Supplemental Online Content

Walti LN, Mugglin C, Mombelli M, et al; Swiss Transplant Cohort Study. Vaccine-preventable infections among solid organ transplant recipients in Switzerland. *JAMA Netw Open.* 2023;6(4):e2310687. doi:10.1001/jamanetworkopen.2023.10687

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This supplemental material has been provided by the authors to give readers additional information about their work.

Abbreviations:

DNA, Deoxyribonucleic Acid

HBV, Hepatitis-B Virus

FOPH; Federal office of public health

NAAT, nucleic acid amplification tests

NGS, next-generation sequencing

PCR, polymerase chain reaction

STCS; Swiss Transplant Cohort Study

VPI, vaccine-preventable infection

eTable 1

eTable1	**Data sources (STCS/FOPH):**
In	The STCS prospectively enrolls all SOT recipients undergoing transplantation in Switzerland (Koller et al. Eur J Epidemiol (2013) 28:347–355, Stampf et al BMJ Open. 2021 Dec 15;11(12):e051176, Eur J Epidemiol (2013) 28:347–355). Designed as a patient-case system, the database captures both patient- and graft-specific data. Patients are followed from solid organ transplant (time zero) to graft loss and/or death whatever occurs first, and censored at last available follow up. Clinical and laboratory data are continuously collected and entered in the database at the time of transplantation, at 6 and 12 months, then yearly thereafter. Date of event was date of laboratory confirmation. Local site data managers are responsible for data collection pertaining to a certain follow-up period (e.g. baseline, 6 month, yearly). All infections were identified by transplant–infectious disease physicians using electronic hospital records and referral documentation for both inpatients and outpatients in intervals ranging from twice a week to every 3 months, according to standardized definitions (van Delden et al. Clin Infect Dis. 2020 Oct 1; 71(7): e159–e169.).
Federal Office of Public Health (FOPH):	In Switzerland, all healthcare workers and laboratories, operate according to the "diagnosing party" responsible for reporting' principle. Infectious diseases with reporting obligations are directly reported to the respective health authority using a declaration form for communicable diseases: (https://www.bag.admin.ch/bag/en/home/krankheiten/infektionskrankheiten-bekaempfen/meldesysteme-infektionskrankheiten/meldepflichtige-ik.html

eTable 2:

eTable 2: VPI definitions		
	Swiss Transplant Cohort Study	**Swiss Federal Office of Public Health**
Hepatitis A	Detection of antibodies (IgM/IgG) or virus replication (PCR, culture, antigen) in a previously seronegative patient.	At least one of the following positive: I. NAAT (PCR, Sequencing, NGS) Serum or Stool or II. Stool Antigen or III. Antibody detection (IgM, Titer increase ≥ 4x or Seroconversion)
Hepatitis B	Documented post-transplantation new positive HBV-DNA by PCR or HbsAg in blood or compatible histology compatible with HBV infectious disease. Patient should not be known for chronic hepatitis B, inactive HbsAg or resolved hepatitis B	At least one of the following positive I. NAAT (PCR, Sequencing, NGS) or II. Antibody detection (anti-HBc-IgM) or III. Antigen detection (AgHBs, AgHBe)
Diphtheria	Pathogen isolated + clinical signs and/or symptoms + treatment given.	Isolation of Corynebacterium diphtheriae and other toxin-forming Corynebacteria (C. ulcerans, C. pseudotuberculosis)
Invasive *Haemophilus influenzae*	Pathogen isolated form a sterile site + clinical signs and/or symptoms + treatment given.	At least one of the following positive (samples from sterile sites only): I. Culture or II. NAAT (PCR, Sequencing, NGS)
Influenza	Positive PCR/culture from a respiratory sample.	At least one of the following positive: I. Culture or II. NAAT (PCR, Sequencing, NGS) or III. Antibody detection or IV. Antigen detection Not positive rapid antigen test.
Measles	Detection of antibodies (IgM/IgG) or virus replication (PCR, culture) in a previously seronegative patient.	At least of the following positive I. Culture or II. NAAT (PCR, Sequencing, NGS) or III. Antibodies (IgM, ≥ 4 x titer increase or Seroconversion).
Mumps	Detection of antibodies (IgM/IgG) or virus replication (PCR, culture, antigen, in situ hybridization) in a previously seronegative patient.	NA
Pertussis	Pathogen isolated + clinical signs and/or symptoms + treatment given.	NA

Invasive pneumococcal disease	Pathogen isolated from a sterile site + clinical signs and/or symptoms + treatment given.	At least one of the following positive (samples from sterile sites only): I. Culture II. NAAT (PCR, Sequencing, NGS) Serum or Stool or III. Antibody detection (IgM, Titer increase ≥ 4x or Seroconversion) IV. Antigen detection
Poliomyelitis	Detection of antibodies (IgM/IgG) or virus replication (PCR, culture, antigen) in a previously seronegative patient.	At least one of the following positive: I. Culture II. NAAT (PCR, Sequencing, NGS) III. Antibody detection (relevant titer increase ≥ 4 x or Seroconversion)
Invasive Meningococcal disease	Pathogen isolated form a sterile site + clinical signs and/or symptoms + treatment given.	At least one of the following positive (samples from sterile sites only): I. Culture II. NAAT (PCR, Sequencing, NGS) Serum or Stool or III. Microscopy IV. Antigen detection
Rubella	Detection of antibodies (IgM/IgG) or virus replication (PCR, culture, antigen) in a previously seronegative patient.	At least one of the following positive: I. Culture II. NAAT (PCR, Sequencing, NGS) III. Antibody detection (IgM, relevant titer increase or Seroconversion)
Tetanus	Pathogen isolated + clinical signs and/or symptoms + treatment given.	At least one of the following positive: I. Culture II. NAAT (PCR, Sequencing, NGS) III. Antibody detection (relevant titer increase ≥ 4 x or Seroconversion)
Tick-borne encephalitis	Detection of antibodies (IgM/IgG) or virus replication (PCR, culture, antigen) in a previously seronegative patient.	At least of the following positive I. Culture or II. NAAT (PCR, Sequencing, NGS) or III. Antibodies (IgM, Titer increase ≥ 4 x or Seroconversion).
Varicella zoster virus	Detection of virus replication and symptoms/signs of concurrent organ dysfunction. Mucocutaneous infections: viral detection on vesicle swab (immunofluorescence, PCR, culture)	NA

eTable 3

eTable 3: Time from transplant to VPI occurrence	
VPI	Median (IQR), months
Influenza	23.4 (6.9-47.9)
VZV	16.9 (6.2-41.7)
Hepatitis B	13.7 (13.1-32.7)
TBE	16.3 (NA)
IPD	19.0 (15.7-24.5)
IHI	7.76 (0.3-31.2)
Pertussis	44.8 (NA)
IMD	30.6 (NA)

Abbreviations: IMD, invasive meningococcal disease; IHI, invasive *Haemophilus influenzae* infection; IPD, invasive pneumococcal disease; IQR; interquartile range; NA, not applicable; TBE, tick-borne encephalitis; VPI, vaccine-preventable infection; VZV, varicella zoster virus.

eTable 4

eTable 4 : Risk factors for VPI occurrence in solid organ transplant recipients		
Variable	HR (95% CI)	p-value
Sex		
Male	Reference	
Female	1.15 (0.98-1.36)	0.08
Age, years		
<18	1.30 (0.94-1.79)	0.11
≥18-64.9	Reference	
≥65	1.22 (0.97-1.54)	0.09
Organ transplant		
Kidney	Reference	
Liver	0.59 (0.46-0.76)	<0.001
Lung	1.67 (1.31-2.15)	<0.001
Heart	1.35 (1.01-1.80)	0.04
Combined	0.73 (0.46-1.15)	0.17
Induction Therapy		
Basiliximab/Other	Reference	
ATG	1.06 (0.85-1.32)	0.60
Rituximab	1.17 (0.82-1.68)	0.39
Treated Rejection Episode		
No	Reference	
Yes	1.26 (0.90-1.76)	0.17

Abbreviations: ATG, antithymocyte globulins; CI, confidence interval; HR, hazard ratio; VPI, vaccine preventable infection.

eTable 5

eTable 5 : Risk factors for influenza occurrence in solid organ transplant recipients		
Variable	IRR (95% CI)	p-value

Sex		
Male	Reference	
Female	0.971 (0.78-1.21)	0.79
Age, years		
<18	1.53 (0.97-2.41)	0.063
≥18-64.9	Reference	
≥65	1.25 (0.91-1.71)	0.09
Organ transplant		
Kidney	Reference	
Liver	0.53 (0.36-0.76)	0.001
Lung	2.51 (1.88-3.34)	<0.001
Heart	1.04 (0.66-1.63)	0.86
Combined	0.57 (0.31-1.09)	0.093
Induction Therapy		
Basiliximab/Other	Reference	
ATG	1.15 (0.85-1.58)	0.35
Rituximab	0.82 (0.47-1.42)	0.48

Abbreviations: ATG, antithymocyte globulins; CI, confidence interval; HR, hazard ratio.

eTable 6

eTable 6 : Risk factors for VZV occurrence in solid organ transplant recipients		
Variable	IRR (95% CI)	p-value
Sex		
Male	Reference	
Female	1.32 (1.04-1.69)	0.024
Age, years		
<18	0.79 (0.47-1.35)	0.39
≥18-64.9	Reference	
≥65	1.19 (0.85-1.67)	0.30
Organ transplant		
Kidney	Reference	
Liver	0.59 (0.46-0.76)	0.006
Lung	0.71 (0.41-1.21)	0.21
Heart	1.72 (1.16-2.55)	0.007
Combined	0.77 (0.42-1.42)	0.39
Induction Therapy		
Basiliximab/Other	Reference	
ATG	0.92 (0.67-1.32)	0.59
Rituximab	1.38 (0.83-2.30)	0.20

Abbreviations: ATG, antithymocyte globulins; CI, confidence interval; HR, hazard ratio; VZV, varicella zoster virus.

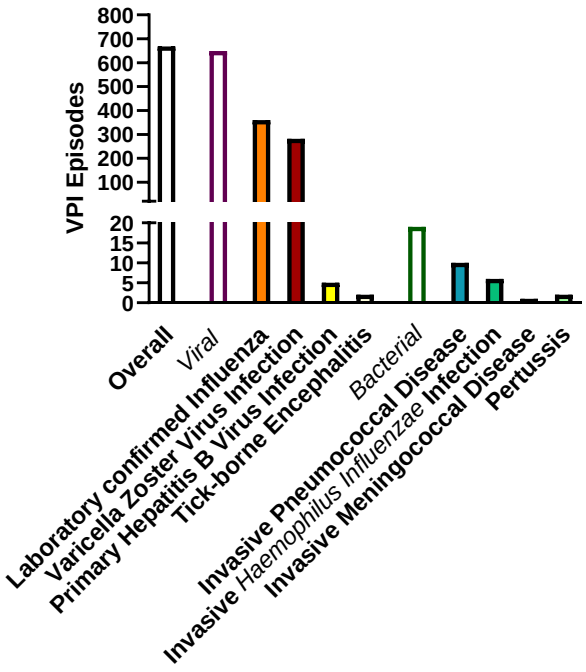
eTable 7

eTable 7: Association of VPI occurrence and graft-loss/death during the first 90 days post-transplant		
Variable	HR (95% CI)	P-value
Sex		
Male	Reference	

Female	0.80 (0.70-0.91)	0.001
Age, years		
<18	0.61 (0.43-0.88)	0.008
≥18-64.9	Reference	
≥65	2.23 (2.03-2.76)	<0.001
Organ transplant		
Kidney	Reference	
Liver	1.59 (1.35-1.87)	<0.001
Lung	3.28 (2.75-3.89)	<0.001
Heart	1.44 (1.10-1.88)	0.007
Combined	1.53 (1.14-2.05)	0.005
VPI occurrence		
No	Reference	
Yes	2.44 (1.50-3.99)	<0.001

Abbreviations: CI, confidence interval; HR, hazard ratio; VPI, vaccine preventable infections

eFigure Vaccine preventable infections in 4967 solid organ transplant recipients.



Cases of VPIs recorded in the STCS from May 2008 to December 2019. STCS; Swiss Transplant Cohort Study. VPI; vaccine preventable infection.

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