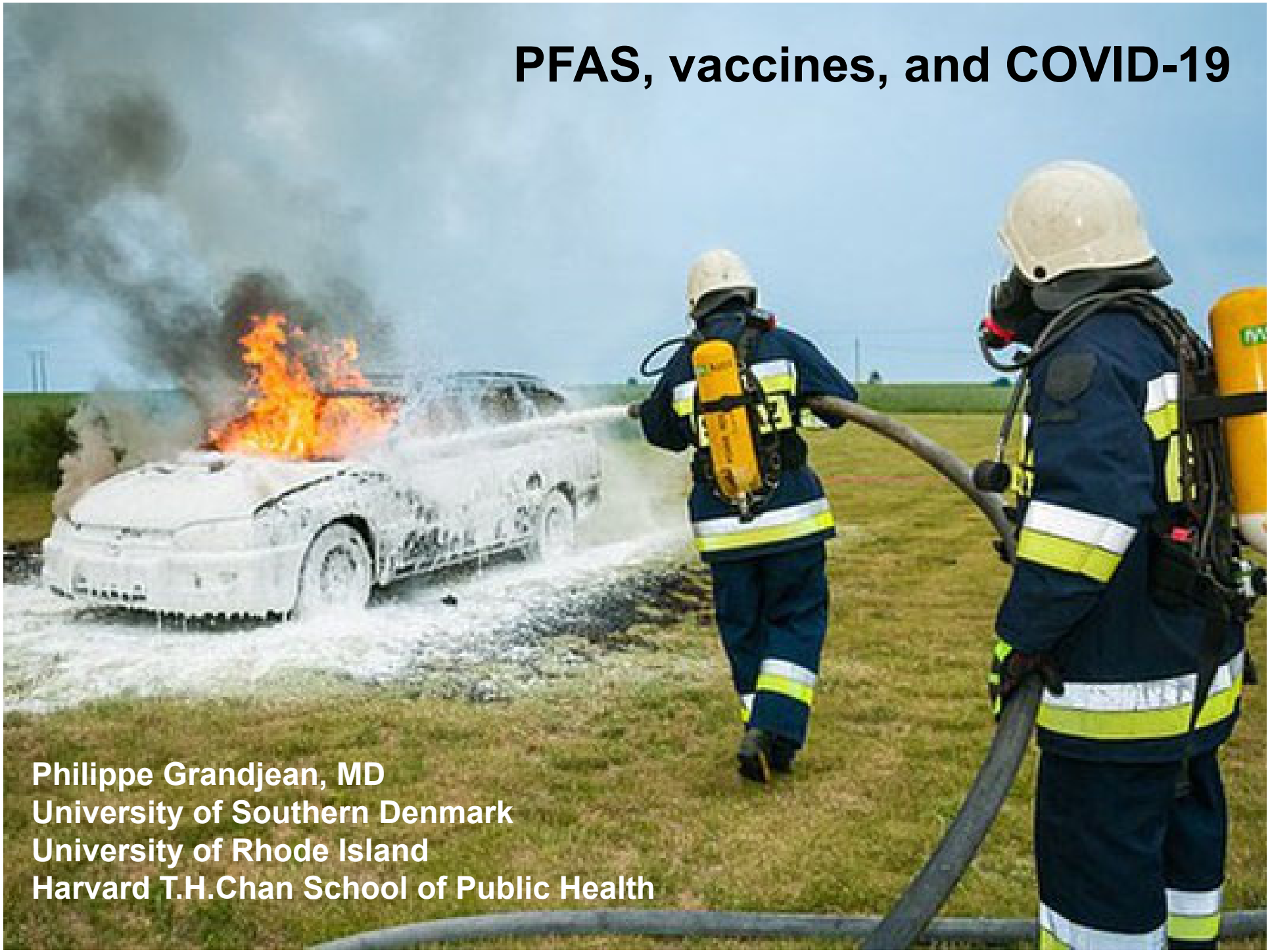
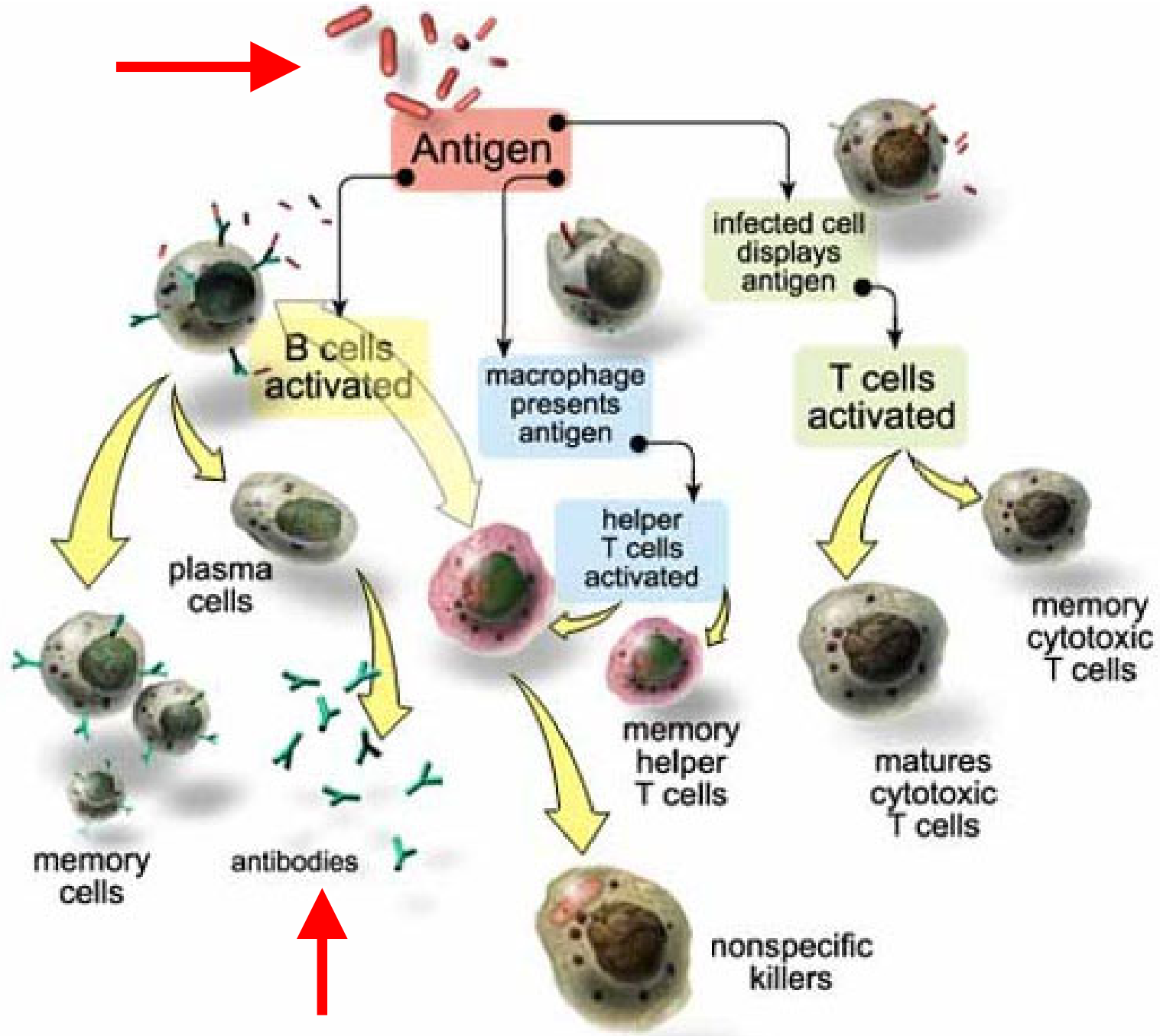
PFAS, vaccines, and COVID-19

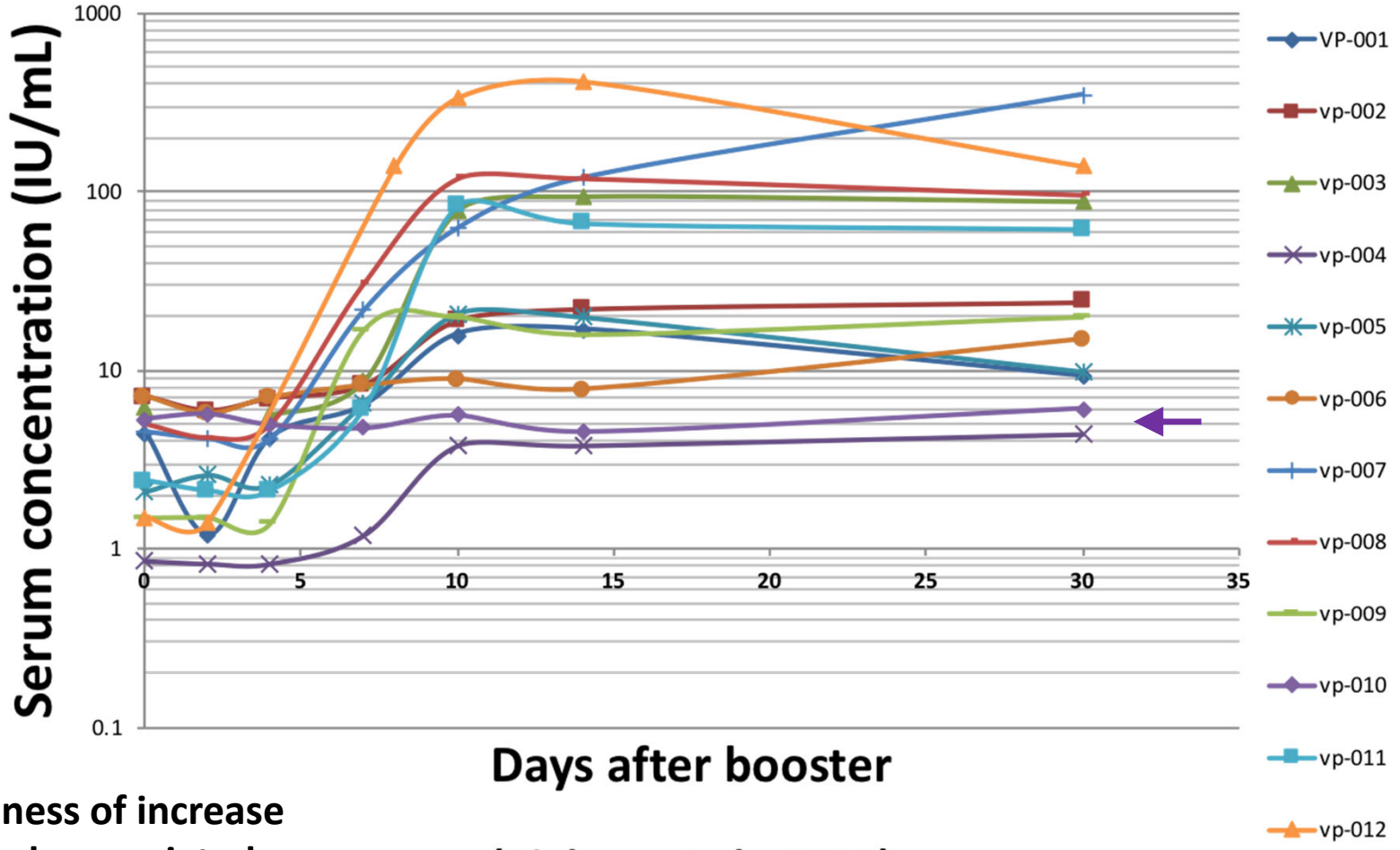


Philippe Grandjean, MD
University of Southern Denmark
University of Rhode Island
Harvard T.H.Chan School of Public Health



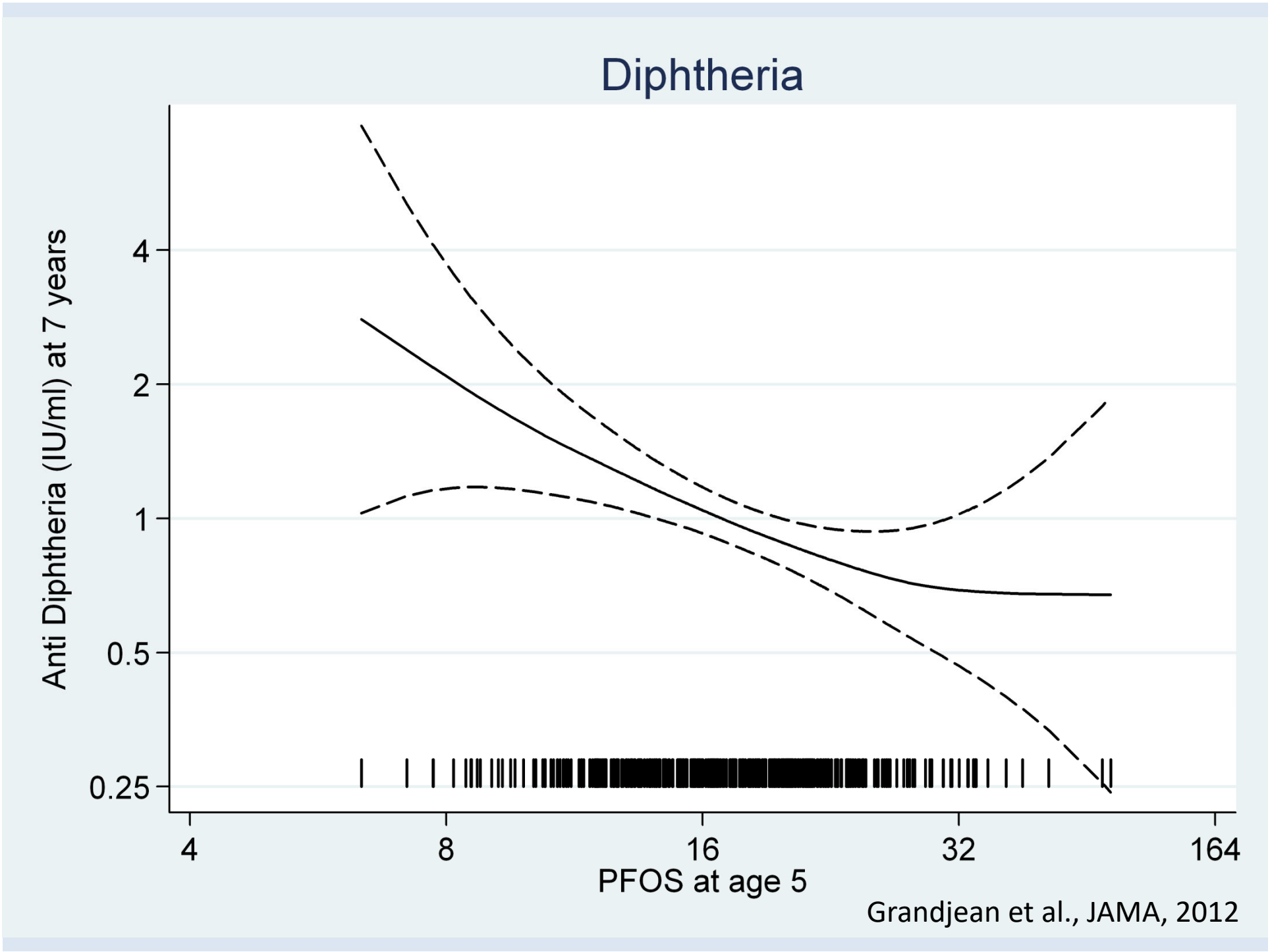
(Source: the Human Immune Response System www.uta.edu/chagas/images/immunSys.jpg)

Change in tetanus antibody concentration after booster in 12 adult volunteers



Steepness of increase inversely associated with serum-PFAS

(Kielsen et al., 2015)


Diphtheria
Anti Diphtheria (IU/ml) at 7 years
4
2
1
0.5
0.25
4
8
16
32
164
PFOS at age 5
Grandjean et al., JAMA, 2012

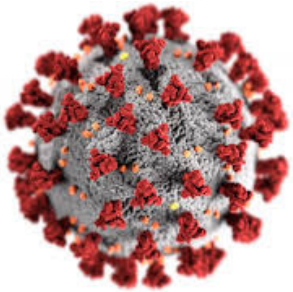
	PFAS Immunotoxicity	Unpublished
1978	Monkey study: PFOA immunotoxicity	
1992	Leukocyte changes in exposed workers	
2008	Mouse immunotoxicity at serum PFAS concentrations similar to humans	
2012	PFAS immunotoxicity in children	
2013	Benchmark Dose calculations suggest that guidelines are far from protective	
2020	EFSA considers immunotoxicity the critical effect and lowers tolerable dose	

Risk factors for COVID-19

- Elderly
- Men
- Existing disease, such as
  - Diabetes
  - Obesity

Have higher accumulated PFAS levels in blood

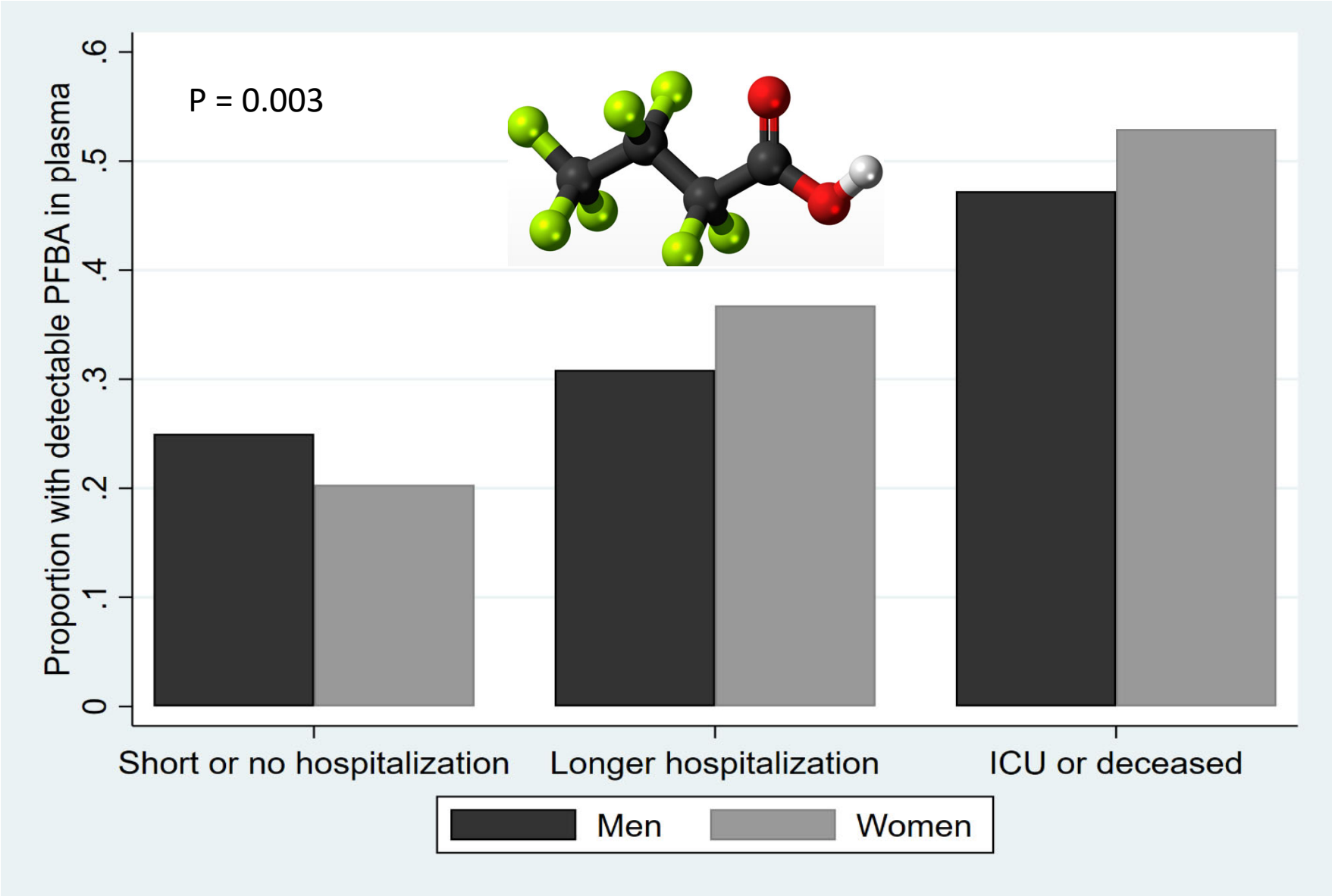
Occur at increased incidence when PFAS exposure is elevated



Study design

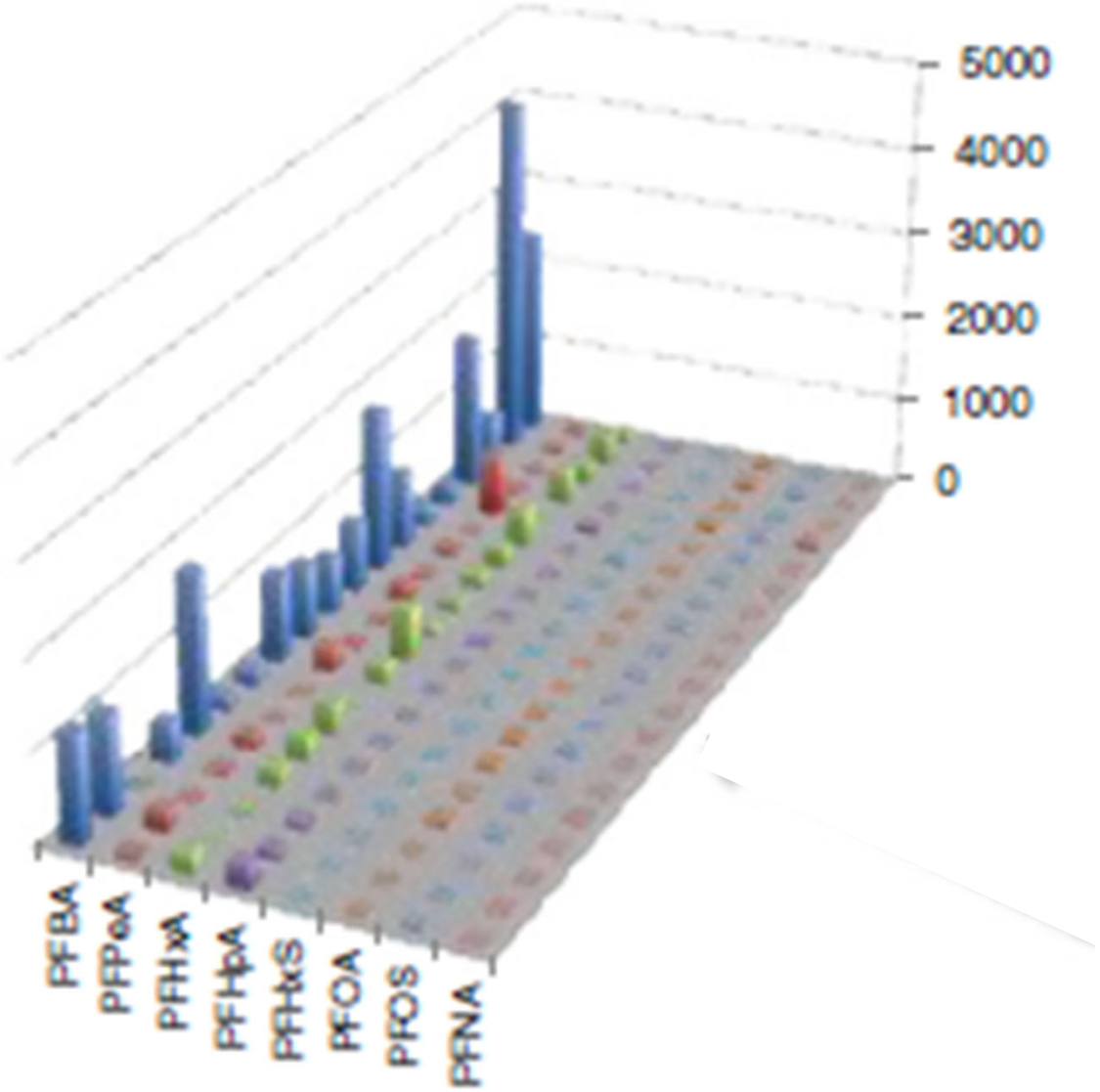
- Plasma from residual volumes from diagnostic blood tests at Danish hospitals (30-70 years)
- 323 subjects who were positive for SARS-CoV-2
- Health and demographic information from existing national registers (anonymized)
- Clinical course: no hospitalization, two weeks, or longer, intensive care, and death
- Adjustment for age, sex, chronic disease, ethnicity

https://doi.org/10.1101/2020.10.22.20217562



44 men and 64 women with up to two weeks of hospitalization
94 men and 68 women with longer hospitalization
36 men and 17 women admitted to the intensive care unit (ICU) or deceased

Lung



Perez et al., 2013

PFAS as immunotoxic pollutants

- No mandatory testing for immunotoxicity before marketing (not even today)
- Decreased antibody responses at background PFAS exposures
- New (limited) evidence that PFAS can aggravate COVID-19
- The mechanism may involve immunotoxicity
- If true, response to corona vaccination may be affected (not yet studied)

Drinking Water Health Advisory Levels

2009 (U.S.EPA):

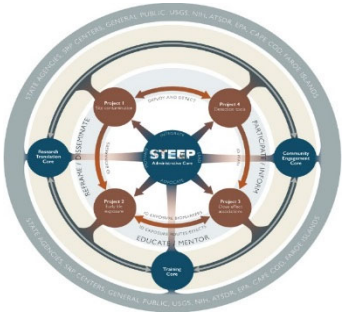
Provisional level of 400 ppt for PFOA
and 200 ppt for PFOS

2016 (U.S.EPA):

Guidance level of 70 ppt for total of PFOA and PFOS

2020: EFSA (EU) proposal for sum of 4 PFASs
TWI (for PFOA+PFNA+PFHxS+PFOS) 8 ng/kg bw · wk
Corresponds to 2.2 ppt in water

STEEP SRP Center



STEEP Mission

Address the ubiquitous human health threat of PFASs through rigorous interdisciplinary science to redefine dose exposure benchmarks, develop novel detection techniques, and prepare communities to expect long-term solutions for contaminated sites.

STEEP Vision

To avert human and environmental health impacts of PFASs exposure and disseminate lessons learned to help avoid similar contamination problems in the future.

THE UNIVERSITY OF RHODE ISLAND

HARVARD T.H. CHAN SCHOOL OF PUBLIC HEALTH

SILENT SPRING INSTITUTE
Researching the Environment and Women's Health

NIH NIEHS

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More information about STEEP is available at: https://web.uri.edu/steep/ and https://tools.niehs.nih.gov/srp/programs/Program_detail.cfm?Project_ID=P42ES027706