#Talking Special Populations

Vaccination of Special Populations: Are you Up-To-Date?

Barbara Pahud MD MPH

Associate Professor of Pediatrics

Outline

- 2017 Immunization Schedule
- Responsibility for Vaccinating
- Recommendations for Vaccination After:
  - Blood products/IG
  - Immunosuppressive medications
  - Blood and marrow transplant
  - Solid Organ Transplant (SOT)

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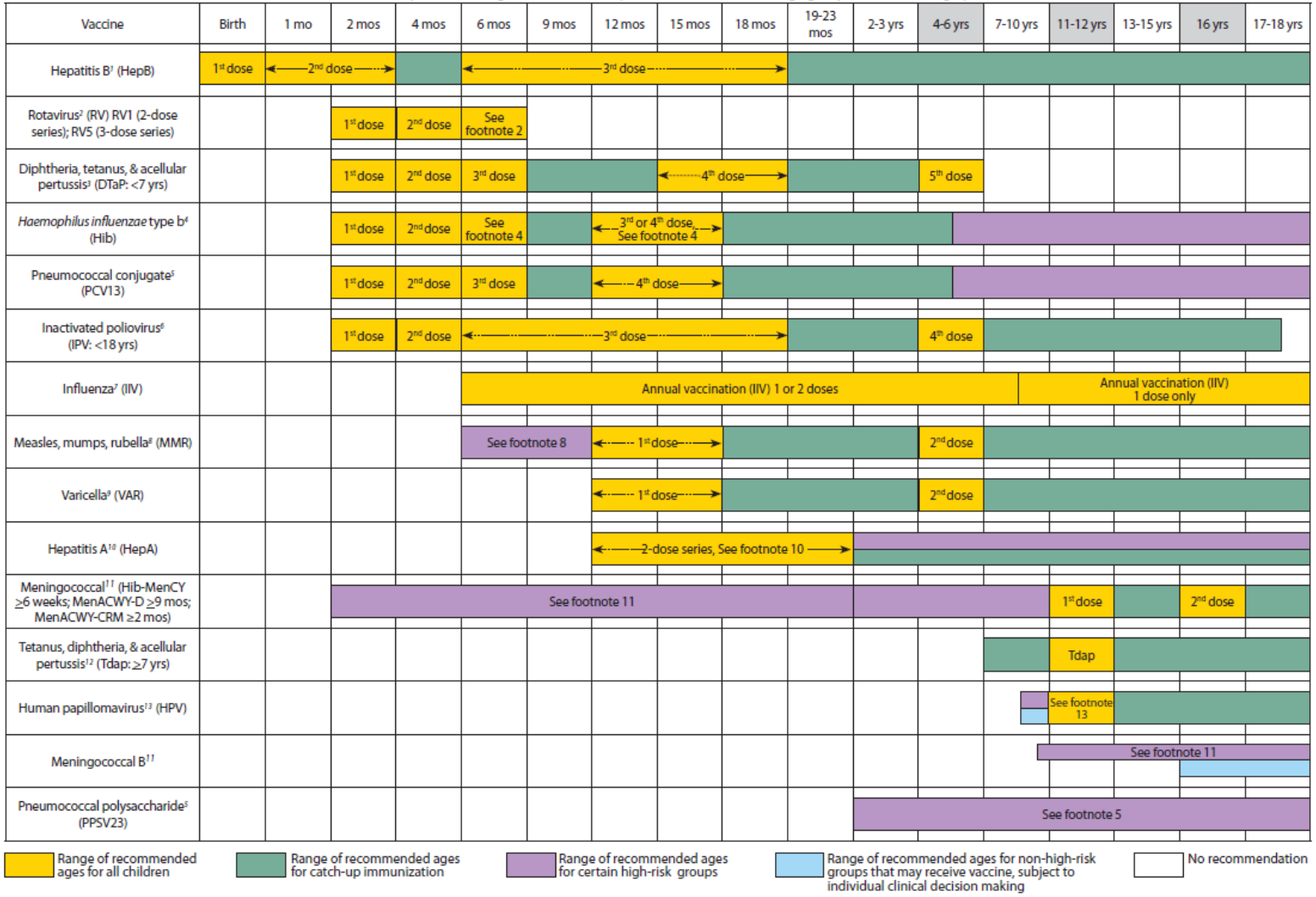
Figure 1. Recommended immunization schedule for children and adolescents aged 18 years or younger—United States, 2017.

(FOR THOSE WHO FALL BEHIND OR START LATE, SEE THE CATCH-UP SCHEDULE [FIGURE 2]).

These recommendations must be read with the footnotes that follow. For those who fall behind or start late, provide catch-up vaccination at the earliest opportunity as indicated by the green bars in Figure 1. To determine minimum intervals between doses, see the catch-up schedule (Figure 2). School entry and adolescent vaccine age groups are shaded in gray.



NOTE: The above recommendations must be read along with the footnotes of this schedule.

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FIGURE 2. Catch-up immunization schedule for persons aged 4 months through 18 years who start late or who are more than 1 month behind—United States, 2017.

The figure below provides catch-up schedules and minimum intervals between doses for children whose vaccinations have been delayed. A vaccine series does not need to be restarted, regardless of the time that has elapsed between doses. Use the section appropriate for the child's age. Always use this table in conjunction with Figure 1 and the footnotes that follow.

Vaccine	Minimum Age for Dose 1	Minimum Interval Between Doses			
		Dose 1 to Dose 2	Dose 2 to Dose 3	Dose 3 to Dose 4	Dose 4 to Dose 5
Children age 4 months through 6 years					
Hepatitis B[7]	Birth	4 weeks	8 weeks *and* at least 16 weeks after first dose. Minimum age for the final dose is 24 weeks.		
Rotavirus[2]	6 weeks	4 weeks	4 weeks[2]		
Diphtheria, tetanus, and acellular pertussis[3]	6 weeks	4 weeks	4 weeks	6 months	6 months[3]
Haemophilus influenzae type b[4]	6 weeks	4 weeks if first dose was administered before the 1st birthday. 8 weeks (as final dose) if first dose was administered at age 12 through 14 months. No further doses needed if first dose was administered at age 15 months or older.	4 weeks[4] if current age is younger than 12 months **and** first dose was administered at younger than age 7 months, **and** at least 1 previous dose was PRP-T (ActHib, Pentacel, Hiberix) or unknown. 8 weeks *and* age 12 through 59 months (as final dose)[4] • if current age is younger than 12 months **and** first dose was administered at age 7 through 11 months; OR • if current age is 12 through 59 months **and** first dose was administered before the 1st birthday, **and** second dose administered at younger than 15 months; OR • if both doses were PRP-OMP (PedvaxHIB; Comvax) **and** were administered before the 1st birthday. No further doses needed if previous dose was administered at age 15 months or older.	8 weeks (as final dose) This dose only necessary for children age 12 through 59 months who received 3 doses before the 1st birthday.	
Pneumococcal[5]	6 weeks	4 weeks if first dose administered before the 1st birthday. 8 weeks (as final dose for healthy children) if first dose was administered at the 1st birthday or after. No further doses needed for healthy children if first dose was administered at age 24 months or older.	4 weeks if current age is younger than 12 months and previous dose given at <7 months old. 8 weeks (as final dose for healthy children) if previous dose given between 7-11 months (wait until at least 12 months old); OR if current age is 12 months or older and at least 1 dose was given before age 12 months. No further doses needed for healthy children if previous dose administered at age 24 months or older.	8 weeks (as final dose) This dose only necessary for children aged 12 through 59 months who received 3 doses before age 12 months or for children at high risk who received 3 doses at any age.	
Inactivated poliovirus[6]	6 weeks	4 weeks[6]	4 weeks[6]	6 months[6] (minimum age 4 years for final dose).	
Measles, mumps, rubella[8]	12 months	4 weeks			
Varicella[9]	12 months	3 months			
Hepatitis A[10]	12 months	6 months			
Meningococcal[11] (Hib-MenCY ≥6 weeks; MenACWY-D ≥9 mos; MenACWY-CRM ≥2 mos)	6 weeks	8 weeks[11]	See footnote 11	See footnote 11	
Children and adolescents age 7 through 18 years					
Meningococcal[11] (MenACWY-D ≥9 mos; MenACWY-CRM ≥2 mos)	Not Applicable (N/A)	8 weeks[11]			
Tetanus, diphtheria; tetanus, diphtheria, and acellular pertussis[12]	7 years[12]	4 weeks	4 weeks if first dose of DTaP/DT was administered before the 1st birthday. 6 months (as final dose) if first dose of DTaP/DT or Tdap/Td was administered at or after the 1st birthday.	6 months if first dose of DTaP/DT was administered before the 1st birthday.	
Human papillomavirus[13]	9 years	Routine dosing intervals are recommended.[13]			
Hepatitis A[10]	N/A	6 months			
Hepatitis B[7]	N/A	4 weeks	8 weeks **and** at least 16 weeks after first dose.		
Inactivated poliovirus[6]	N/A	4 weeks	4 weeks[6]	6 months[6]	
Measles, mumps, rubella[8]	N/A	4 weeks			
Varicella[9]	N/A	3 months if younger than age 13 years. 4 weeks if age 13 years or older.			

NOTE: The above recommendations must be read along with the footnotes of this schedule.

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Footnotes — Recommended Immunization Schedule for Children and Adolescents Aged 18 Years or Younger, UNITED STATES, 2017

For further guidance on the use of the vaccines mentioned below, see: www.cdc.gov/vaccines/hcp/acip-recs/index.html.
For vaccine recommendations for persons 19 years of age and older, see the Adult Immunization Schedule.

Additional information

- For contraindications and precautions to use of a vaccine and for additional information regarding that vaccine, vaccination providers should consult the ACIP General Recommendations on Immunization and the relevant ACIP statement, available online at www.cdc.gov/vaccines/hcp/acip-recs/index.html.
- For purposes of calculating intervals between doses, 4 weeks = 28 days. Intervals of 4 months or greater are determined by calendar months.
- Vaccine doses administered ≤4 days before the minimum interval are considered valid. Doses of any vaccine administered ≥5 days earlier than the minimum interval or minimum age should not be counted as valid doses and should be repeated as age-appropriate. The repeat dose should be spaced after the invalid dose by the recommended minimum interval. For further details, see Table 1, *Recommended and minimum ages and intervals between vaccine doses, in MMWR, General Recommendations on Immunization and Reports / Vol. 60 / No. 2,* available online at www.cdc.gov/mmwr/pdf/rr/rr6002.pdf.
- Information on travel vaccine requirements and recommendations is available at wwwnc.cdc.gov/travel/.
- For vaccination of persons with primary and secondary immunodeficiencies, see Table 13, *Vaccination of persons with primary and secondary immunodeficiencies,* in *General Recommendations on Immunization* (ACIP), available at www.cdc.gov/mmwr/pdf/rr/rr6002.pdf.; and Immunization in Special Clinical Circumstances, (American Academy of Pedatrics). In: Kimberlin DW, Brady MT, Jackson MA, Long SS, eds. *Red Book: 2015 report of the Committee on Infectious Diseases. 30th ed.* Elk Grove Village, IL: American Academy of Pediatrics, 2015:68-107.
- The National Vaccine Injury Compensation Program (VICP) is a no-fault alternative to the traditional legal system for resolving vaccine injury petitions. Created by the National Childhood Vaccine Injury Act of 1986, it provides compensation to people found to be injured by certain vaccines. All vaccines within the recommended childhood immunization schedule are covered by VICP except for pneumococcal polysaccharide vaccine (PPSV). For more information; see www.hrsa.gov/vaccinecompensation/index.html.

1. **Hepatitis B (HepB) vaccine. (Minimum age: birth)**

Routine vaccination:

At birth:

- Administer monovalent HepB vaccine to all newborns within 24 hours of birth.
- For infants born to hepatitis B surface antigen (HBsAg)-positive mothers, administer HepB vaccine and 0.5 mL of hepatitis B immune globulin (HBIG) within 12 hours of birth. These infants should be tested for HBsAg and antibody to HBsAg (anti-HBs) at age 9 through 12 months (preferably at the next well-child visit) or 1 to 2 months after completion of the HepB series if the series was delayed.
- If mother's HBsAg status is unknown, within 12 hours of birth, administer HepB vaccine regardless of birth weight. For infants weighing less than 2,000 grams, administer HBIG in addition to HepB vaccine within 12 hours of birth. Determine mother's HBsAg status as soon as possible and, if mother is HBsAg-positive, also administer HBIG to infants weighing 2,000 grams or more as soon as possible, but no later than age 7 days.

Doses following the birth dose:

- The second dose should be administered at age 1 or 2 months. Monovalent HepB vaccine should be used for doses administered before age 6 weeks.
- Infants who did not receive a birth dose should receive 3 doses of a HepB-containing vaccine on a schedule of 0, 1 to 2 months, and 6 months, starting as soon as feasible (see figure 2).
- Administer the second dose 1 to 2 months after the first dose (minimum interval of 4 weeks); administer the third dose at least 8 weeks after the second dose AND at least 16 weeks after the **first** dose. The final (third or fourth) dose in the HepB vaccine series should be administered **no earlier than age 24 weeks**.
- Administration of a total of 4 doses of HepB vaccine is permitted when a combination vaccine containing HepB is administered after the birth dose.

Catch-up vaccination:

- Unvaccinated persons should complete a 3-dose series.
- A 2-dose series (doses separated by at least 4 months) of adult formulation Recombivax HB is licensed for use in children aged 11 through 15 years.
- For other catch-up guidance, see Figure 2.

2. **Rotavirus (RV) vaccines. (Minimum age: 6 weeks for both RV1 [Rotarix] and RV5 [RotaTeq])**

Routine vaccination:

Administer a series of RV vaccine to all infants as follows:

1. If Rotarix is used, administer a 2-dose series at ages 2 and 4 months.
2. If RotaTeq is used, administer a 3-dose series at ages 2, 4, and 6 months.
3. If any dose in the series was RotaTeq or vaccine product is unknown for any dose in the series, a total of 3 doses of RV vaccine should be administered.

Catch-up vaccination:

- The maximum age for the first dose in the series is 14 weeks, 6 days; vaccination should not be initiated for infants aged 15 weeks, 0 days, or older.
- The maximum age for the final dose in the series is 8 months, 0 days.
- For other catch-up guidance, see Figure 2.

3. **Diphtheria and tetanus toxoids and acellular pertussis (DTaP) vaccine. (Minimum age: 6 weeks. Exception: DTaP-IPV [Kinrix, Quadracel]: 4 years)**

Routine vaccination:

- Administer a 5-dose series of DTaP vaccine at ages 2, 4, 6, 15 through 18 months, and 4 through 6 years. The fourth dose may be administered as early as age 12 months, provided at least 6 months have elapsed since the third dose.
- Inadvertent administration of fourth DTaP dose early: If the fourth dose of DTaP was administered at least 4 months after the third dose of DTaP and the child was 12 months of age or older, it does not need to be repeated.

Catch-up vaccination:

- The fifth dose of DTaP vaccine is not necessary if the fourth dose was administered at age 4 years or older.
- For other catch-up guidance, see Figure 2.

4. ***Haemophilus influenzae* type b (Hib) conjugate vaccine. (Minimum age: 6 weeks for PRP-T [ActHIB, DTaP-IPV/Hib (Pentacel), Hiberix, and Hib-MenCY (MenHibrix)], PRP-OMP [PedvaxHIB])**

Routine vaccination:

- Administer a 2- or 3-dose Hib vaccine primary series and a booster dose (dose 3 or 4, depending on vaccine used in primary series) at age 12 through 15 months to complete a full Hib vaccine series.
- The primary series with ActHIB, MenHibrix, Hiberix, or Pentacel consists of 3 doses and should be administered at ages 2, 4, and 6 months. The primary series with PedvaxHIB consists of 2 doses and should be administered at ages 2 and 4 months; a dose at age 6 months is not indicated.
- One booster dose (dose 3 or 4, depending on vaccine used in primary series) of any Hib vaccine should be administered at age 12 through 15 months.
- For recommendations on the use of MenHibrix in patients at increased risk for meningococcal disease, refer to the meningococcal vaccine footnotes and also to *MMWR* February 28, 2014 / 63(RR01):1-13, available at www.cdc.gov/mmwr/PDF/rr/rr6301.pdf.

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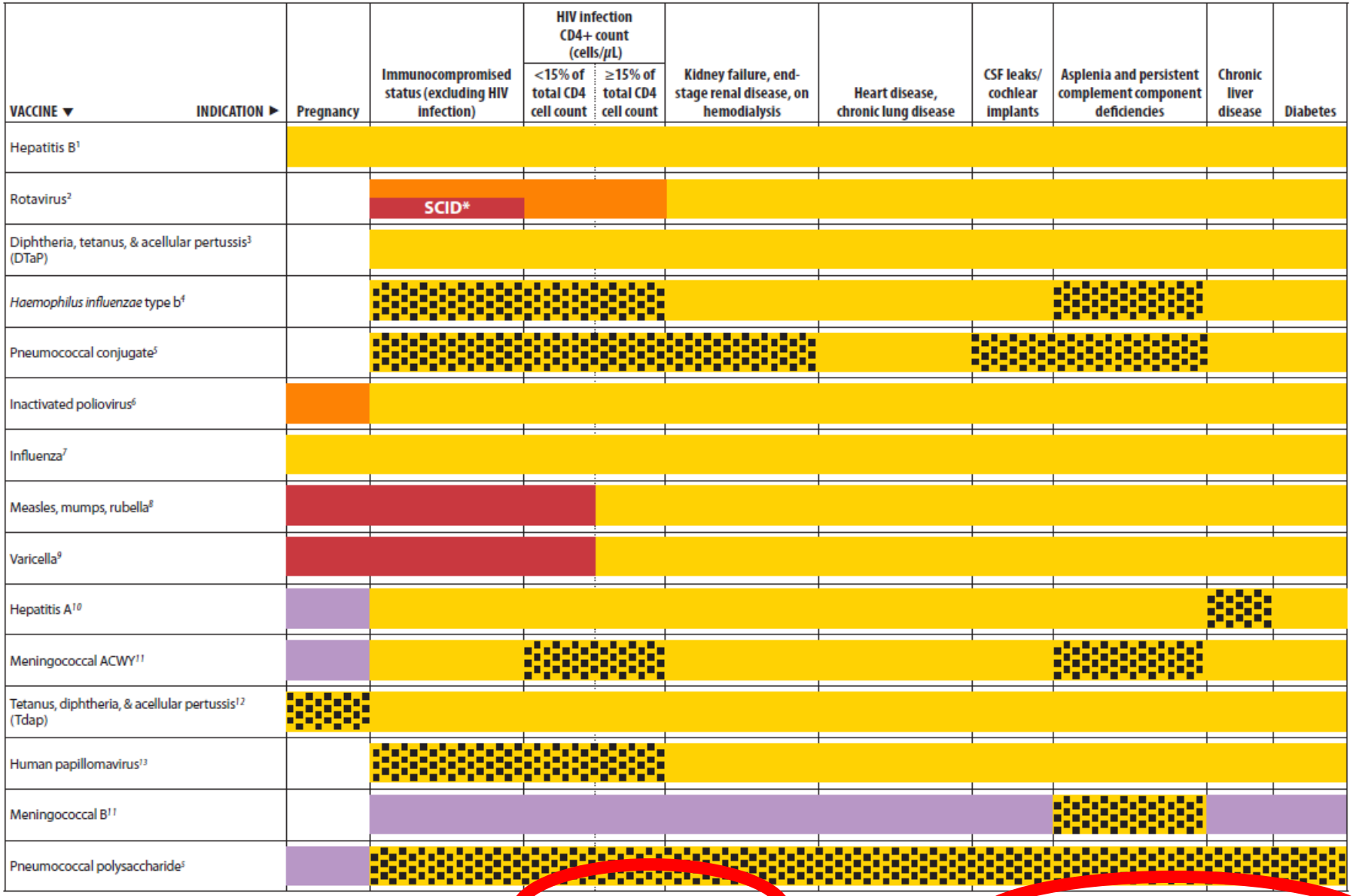
Figure 3. Vaccines that might be indicated for children and adolescents aged 18 years or younger based on medical indications



*Severe Combined Immunodeficiency

NOTE: The above recommendations must be read along with the footnotes of this schedule.

2013 IDSA Clinical Practice Guideline for Vaccination of the Immunocompromised Host

Lorry G. Rubin,[1] Myron J. Levin,[2] Per Ljungman,[3,4] E. Graham Davies,[5] Robin Avery,[6] Marcie Tomblyn,[7] Athos Bousvaros,[8] Shireesha Dhanireddy,[9] Lillian Sung,[10] Harry Keyserling,[11] and Insoo Kang[12]

[1]Division of Pediatric Infectious Diseases, Steven and Alexandra Cohen Children's Medical Center of New York of the North Shore-LIJ Health System, New Hyde Park; [2]Section of Pediatric Infectious Diseases, University of Colorado Denver Anschutz Medical Campus, Aurora; [3]Department of Hematology, Karolinska University Hospital; [4]Division of Hematology, Department of Medicine Huddinge, Karolinska Institutet, Stockholm, Sweden; [5]Department of Immunology, Great Ormond Street Hospital & Institute of Child Health, London, United Kingdom; [6]Division of Infectious Diseases, Johns Hopkins University School of Medicine, Baltimore, Maryland; [7]Department of Blood and Marrow Transplant, H. Lee Moffitt Cancer Center and Research Institute, University of South Florida, Tampa; [8]Department of Gastroenterology and Nutrition, Children's Hospital Boston, Massachusetts; [9]Department of Allergy and Infectious Diseases, University of Washington, Seattle; [10]Division of Hematology-Oncology, Hospital for Sick Children, Toronto, Ontario, Canada; [11]Division of Pediatric Infectious Diseases, Emory University of School of Medicine, Atlanta, Georgia [12]Section of Rheumatology, Department of Internal Medicine, Yale University School of Medicine, New Haven, Connecticut

An international panel of experts prepared an evidenced-based guideline for vaccination of immunocompromised adults and children. These guidelines are intended for use by primary care and subspecialty providers who care for immunocompromised patients. Evidence was often limited. Areas that warrant future investigation are highlighted.

Keywords. vaccination; immunization; immunocompromised patients; immunosuppression; asplenic patients; immunodeficiency patients

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Clin Infect Dis (2014) 58 (3): e44-e100.

American Journal of Transplantation 2013; 13: 311–317
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Special Article

Vaccination in Solid Organ Transplantation

L. Danziger-Isakov[a,*], D. Kumar[b] and the AST Infectious Diseases Community of Practice

[a]*Cincinnati Children's Hospital Medical Center, Cincinnati, OH*
[b]*University of Alberta, Alberta, Canada*
**Corresponding author: L. Danziger-Isakov, Lara.Danziger-Isakov@cchmc.org*

Key words: Immunizations, influenza, live virus vaccines, prevention, vaccines

Abbreviations: HCW, healthcare worker; HPV, human papilloma virus; LAIV, live-attenuated influenza vaccine; MMR, measles, mumps rubella vaccine; TST, tuberculin skin test; VZV, varicella zoster virus.

In general live vaccines are not administered after transplantation. Therefore, when possible it is recommended to administer live vaccines such as measles, mumps, rubella IMMRI, Varicella vaccine and Zoster vaccine prior to transplantation. For patients who are incompletely or unvaccinated prior to transplant, consultation with an infectious diseases specialist is recommended. If possible, this should be done at the time of pretransplant assessment to allow for sufficient time for vaccine administration.

While the optimal time to give vaccines after transplantation is not known, most centers restart vaccinations at approximately 3–6 months after transplantation when baseline immunosuppression levels are attained. The ability to mount an immune response will be impacted by the type and amount of immunosuppression after organ transplantation. It is unknown whether the type-of-transplant impacts response as this is closely linked with degree of

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American Journal of Transplantation 2013; 13:311-317

Bone Marrow Transplantation

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Guidelines

Bone Marrow Transplantation (2009) **44,** 521–526; doi:10.1038/bmt.2009.263

Vaccination of hematopoietic cell transplant recipients

P Ljungman[1], C Cordonnier[2], H Einsele[3], J Englund[4], C M Machado[5], J Storek[6] and T Small[7]

[1]Karolinska University Hospital, Stockholm, Sweden
[2]Hopital Henri Mondor, Creteil, France
[3]Universitatsklinik Wurzburg Medizinische Klinik und Poliklinik II, Wurzburg, Germany
[4]University of Washington/Seattle Children's Hospital and Regional Medical Center, Seattle, WA, USA
[5]Institue of Tropical Medicine, Universidade de São Paulo, São Paulo, Brazil
[6]Department of Medicine, Oncology, Microbiology and Infectious Diseases, University of Calgary, Calgary, Alberta, Canada
[7]Memorial Sloan Kettering Cancer Center, New York, NY, USA

Correspondence: Dr P Ljungman, Department of Hematology, Karolinska University Hospital/Huddinge M54, Stockholm, S-14186, Sweden. E-mail: Per.Ljungman@ki.se; Dr M Tomblyn, Blood & Marrow Transplantation, H Lee Moffitt Cancer Center & Research Institute, 12902 Magnolia Drive FOB 3, Tampa, FL 33612, USA. E-mail: marcie.tomblyn@moffitt.org

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Bone Marrow Transplantation (2009) 44, 521–526

RECOMMENDATIONS FOR RESPONSIBILITY FOR VACCINATION

Who Is Responsible for Vaccinating Immunocompromised Patients and Members of Their Household?

Specialists who care for immunocompromised patients share responsibility with the primary care provider

- for ensuring that appropriate vaccinations are administered to immunocompromised patients
- for recommending appropriate vaccinations for members of immunocompromised patients' household

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Immunization and IVIG or Blood Products

- Live-virus vaccines may have diminished immunogenicity when given within 2 weeks before or up to 11 months following receipt of IG
- IG administration inhibits the response to measles vaccine for up to 11 months
- Inhibition of immune response to rubella vaccine also has been demonstrated, but the effect on response to mumps or varicella vaccines is not known
- The appropriate interval between IG administration and measles immunization varies with the dose of IG and the specific product.

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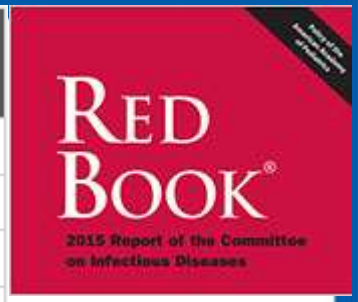
Indications or Product	Route	Dose		Interval, mo[a]
		U or mL	mg IgG/kg	
RSV prophylaxis (palivizumab monoclonal antibody)[b]	IM	...	15 (monoclonal)	None
Tetanus prophylaxis (as TIG)	IM	250 U	10	3
Hepatitis A prophylaxis (as IG)				
Contact prophylaxis	IM	0.02 mL/kg	3.3	3
International travel	IM	0.06 mL/kg	10	3
Hepatitis B prophylaxis (as HBIG)	IM	0.06 mL/kg	10	3
Rabies prophylaxis (as RIG)	IM	20 IU/kg	22	4
Varicella prophylaxis (as VariZIG)	IM	125 U/10 kg (maximum 625 U)	20–40	5
Measles prophylaxis (as IG)				
Standard	IM	0.25 mL/kg	40	5
Immunocompromised host	IM	0.50 mL/kg	80	6
Botulinum Immune Globulin Intravenous (Human [as BabyBIG])	IV	1.5 mL/kg	75	6
Blood transfusion				
Washed RBCs	IV	10 mL/kg	Negligible	0
RBCs, adenine-saline added	IV	10 mL/kg	10	3
Packed RBCs	IV	10 mL/kg	20–60	5
Whole blood	IV	10 mL/kg	80–100	6
Plasma or platelet products	IV	10 mL/kg	160	7
Replacement (or therapy) of immune deficiencies (as IGIV)	IV	...	300–400	8
Therapy for ITP (as IGIV)	IV	...	400	8
Varicella prophylaxis (as IGIV)	IV		400	8
Therapy for ITP (as IGIV)	IV	...	1000	10
Therapy for ITP or Kawasaki disease (as IGIV)	IV	...	1600–2000	11



BLOOD AND BONE MARROW TRANSPLANT RECIPIENTS

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When should vaccination begin?

- Incativated:3-6 months after BMT, others do 1 year, depends on the reason for the transplant
- Live: Wait at least 2 years

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General guidelines to live vaccines

- 2-1-8 rule
  - 2 years post BMY
  - 1 year off immunosuppressive drugs
  - 8 monts post IVg replacement
- Patient should be w/o infections in the past 6 months
- Should not be needing IgG replacement therapy with normal IgG levels and detectable IgA levels

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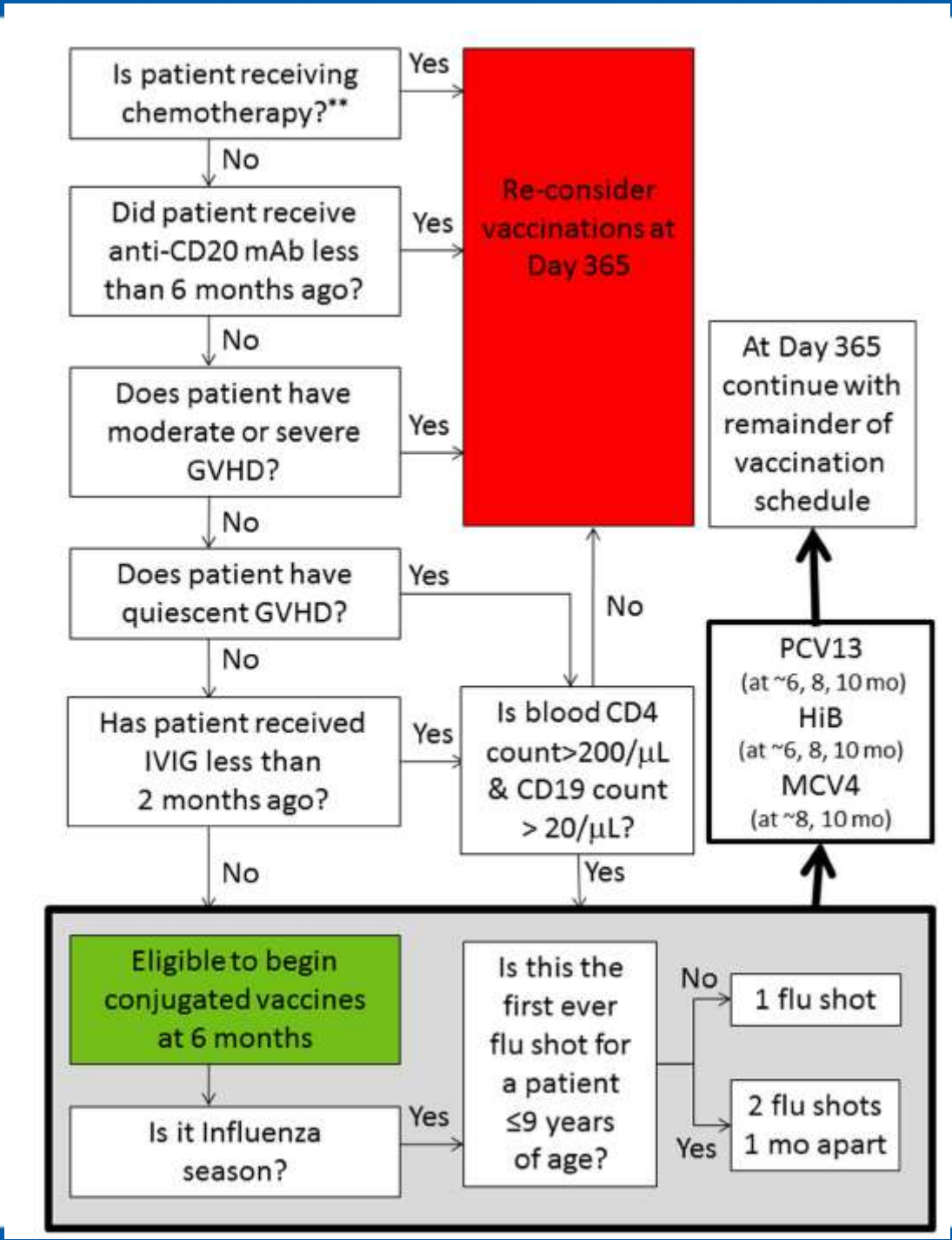

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What if they already have protective titiers?

YES

- Antibody titers to vaccine-preventable diseases decline after autologous or allogeneic BMT despite the fact that most BMT recipients were vaccinated earlier in life
- Except- varicella (latency outside the hematopoietic system)

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IMMUNOSUPPRESSIVE MEDICATIONS

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Immunosuppressive Medications

- When feasible, clinicians should administer all indicated vaccines to all persons before treatment with other immunosuppressive drugs.
- Evidence that use of therapeutic monoclonal antibody preparations, especially the antitumor necrosis factor agents adalimumab, infliximab, and etanercept, causes reactivation of latent tuberculosis infection and tuberculosis disease and predisposes persons to other opportunistic infections suggests caution in the use of live vaccines in patients receiving these drug.

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Immunosuppressive Medications

Inactivated Vaccines

- It is preferable to vaccinate an immunocompromised person and obtain a less-than-optimal response than to withhold the vaccine and obtain NO response
- Inactivated vaccines may be administered during low-dose intermittent or maintenance therapy with immunosuppressive drugs.
- If currently on chemotherapy/radiation therapy, transplant rejection therapy: repeat doses 3 months after cessation of therapy and remission

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Immunosuppressive Medications

Live Vaccines

- Efficacy concerns the same with inactivated vaccines
- The safety and efficacy of live, attenuated vaccines administered concurrently with recombinant human immune mediators and immune modulators are unknown
  - Safety concerns – live vaccines microbes replicate
  - Absent /weakened immune system to prevent replication
- If currently on chemotherapy/radiation therapy, transplant rejection therapy: withhold vaccine dose, and repeat doses 3 months after cessation of therapy and remission
- Avoidance of live, attenuated vaccines during immunosuppressive therapy is prudent, unless the benefit of vaccination outweighs the hypothetical increased risk for an adverse reaction after vaccination

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Immunosuppressive Medications

- Patients vaccinated within 14 days before starting immunosuppressive therapy or while receiving immunosuppressive therapy should be considered unimmunized and should be revaccinated at least 3 months after therapy is discontinued if immune competence has been restored

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Corticosteroids

Corticosteroid therapy usually is not a contraindication to administering live-virus vaccine when administration is

1) short term (i.e., <14 days);
2) a low to moderate dose (<20 mg of prednisone or equivalent per day);
3) long-term, alternate-day treatment with short-acting preparations;
4) maintenance physiologic doses (replacement therapy); or
5) topical (skin or eyes), inhaled, or by intraarticular, bursal, or tendon injection.

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Corticosteroids

- Avoid live vaccines if dose equivalent to
  - ≥2 mg/kg of body weight
  - ≥20 mg/day of prednisone or equivalent for persons who weigh >10 kg
  - when administered for ≥14 days
- Corticosteroids used in greater than physiologic doses also can reduce the immune response to vaccines
- Live-virus vaccination should be deferred for at least 1 month after discontinuation of high-dose systemically absorbed corticosteroid therapy administered for >14 days

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Solid Organ Transplant (SOT)

Many of the conditions for which patients undergo organ transplantation are at least to some extent immunosuppressive

Vaccinations should be ***considered early*** during the disease

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SOT

- Immunizations can be given:
  - Prior to transplantation (because the immune response then is more likely to be less suppressed and the patient more likely to respond)
  - After transplantation
  - Both

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SOT DONOR

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RECOMMENDATIONS FOR VACCINATION OF SOLID ORGAN TRANSPLANT **LIVING DONORS**

Which Vaccines Should Be Administered During Pretransplant Evaluation?

- Living donors should be current with vaccines based on age, vaccination history, and exposure history according to the CDC annual schedule (strong, high)
- MMR, MMRV, VAR, and ZOS vaccine administration should be avoided within 4 weeks of organ donation

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SOT CANDIDATE

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Pre-SOT

- In general, standard vaccine series should be given to children awaiting SOT

- Consider an accelerated schedule!

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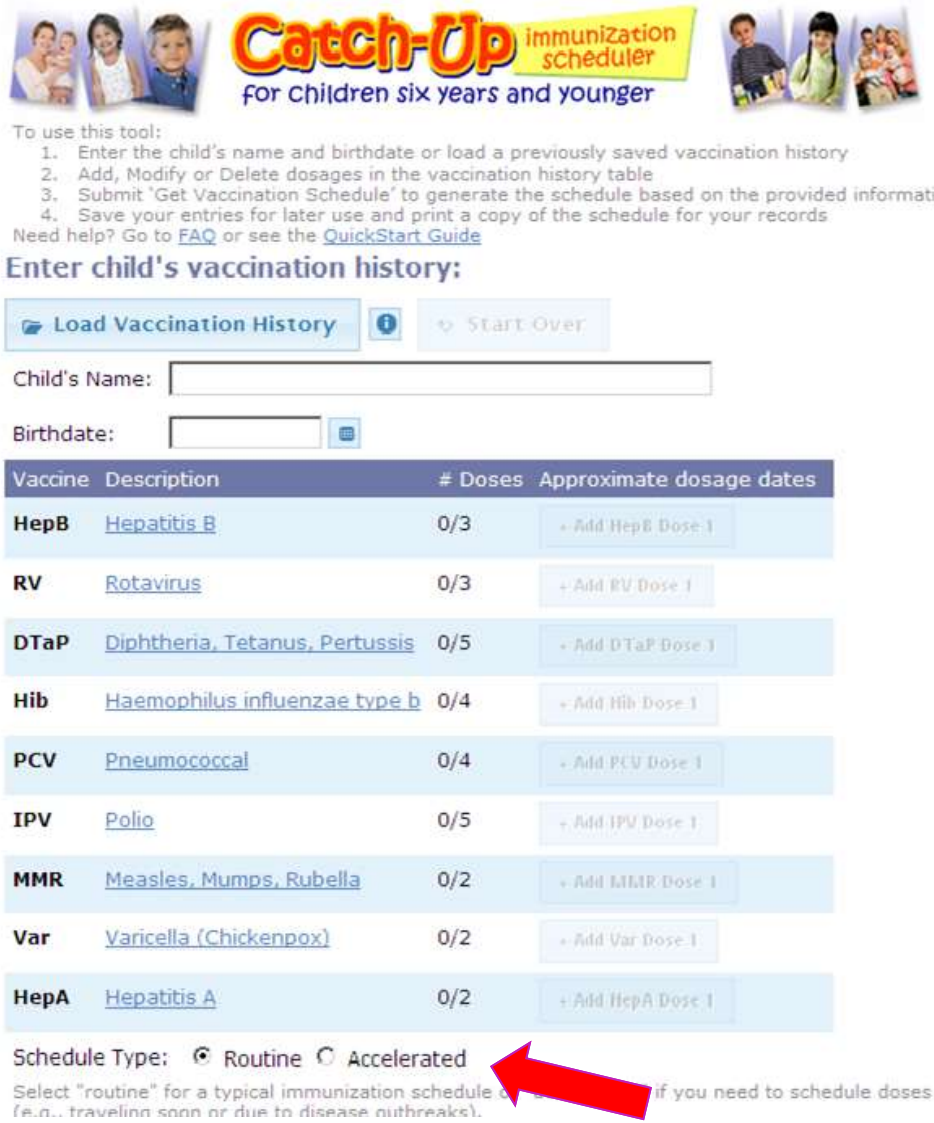
CDC catch-up vaccine scheduler tool as per Advisory Committee on Immunization Practices (ACIP)



RECOMMENDATIONS FOR VACCINATION OF SOLID ORGAN TRANSPLANT *CANDIDATES*

- Pediatric patients who are SOT candidates aged 6–18 years and have end-stage kidney disease should receive PCV13 per recommendations (strong, very low).

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PCV13? PPSV23?

- If a patient needs both PCV 13 and PPVS23, which do you give first?
- PPSV23 contains 12 of the serotypes included in PCV13, plus 11 additional serotypes, which account for 23% of IPD among immunocompromised children aged 6–18 years

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Pneumococcal Vaccines

ACIP Recommendations for PCV13 and PPSV23 Use in Immunocompromised Children Aged 6–18 Years

- **PPSV23-naïve**
  - single PCV13 dose **first**, followed ≥8 weeks later by a dose of PPSV23
  - A second PPSV23 dose is recommended 5 years after the first PPSV23
- **Previous PPSV23**
  - single PCV13 dose ≥8 weeks after the last PPSV23 dose, even if they have received PCV7
  - If a second PPSV23 dose is indicated, it should be given ≥5 years after the first PPSV23 dose
  - Children should not receive more than 2 doses of PPSV23 before age 65 years

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Always go in order

7→13 → 23

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Hepatitis B Vaccine

- At risk of acquiring HBV through an HBV-positive organ or through transfusions
- Patients receiving grafts from HBV-immune donors have a lower risk of de-novo HBV infection post-transplantation
- The efficacy of HBV vaccine is low in patients undergoing hemodialysis
  - seroconversion rates varied from 31% to 62% in various studies
  - antibody levels may also decreased rapidly
- Despite the less-than-optimal responses, pretransplantation immunization is recommended

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RECOMMENDATIONS FOR VACCINATION OF SOLID ORGAN TRANSPLANT *CANDIDATES*

- Anti-HBs–negative SOT candidates should receive the HepB vaccine series (strong, moderate) and, if on hemodialysis and aged ≥20 years, they should receive the high-dose (40 µg) HepB vaccine series (strong, moderate).
- If a postvaccination anti-HBs concentration of ≥10 mIU/mL is not attained, then
  - a second 3-dose series of HepB vaccine (strong, low) should be administered, using standard dose (strong, moderate) or high dose for children (weak, low) and high dose for adolescents and adults (strong, low).
  - alternative: 1 dose of HepB vaccine after which anti-HBs is tested)
  - !(my third alternative: combo hep a/b vaccine- not in guidelines)

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Hepatitis B Vaccine

Strategies

- Intradermal HBV vaccination
  - Choy et al reported a 62% response rate to intradermal HBV infection in renal transplant recipients in whom intramuscular vaccination failed
- Accelerated dose schedules and double-strength doses
- A booster with conventional vaccine might improve long-term retention of immunity

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RECOMMENDATIONS FOR VACCINATION OF SOLID ORGAN TRANSPLANT *CANDIDATES*

- HepA-unvaccinated, -undervaccinated, or –seronegative SOT candidates (particularly liver transplant candidates) aged 12–23 months (strong, moderate) and ≥2 years (strong, moderate) should receive a HepA vaccine series.

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RECOMMENDATIONS FOR VACCINATION OF SOLID ORGAN TRANSPLANT *CANDIDATES*

- Combined HepA–HepB vaccine can be used for SOT candidates aged ≥12 years of age in whom both vaccines are indicated (strong, moderate).

  !(or if they did not respond to hep B)

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RECOMMENDATIONS FOR VACCINATION OF SOLID ORGAN TRANSPLANT *CANDIDATES*

- The HPV vaccine series should be administered to SOT candidates aged 9–26 years (strong, low-moderate).

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SOT

Table 63-4 -- Recommendations for Immunizations in Solid Organ Transplant Recipients

Vaccine	Recommendations for Candidates	Recipients	Comments
Nonlive vaccines			
Pneumococcal polysaccharide	Yes	Yes	Adults and children >5 y
Pneumococcal conjugate	Yes	Yes	Children >5 y
Conjugated Hib	Yes		Children
Influenza	Yes	Yes	Adults and children; annually
Hepatitis A virus	Yes	Yes	Adults and children; liver transplantation
Hepatitis B virus	Yes	Yes	Adults and children
Inactivated poliovirus	Yes	Yes	Complete primary schedule before transplantation (children); booster before transplantation (adults)
Tetanus and diphtheria toxoid	Yes	Yes	Complete primary schedule before transplantation (children); booster dose before transplantation (adults)
Acellular pertussis	Yes	Yes	Children
Papillomavirus	Yes	Yes	In age groups as in the general population
Meningococcal	Yes	Yes	In countries where vaccination is recommended for the general population
Live vaccines			
MMR			Complete primary schedule before transplantation (children)
Varicella			Before transplantation in seronegative patients

Adapted from Avery RK, Ljungman P. Prophylactic measures in the solid-organ recipient before transplantation. Clin Infect Dis 33(suppl 1):S15-S21, 2001; Danzinger-Isakov L, Kumar D; AST Infectious Diseases Community of Practice Guidelines for vaccination of solid organ transplant candidates and recipients. Am J Transplant. 2009 Dec;9 Suppl 4:S258-62;.

Hib, *Haemophilus influenzae* type b; MMR, measles, mumps, and rubella.

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Chapter 63,Vaccine, Plotkin 6th Edition

RECOMMENDATIONS FOR VACCINATION OF SOLID ORGAN TRANSPLANT CANDIDATES

- ! SOT candidates aged 6–11 months can receive MMR vaccine if they are not receiving immunosuppression and if transplantation is not anticipated within 4 weeks (weak, very low). If transplantation is delayed (and the child is not receiving immunosuppression), the MMR vaccine should be repeated at 12 months (strong, moderate).

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RECOMMENDATIONS FOR VACCINATION OF SOLID ORGAN TRANSPLANT CANDIDATES

VARICELLA

- VAR should be administered to SOT candidates without evidence of varicella immunity if they are not receiving immunosuppression and if transplantation is not anticipated within 4 weeks (strong, moderate).
- VAR can be administered to varicella-naive SOT candidates aged 6–11 months who are not immunosuppressed provided the timing is ≥4 weeks prior to transplant (weak, very low). Optimally, 2 doses should be administered ≥3 months apart (strong, low).
- A 2-dose schedule of VAR, separated by ≥3 months for patients aged 1–12 years and by >4 weeks for patients aged ≥13 years, is recommended if there is sufficient time prior to initiating immunosuppressive therapy (strong, low).

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SOT RECIPIENTS

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Post-SOT

- All solid organ transplant recipients are eligible to receive inactivated vaccines following transplantation
- The efficacy of the vaccines may be reduced after transplantation, *but is not harmful*

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RECOMMENDATIONS FOR VACCINATION OF SOLID ORGAN TRANSPLANT RECIPIENTS

- Vaccination should be withheld from SOT recipients during intensified immunosuppression, including the first 2-month posttransplant period, because of the likelihood of inadequate response (strong, low). However, IIV can be administered ≥1 month after transplant during a community influenza outbreak (weak, very low).
- Standard age-appropriate inactivated vaccine series should be administered 2 to 6 months after SOT based on the CDC annual schedule (strong, low to moderate), including IIV (strong, moderate).

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RECOMMENDATIONS FOR VACCINATION OF SOLID ORGAN TRANSPLANT RECIPIENTS

- PCV13 should be administered 2 to 6 months after SOT if not administered before SOT
- Patients 2–5 years should receive:
  - 1 dose of PCV13 if they have received 3 doses of PCV (PCV7 or PCV13) before age 24 months
  - 2 doses of PCV13 (8 weeks apart) if they have received an incomplete schedule of ≤2 doses of PCV7 (PCV7 or PCV13) before age 24 months (strong, low).
- Patients aged ≥6 years with a classic pathway (C1, C2, C3, C4), alternate pathway, or severe mannan-binding lectin deficiency who are PCV13 naive should receive a single dose of PCV13 (strong, very low).
- For those who received pneumococcal polysaccharide vaccine-23 (PPSV23), PCV13 should be administered ≥1 year after the last PPSV23 dose (weak, low)

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RECOMMENDATIONS FOR VACCINATION OF SOLID ORGAN TRANSPLANT RECIPIENTS

- For SOT patients aged ≥2 years, 1 dose of PPSV23 should be administered 2 to 6 months after SOT…
  - with the timing based on the patient's degree of immunosuppression
  - ≥8 weeks after indicated doses of PCV13
  - if not given within 5 years of another PPSV23 dose
  - if the patient has received no more than 1 previous lifetime dose

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RECOMMENDATIONS FOR VACCINATION OF SOLID ORGAN TRANSPLANT RECIPIENTS

- MMR vaccine and VAR should generally not be administered to SOT recipients because of insufficient safety and effectiveness data (strong, low), except for varicella in children without evidence of immunity (vaccination, serological evidence of immunity, of clinician or laboratory diagnosed disease) who are renal transplant recipients, are receiving minimal or no immunosuppression, and have no recent graft rejection (weak, moderate).

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Influenza

Inactivated influenza vaccine is indicated for all persons with altered immune competence

- Immune response good
  - •Most children with inflammatory bowel disease
  - •Most persons with kidney or heart transplant
  - •Most persons with rheumatologic diseases
- Immune response/efficacy may be poor
  - Cancer chemotherapy-particularly induction, consolidation
  - Reduced immunogenicity in adults receiving azathioprine, infliximab, or rituximab
  - Reduced in children receiving anti-TNF antibodies
  - Suboptimal response in solid organ transplant patients receiving mycophenolate
- Vaccination of household contacts (and healthcare professionals) is important

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Vaccination of Contacts

- Household contacts and other close contacts may receive all age-appropriate vaccine (including MMR, VZV, rotavirus)
  - Exceptions: OPV and smallpox vaccine
  - MMR vaccine viruses are not transmitted to contacts
  - Transmission of varicella vaccine is rare
    - No specific precautions are needed unless the varicella vaccine recipient has a rash after vaccination, in which case direct contact with susceptible household contacts should be avoided until the rash resolve
- All members of the household should wash their hands after changing the diaper of and infant who received rotavirus vaccine
- Annual influenza vaccination

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QUESTIONS?

bapahud@cmh.edu

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RECOMMENDATIONS FOR VACCINATION OF SOLID ORGAN TRANSPLANT RECIPIENTS

- Vaccination should not be withheld because of concern about transplant organ rejection (strong, moderate).

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Safety of Vaccines after Transplant: Does Vaccination Trigger Rejection?

- Case reports and small series have raised the question of vaccines triggering allograft rejection
- Larger studies have not found an excess in rejection or clinically significant allograft dysfunction after vaccinations
- Study of 50,000 adults who received renal transplants: receipt of influenza vaccination during the 1st year post-transplant was associated with a lower risk of allograft loss and death
- Although a possible effect cannot be entirely excluded, the benefits of influenza vaccination are far greater than the low possible risks.

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Hurst et al, Clin J Am Soc Nephrol 2011; 6:1192-7.2011