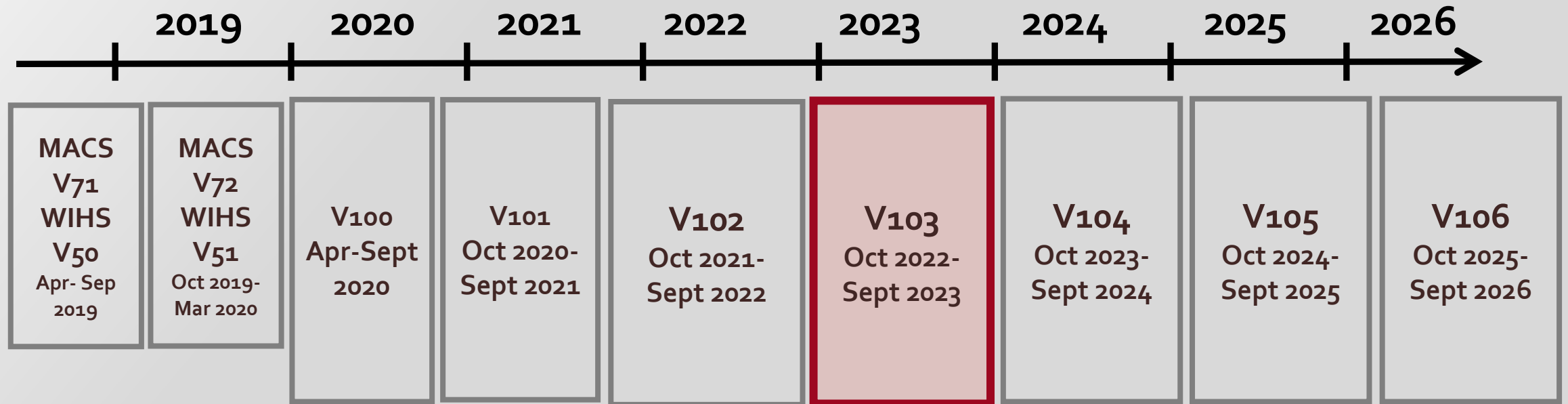
| 1994-95 | 1997 WDMAC | 2001-2 | 2011-13 (Replenishment/ Closing of LA site) | 2013-15 (Southern Sites) |

WIHS was ongoing for 25 years

¹ In April 1995, 2255 HIV-negative men were administratively censored from further follow-up, per an NIH decision.

MW CCS

MACS/WIHS COMBINED COHORT STUDY

MW CCS *Timeline*

2019   2020   2021   2022   2023   2024   2025   2026

| MACS V71 WIHS V50 Apr- Sep 2019 | MACS V72 WIHS V51 Oct 2019- Mar 2020 | V100 Apr-Sept 2020 | V101 Oct 2020- Sept 2021 | V102 Oct 2021- Sept 2022 | V103 Oct 2022- Sept 2023 | V104 Oct 2023- Sept 2024 | V105 Oct 2024- Sept 2025 | V106 Oct 2025- Sept 2026 |

Historic data (1984-2020) now in a harmonized database

During 2020-2022,
- Covid-19 pandemic: phone only data collection (Mar-Sept '20)
- 1st CCS visit (V101): in-person & virtual (Oct '20-Sept '21)
- Enrollment of new participants (V101-103)
- Annual Specimen collection
- 2 visits per year (core visit, shorter visit)

MWCCS Sites in US HIV Epidemic Prevalent Areas*
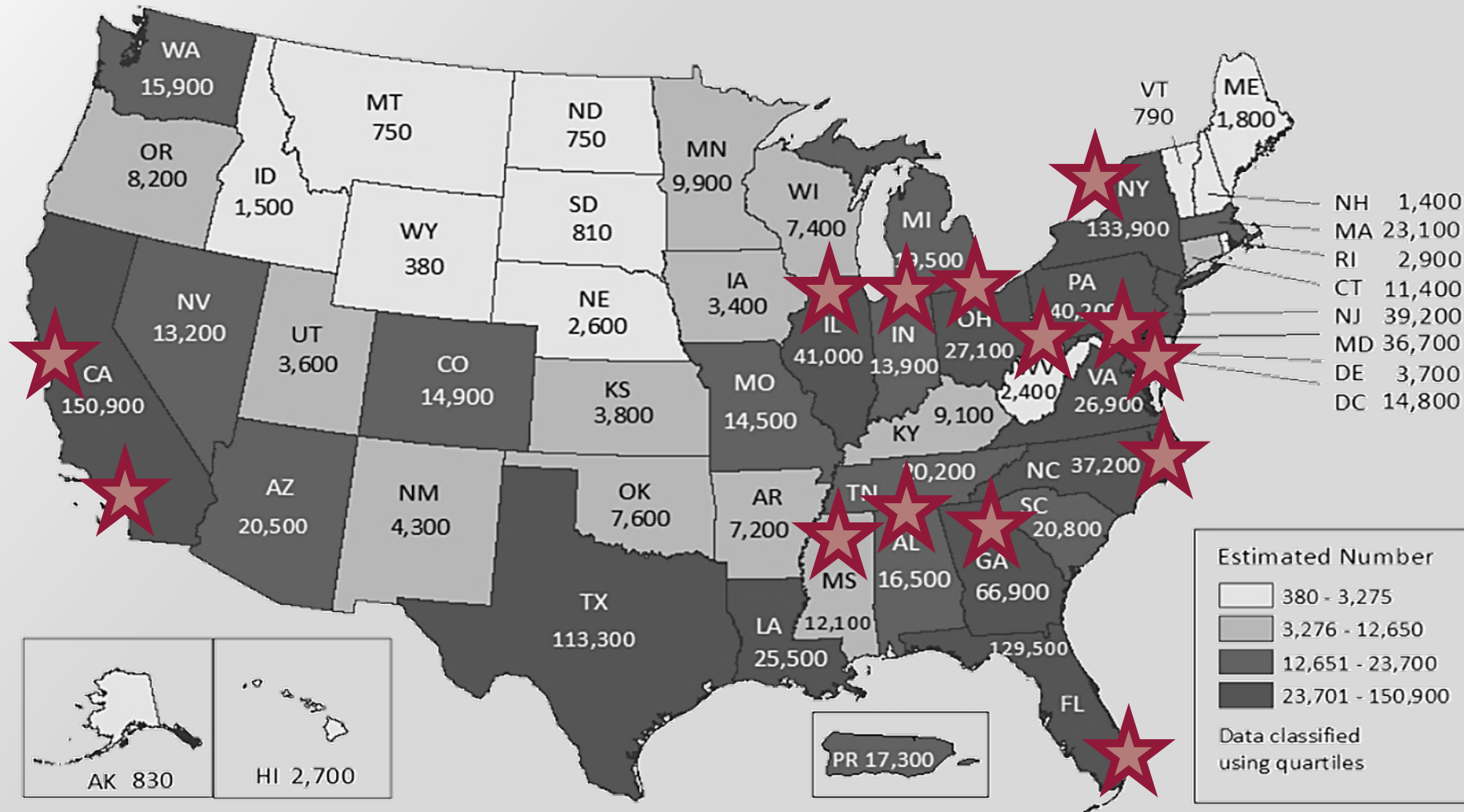
Study sites spread across the Northeast, South, Midwest, and West Coast.

For more information regarding study sites and contact persons, please visit https://statepi.jhsph.edu/mwccs/study-locations/

*Estimated HIV Prevalence among Persons Aged ≥13 years, by Area of Residence 2019

MWCCS
MACS/WIHS COMBINED COHORT STUDY

Participants

Enrollment (as of 5/2/2023)

Site	# Enrolled:
Atlanta, GA	340
Baltimore, MD	383
Birmingham, AL / Jackson, MS	331
Bronx, NY	467
Brooklyn, NY	305
Chapel Hill, NC	300
Chicago (Cook County), IL	319
Chicago (Northwestern), IL	330
Los Angeles, CA	496
Miami, FL	270
Pittsburgh, PA	393
San Francisco, CA	395
Washington DC	278
TOTAL:	**4607**

Participant Characteristics, By HIV Status, Gender and Age (5/2/23)

Characteristics		Carryover Participants [N=3,443] N (%)	New Enrollees [N=1,164] N (%)	Total [N=4,607] N (%)
HIV Status	PLWH	2148 (62)	767 (66)	2915 (63)
	PLWOH	1295 (38)	397 (34)	1692 (37)
Gender	Cis Male	1556 (45)	656 (56)	2212 (48)
	Cis Female	1882 (55)	454 (39)	2336 (51)
	Trans Man	2 (<1)	3 (<1)	5 (<1)
	Trans Woman	3 (<1)	37 (3)	40 (1)
	Gender Fluid	--	9 (1)	9 (<1)
	Identity not listed	--	5 (<1)	5 (<1)
Age in years: Median (IQR)	PLWH	57 (50, 63)	49 (39, 57)	55 (47, 61)
	PLWOH	61 (51, 68)	51 (39, 58)	58 (48, 66)

Age Distribution of Participants

	Women		Men	
	PLWOH	**PLWH**	**PLWOH**	**PLWH**
Median Age (IQR)	53 (45, 59)	55 (48, 61)	64 (55, 70)	58 (48, 65)
Age ≥ 60	24%	29%	66%	46%
Age < 40	9%	6%	10%	13%
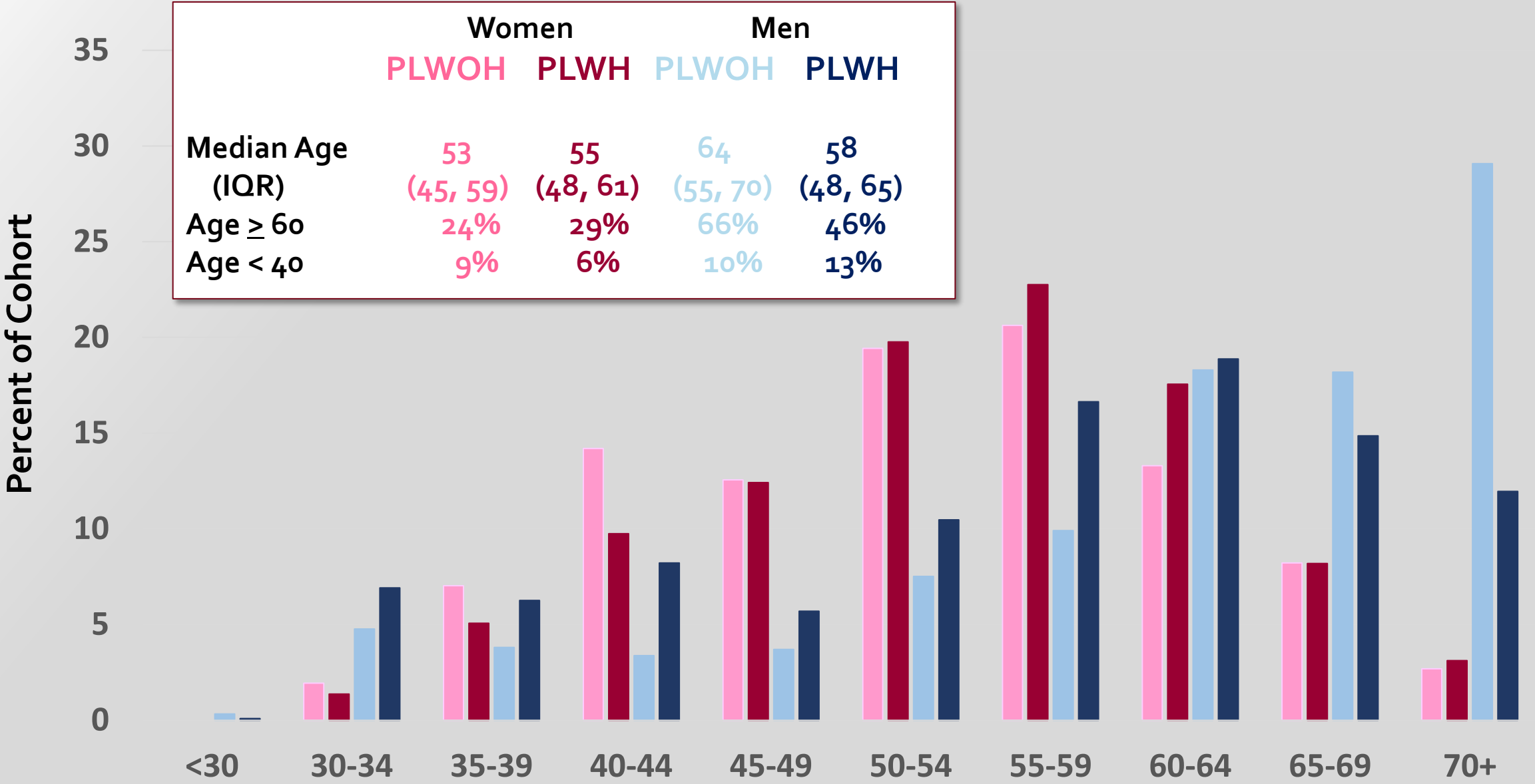
Enrollment: Race/Ethnicity

‡Race	†Hispanic/Latinx [N = 669]		†Not Hispanic/Latinx [N=3,912]		TOTAL (col %)
	*Male	*Female	*Male	*Female	
American Indian / Alaskan Native	11	5	3	10	29 (1)
Asian	2	0	13	8	23 (1)
Native Hawaiian / Pacific Islander	1	0	3	5	9 (<1)
Black/ African American	24	58	730	1,703	2,515 (55)
White	174	100	1,099	204	1,577 (34)
Other	84	162	16	30	292 (6)
Multiracial	23	25	26	62	136 (3)
TOTAL (row %)	319 (7)	350 (8)	1,890 (41)	2,022 (44)	4,581 (100)

*Gender: "Female" includes both cis and trans; "Male" includes both cis and trans
       Fluid and unlisted identity excluded due to small number (N=15)
†Ethnicity: Unknown ethnicity excluded due to small number (N=1)
‡Race: Missing race excluded due to small number (N=10)

MW CCS
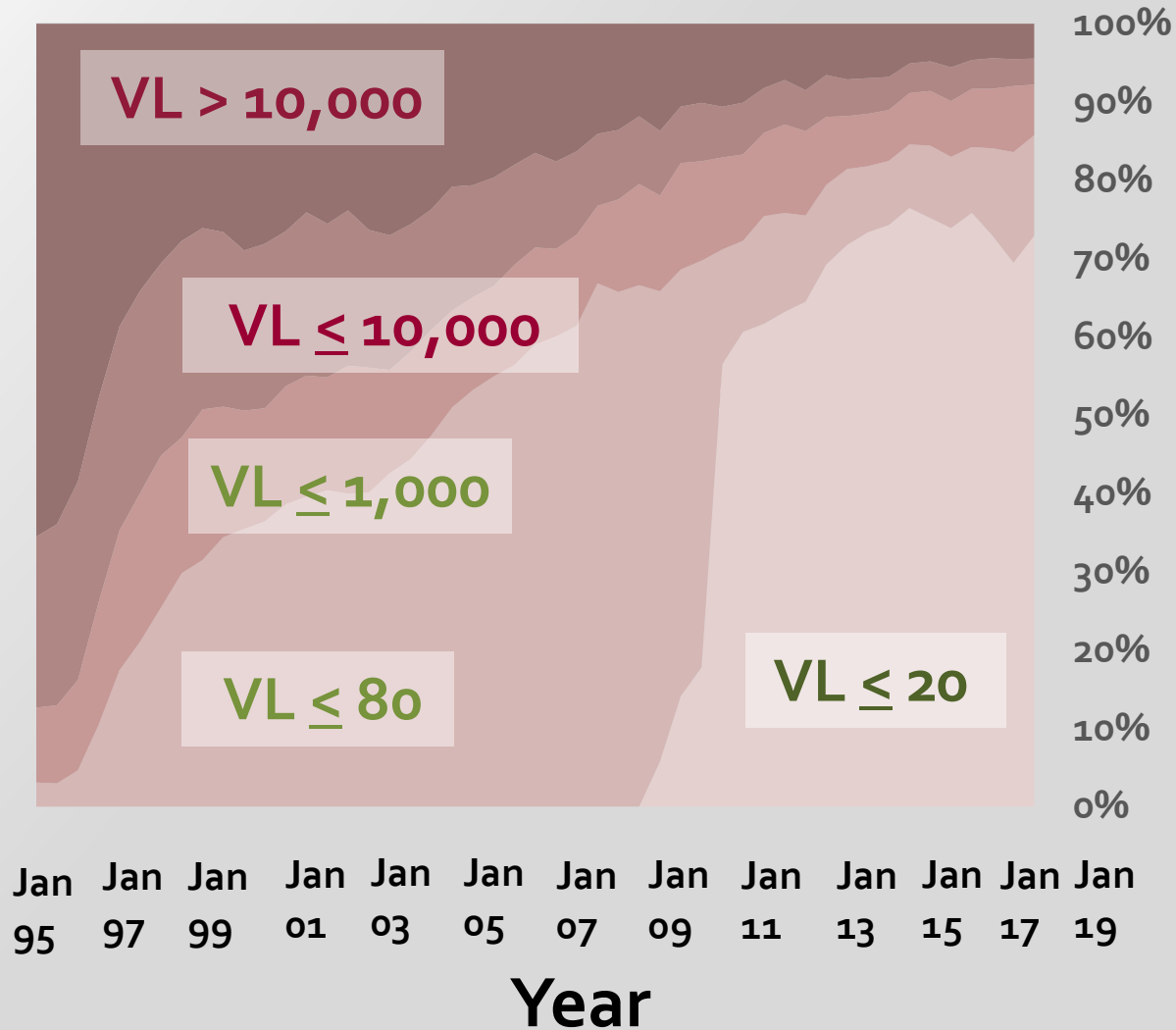MACS/WIHS COMBINED COHORT STUDY

Enrollment: Race/Ethnicity (10/12/22)

Carryover + New	*Female: †Hispanic/Latinx	Male: Hispanic/Latinx	Female: Not Hispanic/ Latinx	Male: Not Hispanic/ Latinx	TOTAL (%)
Black/ African American	56	21	1,587	637	2,301 (55)
American Indian / Alaskan Native	5	10	9	3	27 (< 1)
White	86	149	192	1,024	1,451 (35)
Asian	0	1	8	9	18 (< 1)
Multiracial	22	19	57	26	124 (3)
Native Hawaiian / Pacific Islander	0	0	3	2	5 (< 1)
Other	150	84	27	13	274 (7)
TOTAL (%)	319 (8)	284 (7)	1,883 (45)	1,714 (41)	4,200 (100)

*Gender: "Female" includes both CIS and Trans; "Male" includes both CIS and Trans. Fluid and unlisted identity excluded due to small numbers (N=11)
†Ethnicity: Unknown ethnicity excluded due to small numbers (N=8)

MW CCS
MACS/WIHS COMBINED COHORT STUDY

Changes in Viral Load Profiles Among PLWH — VL > 10,000; VL ≤ 10,000; VL ≤ 1,000; VL ≤ 80; VL ≤ 20

Changes in CD4 Count Profiles Among PLWH — CD4 ≥ 500; CD4 < 500; CD4 < 350; CD4 < 200

TaqMan v2.0 HIV-1, sensitive to 20 copies HIV RNA/mL, implemented in 2009
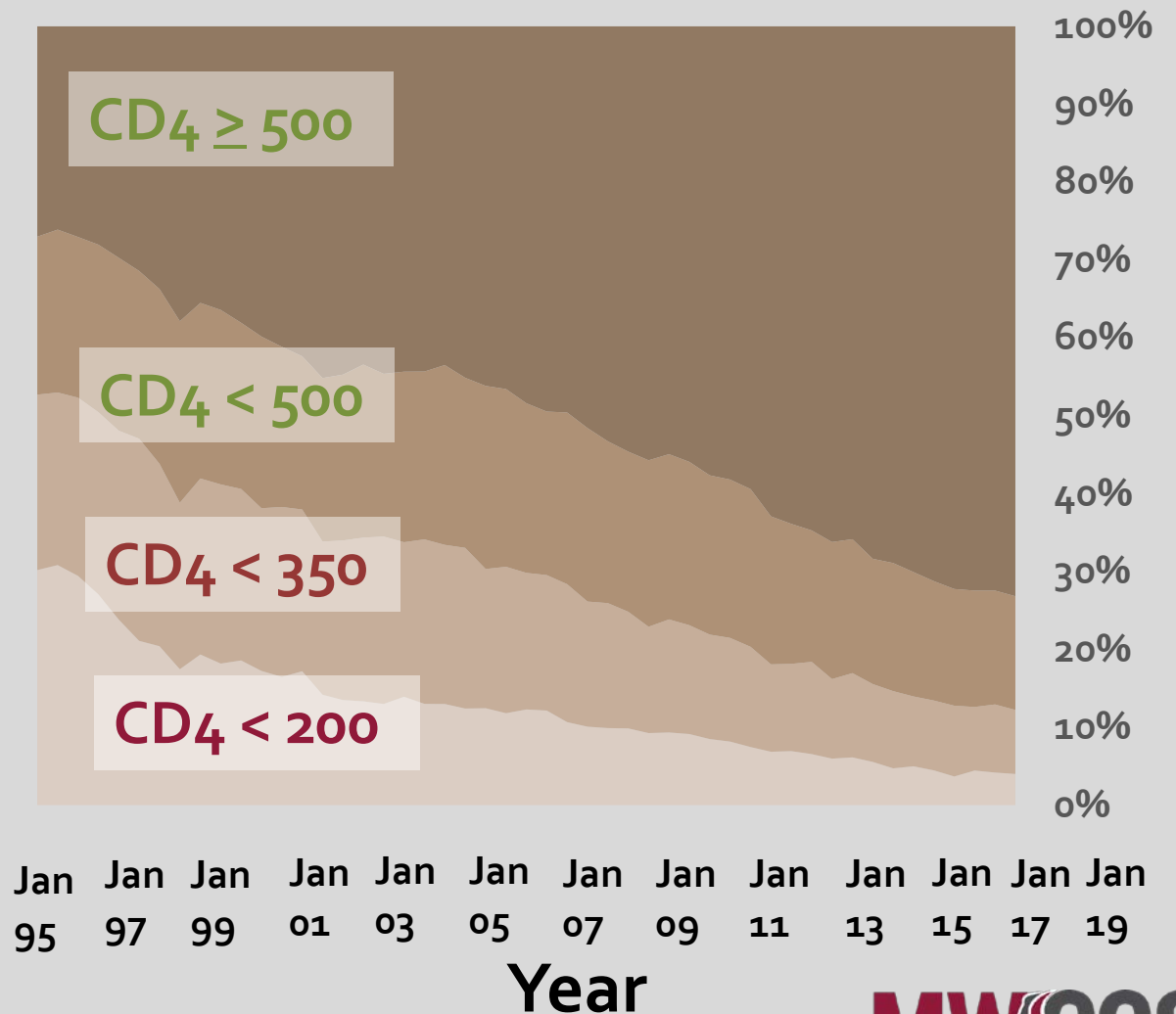
CD4 Count and HIV Viral Load among PLWH

Characteristic	N (%)		
	Women [N=1538]	Men [N=1070]	Total[1] [N=2623]
Current CD4+ T Cell Counts (cells/µl)	**N=1426**	**N=803**	**N=2241**
<200	70 (5)	26 (3)	96 (4)
200-349	115 (8)	66 (8)	181 (8)
350-499	176 (12)	144 (18)	320 (14)
≥ 500	1065 (75)	567 (71)	1644 (73)
Current HIV RNA (cp/mL)	**N=1386**	**N=716**	**N=2113**
Undetectable (no signal)[2]	786 (57)	400 (56)	1189 (56)
Below limit for quantification (< 20 cp/mL)[3]	224 (16)	147 (21)	373 (18)
Detectable ($\geq$ 20 cp/mL)	376 (27)	169 (24)	551 (26)
Median[4] (IQR)	88 (38, 1545)	55 (30, 230)	75 (35, 831)

[1] Total column includes participants who report a gender other than male or female (N=15)
[2] 2 women had lower limit of 30 cp/mL (no signal)
[3] 3 women had lower limit of 30 cp/mL (Below limit for quantification)
[4] Among participants with detectable HIV RNA

MWCCS studies many areas, including, but not limited to…

Cardiovascular and Pulmonary disease	Sleep Quality	Neuro-cognitive ability	Frailty and Physical disability

Cancer	HIV Pathogenesis	Metabolic, liver, and kidney dysfunction	Psychosocial and Behavioral conditions	Health disparities

MWCCS
MACS/WIHS COMBINED COHORT STUDY

Chronic Health Indicators (5/2/23)

	PLWH [N = 2623]		PLWOH [N = 1599]		Total
	Women [N= 1522][1]	Men [N =1101][1]	Women [N = 668][1]	Men [N = 931][1]	[N = 4222]
BMI: Median (IQR) % BMI >30 [% BMI >40]	31.4 (26.4, 38.0) 51 [17]	27.3 (24.2, 31.1) 22 [4]	32.3 (27.0, 38.3) 52 [18]	27.8 (24.5, 31.8) 22 [4]	29.6 (25.3, 35.2) 37 [11]
Hypertension[2]: N(%)	978 [64]	572 (52)	414 (62)	488 (52)	2452 (58)
Systolic BP [mm Hg]: Median (IQR)	128 (116, 141)	124 (116, 135)	129 (115, 146)	128 (117, 141)	127 (116, 140)
Diastolic BP [mm Hg]: Median (IQR)	76 (68, 84)	76 (69, 83)	76 (68, 85)	77 (69, 84)	76 (69, 84)
Diabetes[3] N(%)	370 (24)	224 (20)	151 (23)	172 (18)	917 (22)
Fasting Glucose[mg/dl]: Median (IQR)	92 (84, 105)	94 (87, 102)	90 (82, 101)	94 (87, 102.5)	92 (84, 103)

[1] Sex at birth used for gender classification in chronic health indicators
[2]Hypertension: SBP ≥ 130, DBP ≥ 80, use of medication with ever self-reported diagnosis
[3] Diabetes: ever self- reported medication, confirmation of a) fasting glucose ≥ 126 or HbA1c ≥ 6.5 % or self reported diabetes

Chronic Health Indicators (5/2/23)

	N (%)				
	PLWH [N = 2623]		PLWOH [N = 1599]		Total [N =4222]
	Women [N = 1522][1]	Men [N = 1101][1]	Women [N = 668][1]	Men [N = 931][1]	
Cancer history N(%)	170 (11)	214 (19)	56 (8)	204 (22)	644 (15)
ACC/AHA CVD Risk Score: Median (IQR)[2]	0.05 (0.02, 0.11)	0.08 (0.04, 0.15)	0.05 (0.01, 0.12)	0.11 (0.05, 0.21)	0.06 (0.02, 0.14)
Race-free Estimated Glomerular Rate (eGFR) CKD-EPI (2021) [mL/min/1.73 m2] Median (IQR)[3]	79 (64, 96)	83 (67, 96)	90 (73, 102)	89 (76, 98)	84 (69, 98)

[1] Sex at birth used for gender classification in chronic health indicators table
[2] ACC/AHA CVD Risk Score: ACC/AHA 2013 Pooled cohort equation 10-year Atherosclerotic risk estimate;
    CVD risk score < 0.5 is considered low risk and > 0.20 is considered high risk
[3] eGFR CKD-EPI (2021)I: Inker et al., 2021, NEJM; equation fit without race; eGFR < 30 is considered severe decrease to kidney failure and ≥90 is considered normal

Cardiovascular and Pulmonary Characteristics[1]

	N (%)				
	PLWH [N=2623]		PLWOH [N=1599]		Total
	Women	Men	Women	Men	[N=4222]
Hospitalized angina[2]	32 (2)	32 (3)	19 (3)	25 (3)	108 (3)
Heart attack / Myocardial infarction (MI)	54 (4)	53 (5)	27 (4)	30 (3)	164 (4)
Hospitalized heart failure (HF)[2]	27 (2)	12 (1)	16 (2)	11 (1)	66 (2)
Stroke	47 (3)	41 (4)	19 (3)	12 (1)	119 (3)
Transient Ischemic Attack (TIA)	61 (4)	40 (4)	21 (3)	26 (3)	148 (4)
Atrial fibrillation	7 (<1)	29 (3)	2 (<1)	49 (5)	87 (2)
Atrial flutter	0 (0)	17 (2)	3 (<1)	21 (2)	41 (1)
Any heart/blood vessel procedure	49 (3)	77 (7)	26 (4)	83 (9)	236 (6)
Hospitalized Chronic Obstructive Pulmonary Disease (COPD), Emphysema, Chronic bronchitis[3]	57 (4)	16 (2)	31 (5)	13 (1)	117 (3)
Hospitalized pneumonia	89 (6)	142 (13)	28 (4)	64 (7)	326 (8)
Hospitalized asthma	96 (7)	31 (3)	68 (10)	40 (4)	237 (6)

[1] Self-reported history from BLHH and FPHH (ever). Added FPHH when able; due to use by some carryover participants at baseline
[2] FPHH does not ask about hospitalized angina or heart failure, so only BL data is presented
[3] COPD in past two reports used 'EVER' COPD vs. Hospitalized COPD, which is why numbers have changed

COVID-19 Metrics

	N (%)		
Metric	**PLWH [N=2585]**	**PLWOH [N=1573]**	**Total [N=4158]**
Ever Tested for COVID-19	2215 (86)	1339 (85)	3554 (85)
Ever Test Positive for COVID-19	615 (24)	351 (22)	966 (23)
COVID-19 Hospitalizations			
Yes	101 (4)	46 (3)	147 (4)
No	1988 (77)	1220 (78)	3208 (77)
Missing	496 (19)	307 (20)	803 (19)
Metric	**PLWH [N=2446]**	**PLWOH [N=1468]**	**Total [N=3914]**
COVID-19 Vaccination Status			
More than 1 Booster	343 (14)	270 (18)	613 (16)
Boosted	898 (37)	450 (31)	1348 (34)
Fully Vaccinated	666 (27)	385 (26)	1051 (27)
Partially Vaccinated	125 (5)	75 (5)	200 (5)
Unvaccinated	248 (10)	181 (12)	429 (11)

Ongoing Sub-studies Cumulative Enrollment (As of 5/2/23)

Sub-study	Enrollment PLan	# MWCCS Participants Enrolled[1]	% of Goal Enrolled	Enrollment Goal[2]
STI Testing	V101 - V103	3940	100%	3906[3]
Oral Health Questionnaire	V102 - V106	3711	95%	3906[3]
Stool Microbiome (Silver study)	V101 - V106	2532	79%	3217[4]
CAT-MH	V102 - V106	3082	79%	3906[3]
BRACE	V102 - V106	2568	66%	3906[3]
BRACE+	V103 - V106	754	19%	3906[3]
Fibroscan	V101 - V106	2499	64%	3906[3]
CIDI	V102 - V105	1182	37%	3217[4]
PFT	V102 - V105	1159	30%	3906[3]
Tooth Count	V103 - V106	612	16%	3906[3]
Echocardiograms	V103 - V104	324	11%	2833[5]

Note: summary table indicates number of participants who have form completed for at least 1 assessment; participants with kit sent to Burk lab for Silver study; specimens collected for STI testing

[1]Numbers from Gemini, as of 4/24/23

[2]Overall study enrollment data as of 4/20/23

[3]All eligible participants completing study visits in-person (estimated 85% of all study participants)

[4]70% of all enrolled study participants

[5]Determined by Echo leads based on number of participants meeting eligibility criteria

Core Sub-studies at Select Sites Cumulative Enrollment (as of 5/2/23)

Sub-study	Enrollment Plan	# MWCCS Participants Enrolled[1]	% of Goal Enrolled	Enrollment Goal[2]
Blood Pressure Crosswalk	V103	27	27%	100
Sleep	V102 - V104	17	7%	260
Neuropsych Crosswalk	V103	29	10%	300
Pathogenesis	V103 - V104	Enrollment will begin before end of V103	0%	40
Brain MRI	V103	Enrollment will begin before end of V103	0%	150

[1]Numbers from Gemini, as of 4/24/23 and BP Crosswalk enrollment reported by substudy leads
[2]Enrollment goals determined by substudy leads

Data and Specimen Collection

We collect data on:

Demographics

HIV medication and adherence

Frailty, aging

Neuropsychology

Attitude and beliefs

Healthcare utilization

Quality of life, depression

Behaviors (substance use and sexual behavior)

Medical conditions and medication

Chronic conditions and co-infection

Lab results performed on:

Blood Chemistries, Complete Blood Count, Hepatitis, T-Cell flow cytometry, HIV Viral Load, Lipid Panel

Physical Examination performed

Outcome verification and adjudication

Biorepository of samples

Registry matching:

National Death Index, Cancer Registry, Renal Disease Registry

For more information on data collection forms: https://statepi.jhsph.edu/mwccs/data-collection-forms/ [22]
Or info on data/specimen collection procedures: https://statepi.jhsph.edu/mwccs/manual-of-operations/

Specimens in Central Repository (05/01/20)

Specimen	Date Range Collected		Current Participants		
	MACS	**WIHS**	**PLWH**	**HIV (-)**	**TOTAL**
Plasma	1984-2019	1994-2019	78,244	48,176	107,922
Plasma (EDTA)	2006-2019	2014-2019	40,841	17,169	58,010
Serum	1984-2019	1994-2019	72,345	48,176	120,521
Peripheral Blood	1994-2019	1994-2019	76,704	29,234	105,938
Cell Pellets	1994-2019	1994-2019	38,637	15,337	53,974
Urine (clean void)	1984-2019	1994-2019	44,060	16,864	60,924
Urine (supernatant)	NC	1994-2019	15,253	6,293	21,546
Cervicovaginal Lavage (CVL)	NC	1994-2019	38,043	16,021	54,064
Oral sample	1984-1993	1995-2004	1,558	607	2,165
B cell lines	N/A	NC	509	195	704
Stool	1984-1985	NC	2798	1,148	3,946
Semen	1984-1993	N/A	1,437	372	1,809

Table was summarized from Table 6 of : https://pubmed.ncbi.nlm.nih.gov/33675224/

MWCCS
MACS/WIHS COMBINED COHORT STUDY

Specimens Collected*, Demographics

	N (%)		
	Specimens Collected [N=3644]	**No Specimens Collected [N=578]**	**Total [N=4222]**
HIV Status			
PLWH	2334 (89)	288 (11)	2622
PLWOH	1310 (82)	290 (18)	1600
Gender			
Cis Male	1515 (76)	466 (24)	1981
Cis Female	2076 (95)	106 (5)	2182
Trans Man	5 (71)	2 (29)	7
Trans Woman	24 (96)	1 (4)	25
Gender Fluid	20 (91)	2 (9)	22
Other	4 (80)	1 (20)	5
Age in Years: Median (IQR)	55 (47, 62)	64 (57, 70)	56 (48, 63)

*Specimens collected in either visit 101 or 102

Specimens Collected by Race/Ethnicity

	N (%)		
	Specimens Collected [N=3644]	No Specimens Collected [N=578]	Total [N=4222]
Race			
Black/African American	2186 (94)	129 (6)	2315
American Indian/ Alaskan Native	26 (90)	3 (10)	29
White	1063 (72)	406 (28)	1469
Asian	17 (89)	2 (11)	19
Multiracial	125 (91)	12 (9)	137
Native Hawaiian/ Pacific Islander	5 (100)	0 (0)	5
Other	212 (89)	26 (11)	238
Ethnicity			
Not Hispanic	3092 (86)	518 (14)	3610
Hispanic	551 (90)	60 (10)	611

MW CCS
MACS/WIHS COMBINED COHORT STUDY

Vials Shipped from Precision Bioservices, 2021-2023
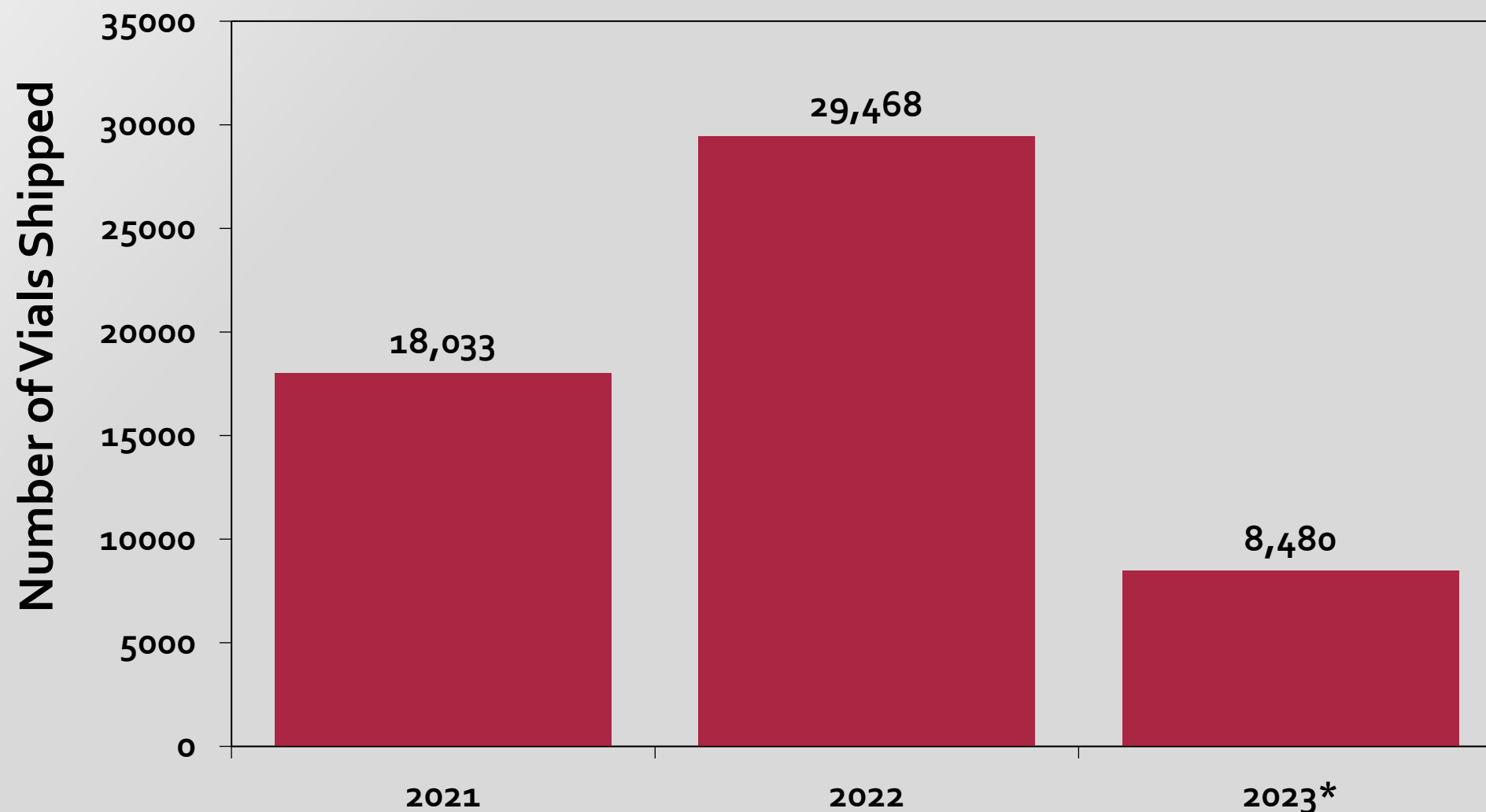
* 2023 includes shipments through 4/21/2023
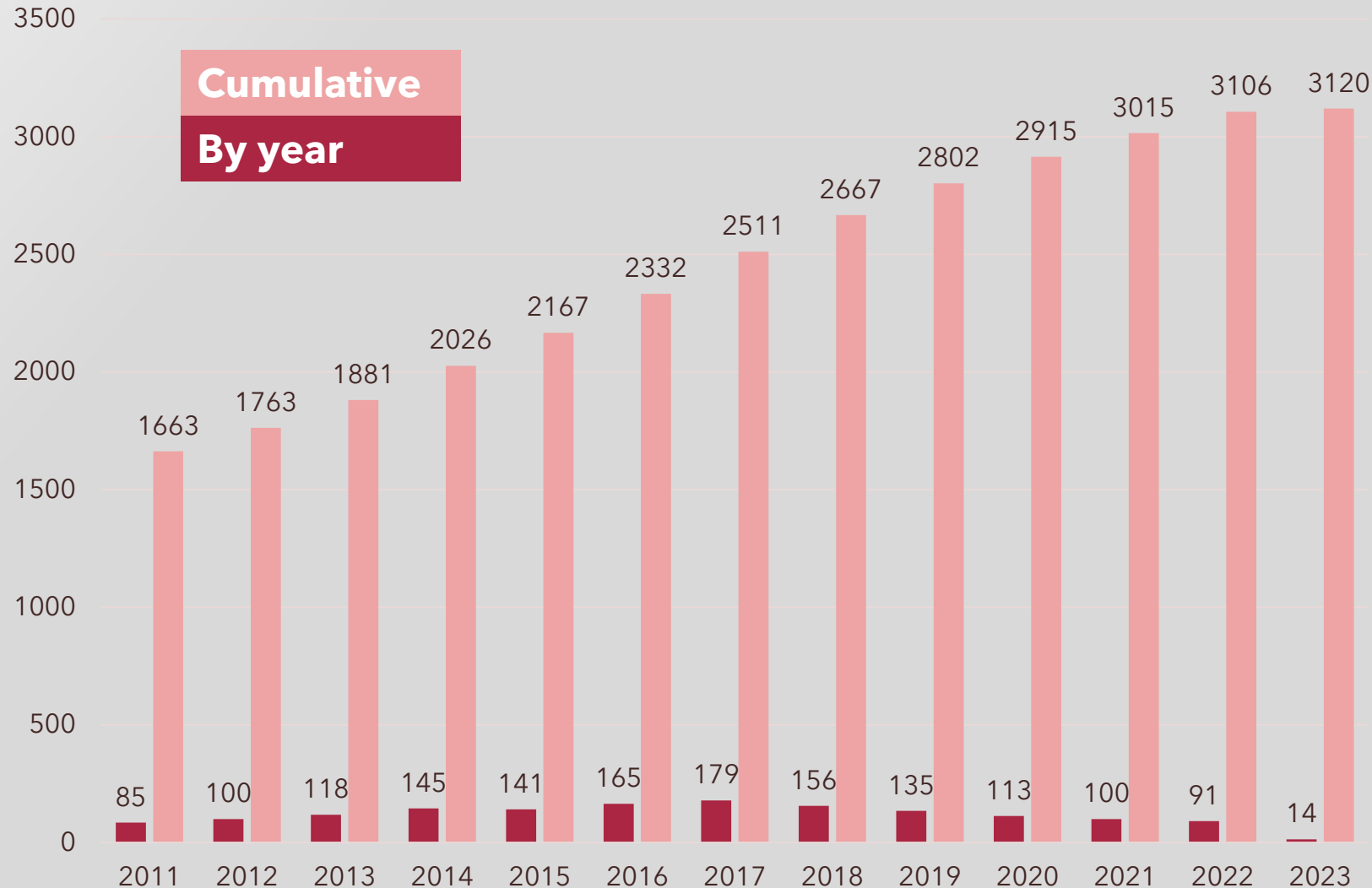
*Selected Studies and Scientific Highlights*

Characteristics of the MACS/WIHS Combined Cohort Study: Opportunities for Research on Aging With HIV in the Longest US Observational Study of HIV (D'Souza, et al, 2021)

- Data protocols for the MACS and WIHS were similar but not identical, this study described how these two cohorts were merged to have a unified protocol.
- This study was able to:
  - Harmonized definition for co-morbidities
  - Harmonized database and specimen collection of the two cohorts
  - Present key characteristics of participants in the two cohorts
    - Key demographics, race/ethnicity, gender
    - Co-morbidity profiles of participants
    - Health Behavioral and Mental Status Characteristics
- This will bring forth a new era in HIV/AIDS research as we learn more about the effect of HIV seropositivity, aging and other co-morbidities
- Please look at their findings in: https://pubmed.ncbi.nlm.nih.gov/33675224/

MW CCS

MACS/WIHS COMBINED COHORT STUDY

Optimal lung cancer screening criteria among persons living with HIV (Sellers, et al, 2022)
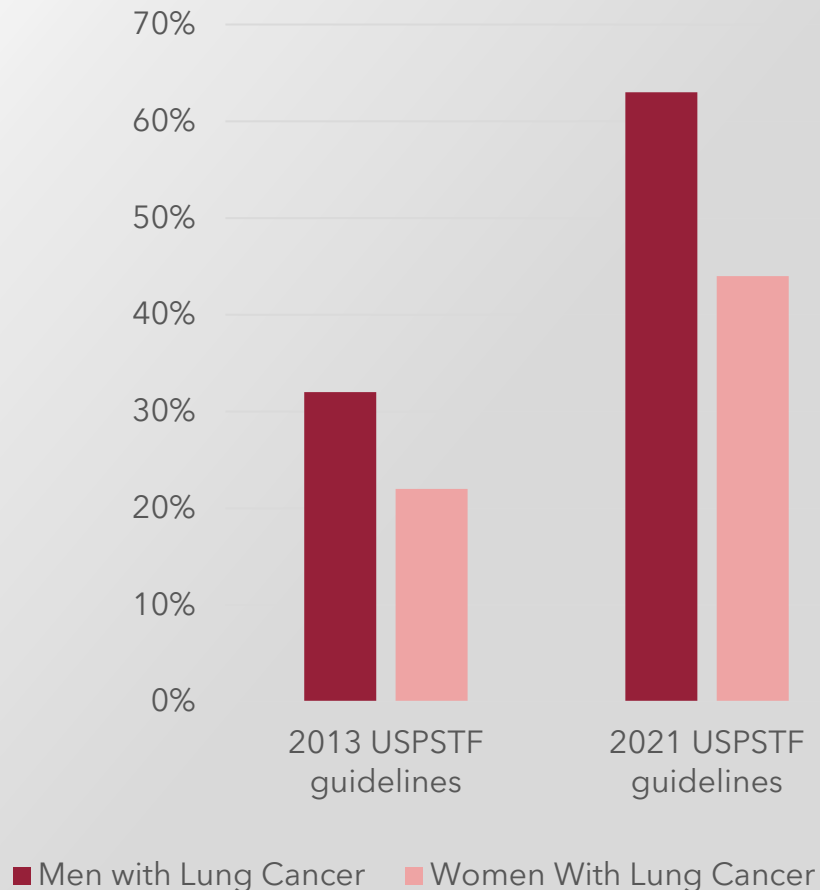
- PLWH are at a higher risk for lung cancer but were not well-represented in the National Lung Screening Trial which was the basis for 2013 USPSTF lung cancer screening guidelines

- Retrospective analysis was done using MWCCS data

- 52 women and 19 men with lung cancer; 1950 women and 1599 men without lung cancer

- 11 women (22%) and 6 men (32%) met the 2013 guidelines

- 22 women (44%) and 12 men (63%) met the 2021 guidelines

  - More PLWH with lung cancer are eligible for screening based on the 2021 USPSTF guidelines

  - Increased sensitivity of 2021 guidelines is attributed to decreased age and tobacco exposure thresholds in women

The online pre-print can be found at:
https://pubmed.ncbi.nlm.nih.gov/35125470/

Examples of Recent Articles (2021)

Article Title	Journal	Authors	Topic Area
Prevalence of COVID-19-Related Social Disruptions and Effects on Psychosocial Health in a Mixed-Serostatus Cohort of Men and Women.	Journal of Acquired Immune Deficiency Syndromes	M. Friedman et al.	Psychosocial and Behavior Covid-19
The IDOze Study: The Link between Sleep Disruption and Tryptophan-Kynurenine Pathway Activation in Women with HIV	Journal of Infectious Diseases	A. Rogando et al.	Sleep
HIV serostatus and incident coronary artery stenosis in men with a baseline zero coronary artery calcium	AIDS	S. Sarkar et al.	Cardiovascular
Risk of smoking-related cancers among women and men living with and without HIV.	AIDS	N. Hessol et al.	Cancer

MWCCS

MACS/WIHS COMBINED COHORT STUDY

Examples of Recent Articles (2022)

Article Title	Journal	Authors	Topic Area
SARS-CoV-2 Infection Among People Living With HIV Compared With People Without HIV: Survey Results From the MACS-WIHS Combined Cohort Study	Journal of Acquired Immune Deficiency Syndromes	G. D'Souza et al.	HIV Pathogenesis Covid-19
Distinct Lipidomic Signatures in People Living With HIV: Combined Analysis of ACTG 5260s and MACS/WIHS	The Journal of Clinical Endocrinology and Metabolism	J. Jao et al.	Metabolic Dysfunction
Optimal Lung Cancer Screening Criteria among persons living with HIV	Journal of Acquired Immune Deficiency Syndromes	S. Sellers et al.	Pulmonary Cancer
Polypharmacy is Associated with Falls in Women With and Without HIV	Journal of Acquired Immune Deficiency Syndromes	C. Psomas et al.	Aging/Frailty

MW CCS
MACS/WIHS COMBINED COHORT STUDY

MWCCS

MACS/WIHS COMBINED COHORT STUDY

Interested in working with us?

Please visit
https://statepi.jhsph.edu/mwccs/work-with-us/
for a comprehensive guide of the process

Administered by NHLBI and co-funded by 13 institutes:

NIAID, NICHD, NHGRI, NIA, NIDCR, NINDS, NIMH, NIDA, NINR, NCI, NIAAA, NIDCD and NIDDK