

***Time spent with HIV viral load >1500 copies/mL among patients in HIV care, 2000–2014***

*Reported by Jules Levin  
CROI 2017 Feb 14-16 Seattle, WA*

**WEBCAST: <http://www.croiwebcasts.org/console/player/33366?mediaType=slideVideo&>**

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**National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention  
Division of HIV/AIDS Prevention**

February 14, 2017

**CROI: State-Level Estimates of HIV Incidence, Prevalence, and Undiagnosed Infections: 12.2% Undiagnosed in NYS; 15% US undiagnosed\_ - (02/24/17)**

**HIV INCIDENCE, PREVALENCE, AND UNDIAGNOSED INFECTIONS IN MEN WHO HAVE SEX WITH MEN**

*Sonia Singh*

*Centers for Disease Control and Prevention, Atlanta, GA, USA*

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## Conclusions

- **U.S. patients in routine HIV care spent progressively less time with HIV viral load above 1500 copies/mL:**
  - 24% overall during 2000-2014; decreasing from 37% to 10%
  - Advances in HIV care, including earlier ART and improved regimens
- **Results suggest decreasing risk of HIV transmission from persons in HIV care**
- **Continued efforts needed to address social, behavioral and structural factors, focusing on patients more likely to have viral load > 1500 copies/mL**
  - Younger
  - Black
  - Having public insurance
  - Higher baseline HIV viral load and lower CD4 cell count

Abstract 32

## Time spent with HIV viral load >1500 copies/mL among patients in HIV care, 2000–2014

**Kate Buchacz<sup>1</sup>, Maria Mendoza<sup>1</sup>, Carl Armon<sup>2</sup>, Frank Palella Jr<sup>3</sup>, Charles Rose<sup>1</sup>, Ellen Tedaldi<sup>4</sup>, Richard Novak<sup>5</sup> and Lytt Gardner<sup>1</sup> for the HIV Outpatient Study (HOPS) Investigators**

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**The findings and conclusions in this presentation are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.**

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## Antiretroviral therapy (ART) and HIV transmission

- ❑ Negligible risk of sexual HIV transmission with durable viral suppression<sup>1</sup>
- ❑ Observational and randomized studies: most cases of sexual HIV transmission when HIV viral load (VL) above 1500 copies/mL<sup>1</sup>
- ❑ Persons diagnosed with HIV infection but not retained in care → 61% of U.S. HIV transmissions<sup>2</sup>
- ❑ Improving retention and virologic suppression in HIV care
  - Individual health benefits
  - Prevention of HIV transmission

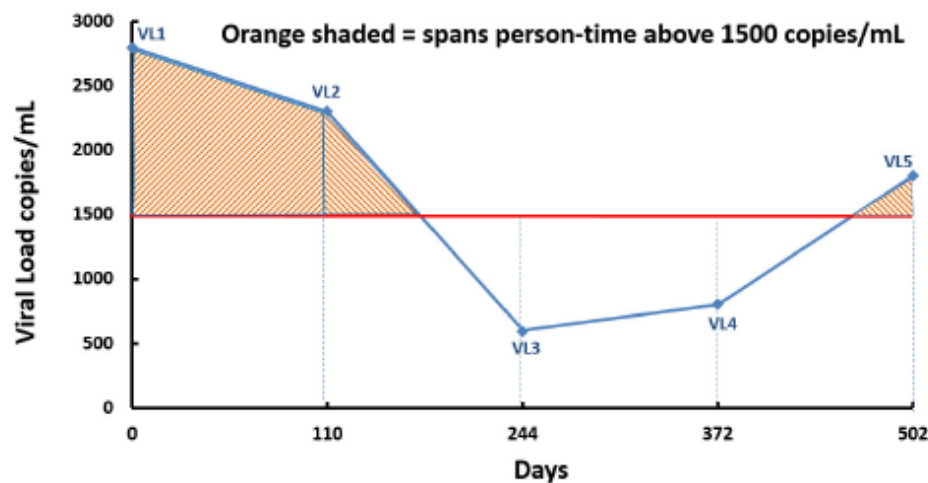
1. Quinn NEJM 2000; Attia, AIDS 2009; Rodger, JAMA 2016; Cohen, NEJM 2016;  
2. Skarbinski, JAMA Intern Med. 2015;

## Background

- ❑ Question → how much time HIV patients spend with VL > 1500 copies/mL ?
- ❑ Hypothesis → decreases during the last 15 years, in part due to:
  - Improvements in ART regimens (simplicity, tolerability, potency)
  - Shifts in HIV care toward earlier ART initiation and away from treatment interruptions

## Estimating Person-Time above 1500 copies/mL - Method

example for one hypothetical patient



Gardner, CROI 2014; Marks AIDS 2015

## Objective

- ❑ **Assess relative amount of person-time with viral load >1500 copies/mL in a cohort of U.S. HIV-infected patients during 2000-2014**
- ❑ **Explore by:**
  - Calendar year, period
  - Patient demographic and clinical characteristics
  - ART prescribed
  - Types of ART regimens

## Methods - Study Design

- ❑ **Data source - HIV Outpatient Study (HOPS), 1993 – present**
  - Open, prospective, cohort study of adult patients in HIV care
  - 9 HIV clinics in the United States
  - Medical record abstraction: demographics, HIV viral load, ART start and stop dates
- ❑ **Study population – inclusion criteria**
  - At least 2 HOPS clinic visits
  - At least 2 VLs during 2000-2014, at least 30 days apart
- ❑ **Observation time**
  - Start: first VL during HOPS on or after 1/1/2000 (baseline)
  - End: last VL during HOPS on or before 12/31/2014

## Methods - Analyses

### □ Outcome variable

- Percent of person-time with >1500 copies/mL: the number of days an HIV patient has a VL >1500 relative to the total number of days during his or her observation

### □ Predictor variables

- Baseline: demographics and clinical characteristics
- Time-updated: prescribed ART (on vs. not on ART)

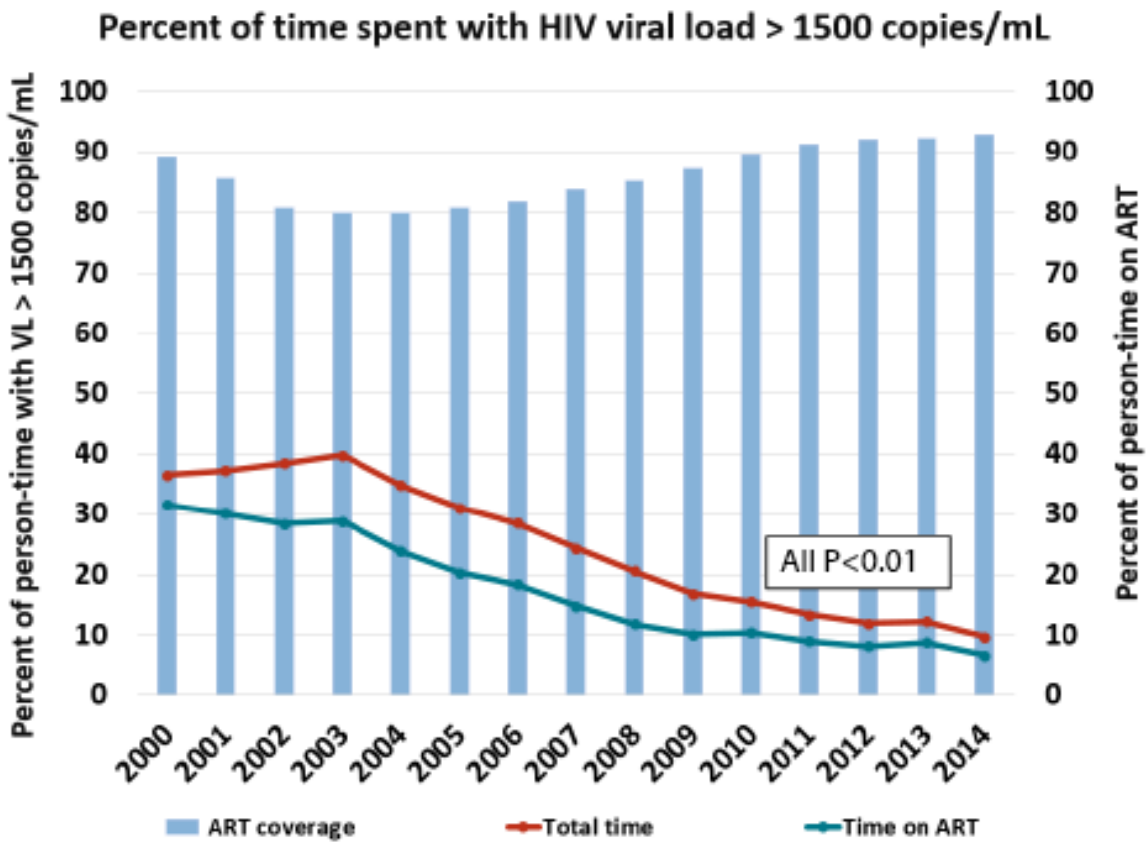
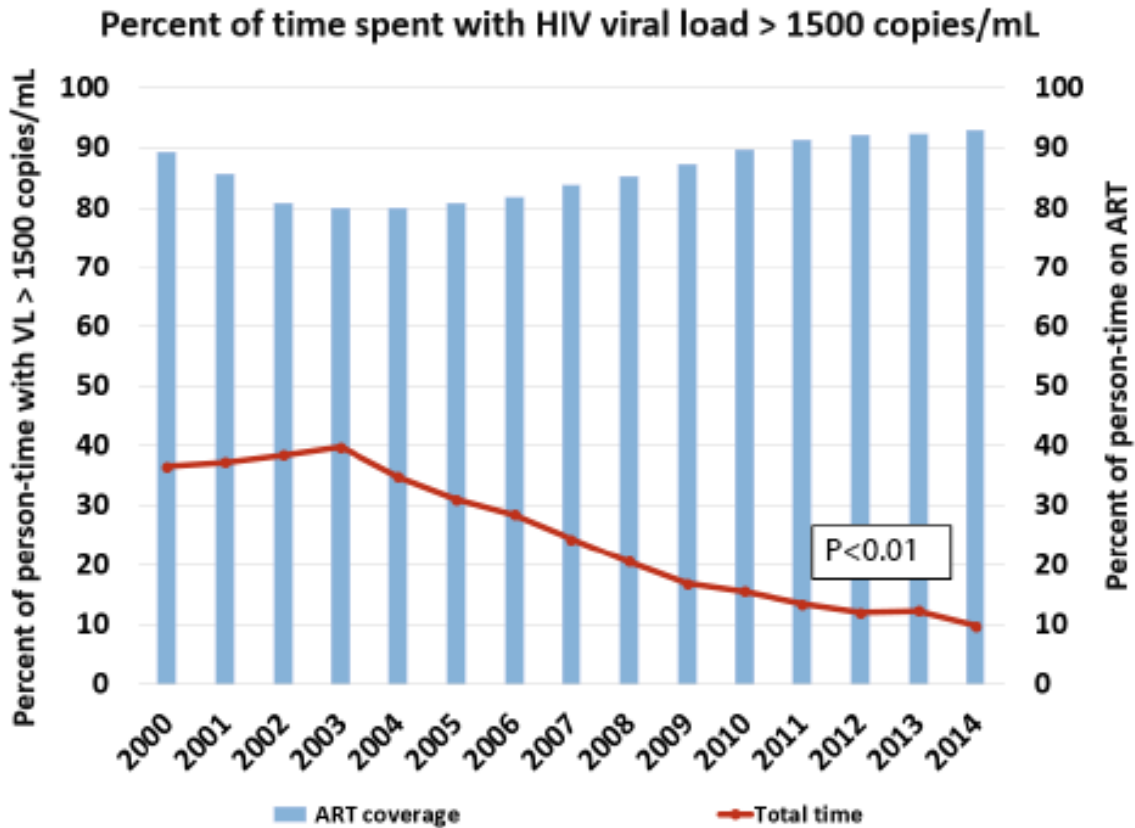
### □ Generalized estimating equations assuming a Poisson model\*

- Percent person time >1500 copies/mL (95% Confidence Intervals)
- Trends per year, and by five 3-year periods during 2000-2014

\* Dependent variable = days above 1500 copies/mL ; offset (denominator) = total days observation ; robust variance estimator.

## Results: Longitudinal Profile (2000-2014)

<b>Total patients</b>	<b>5,873</b>
Follow-up, median (IQR), years	5.4 (2.2 -10.7)
<b>Person-years of observation</b>	<b>37,794</b>
On ART	32,514 (86%)
Not on ART	5,279 (14%)
<b>Total number of viral loads</b>	<b>105,068</b>
On ART, viral load ≤ 1500	77,738 (74%)
On ART, viral load > 1500	13,753 (13%)
Not on ART, viral load > 1500	9,647 ( 9%)
Not on ART, viral load ≤ 1500	3,930 ( 4%)
Number of viral loads, median (IQR)	15 (7-27)
Time between viral loads, median (IQR), months	3.6 (2.5-5.4)



## Characteristics and percent time above 1500 copies/mL, 5,873 patients

	Percent (%) in Category	Percent (%) person-time with VL > 1500 (95% CI)
<b>Total</b>	100	24 (23-25)
<b>Baseline age (years)</b>		
<35	26	32 (30-34)
35-49	56	24 (23-25)
50+	17	16 (14-17)
<b>Sex</b>		
Female	22	31 (29-33)
Male	78	22 (21-23)
<b>Race/ethnicity</b>		
White, non-Hispanic	51	20 (19-21)
Black, non-Hispanic	34	33 (31-34)
Hispanic/Latino	12	24 (21-26)
Other/unknown	4	19 (15-23)

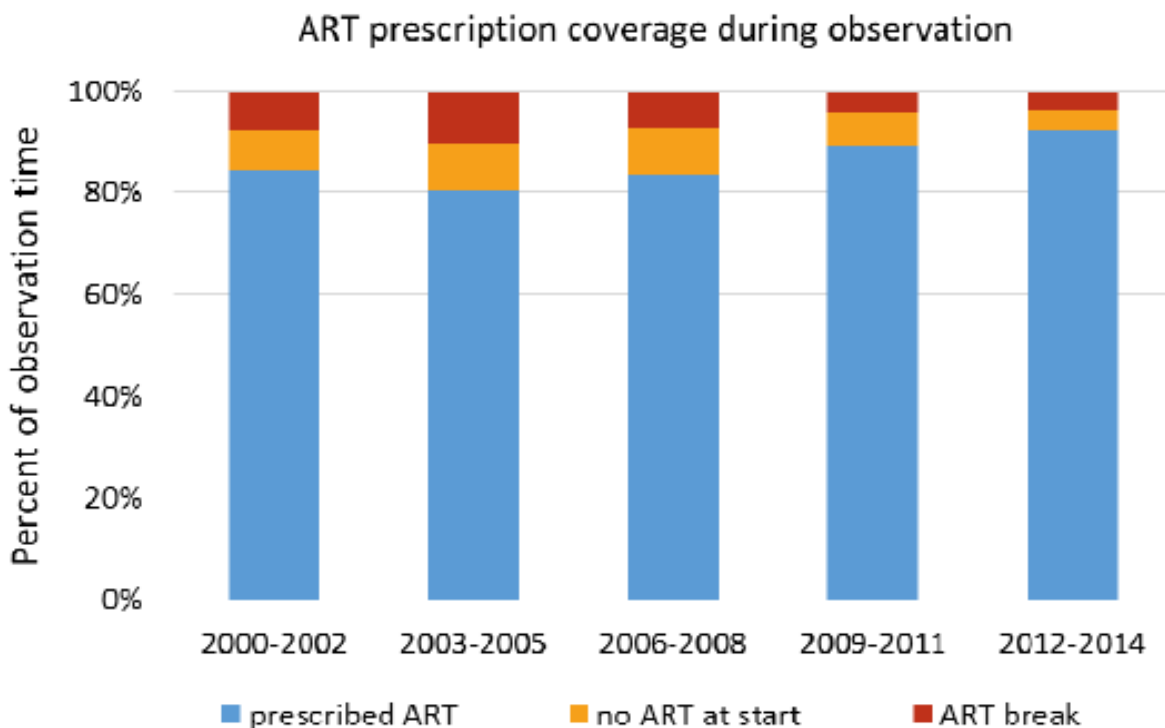
## Characteristics and percent time above 1500 copies/mL, 5,873 patients

	Percent (%) in Category	Percent (%) person-time with VL > 1500 (95% CI)
<b>HIV risk</b>		
Heterosexual female	22	31 (29-33)
Heterosexual male	19	26 (24-28)
MSM	59	21 (20-22)
<b>Baseline insurance</b>		
Public	36	31 (29-32)
Private	54	21 (20-22)
None/unknown	10	23 (21-27)
<b>Baseline ART status</b>		
ART-experienced	72	23 (22-24)
ART-naive	24	29 (27-30)
Unknown	4	28 (23-33)



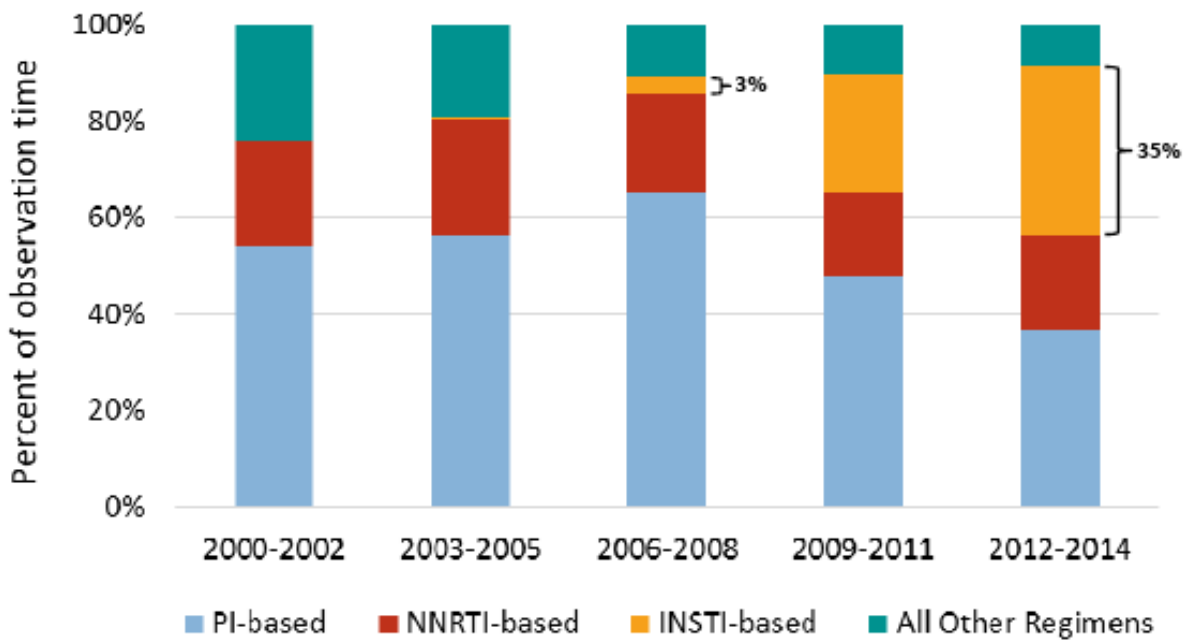
## Characteristics and percent time above 1500 copies/mL, 5,873 patients

	Percent (%) in Category	Percent (%) person-time with VL > 1500 (95% CI)
<b>Baseline HIV viral load (copies/mL)</b>		
≤ 1500	53	14 (13-15)
> 1500	47	38 (37-40)
<b>Baseline CD4 count (cells/mm<sup>3</sup>)</b>		
< 50	7	36 (33-40)
50 - 199	15	29 (27-31)
200 - 349	21	25 (23-27)
350 - 499	19	21 (20-23)
500+	34	21 (20-23)
unknown	4	28 (23-34)

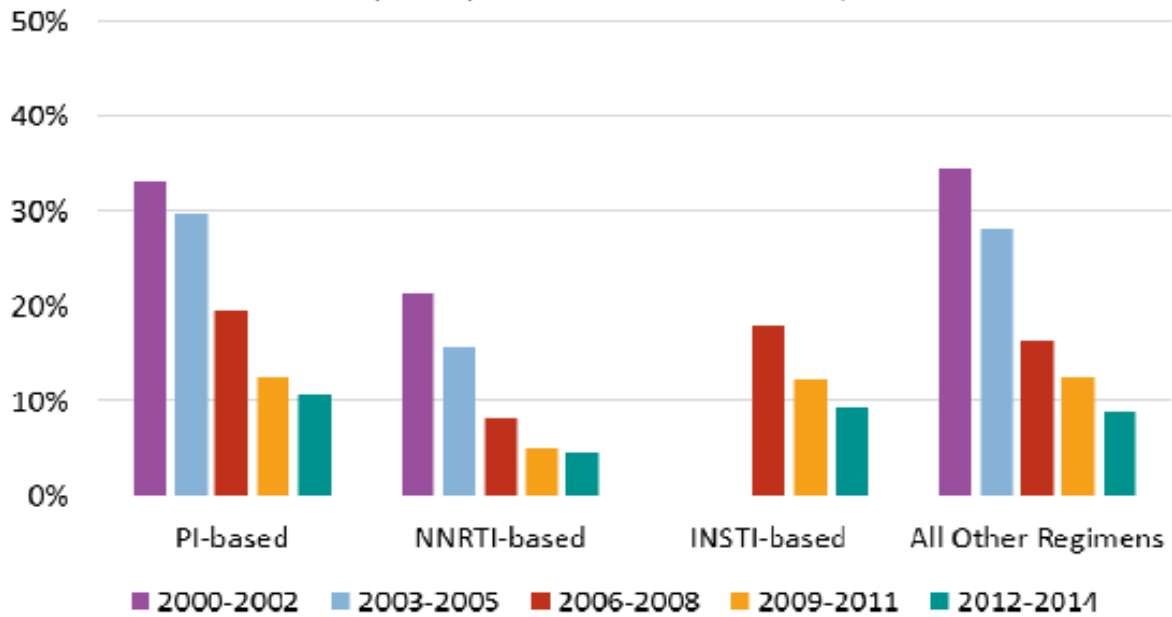




ART-treated observation time, by regimen type



Percent (%) of person-time with VL > 1500 copies/mL, by ART prescribed and calendar period



## Multivariable factors associated with greater percent person-time above 1500 copies/mL

Characteristic	Adjusted Rate Ratio (95% CI)
Calendar year (per year)*	0.91 (0.90 – 0.91)
<b>VL &gt; 1500 copies/mL</b>	<b>2.25 (2.10 – 2.41)</b>
<b>CD4 count &lt; 350 (vs. 500+)</b>	<b>1.16 (1.09 – 1.24)</b>
CD4 count 350 – 499 (vs. 500+)	0.95 (0.87 – 1.02)
<b>No ART (vs. on ART)*</b>	<b>3.48 (3.30 – 3.67)</b>
<b>Age &lt; 35 years (vs. 50+)</b>	<b>1.50 (1.36 – 1.65)</b>
<b>Age 35 – 49 years (vs. 50+)</b>	<b>1.35 (1.23 – 1.48)</b>
<b>Public insurance (vs. private)</b>	<b>1.24 (1.17 – 1.32)</b>
Self-pay/no-insurance (vs. private)	0.93 (0.84 – 1.04)
<b>Non-Hispanic Black (vs. white)</b>	<b>1.19 (1.12 – 1.27)</b>
Hispanic-Latino (vs. white)	1.03 (0.94 – 1.14)
Other/unknown (vs. white)	0.91 (0.77 – 1.05)

\*Calendar year of observation and time-updated ART prescription. All other characteristics measured at baseline.

## Limitations

- ❑ **ART prescription vs. ART use**
  - No data on adherence
- ❑ **Modeled transitions in VL across the 1500 copies/mL threshold**
  - Assumption of linear relationship
  - VL trajectories on ART depend on adherence
  - More error as VLs further apart
- ❑ **Observational data**
  - Unmeasured confounders, loss to observation
  - Caution against direct comparisons of study outcome by type of ART regimen
- ❑ **Large convenience sample of patients at HIV clinics**
  - Research cohort – public (Ryan White) & private clinics
  - Patients marginally/transiently in care may be underrepresented

## HOPS Investigators and Sites

**Feinberg School of Medicine, Northwestern University, Chicago, IL:** Frank J. Palella, Saira Jahangir, Conor D. Flaherty, Patricia Bustamante  
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Thank you

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