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Authors

Denlinger, Crystal Ligibel, Jennifer Are, Madhuri <u>et al.</u>

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Survivorship: Immunizations and Prevention of Infections, Version 2.2014:

Clinical Practice Guidelines in Oncology

Author manuscript

Crystal S. Denlinger, MD, Jennifer A. Ligibel, MD, Madhuri Are, MD, K. Scott Baker, MD, MS, Wendy Demark-Wahnefried, PhD, RD, Don Dizon, MD, Debra L. Friedman, MD, MS, Mindy Goldman, MD, Lee Jones, PhD, Allison King, MD, Grace H. Ku, MD, Elizabeth Kvale, MD, Terry S. Langbaum, MAS, Kristin Leonardi-Warren, RN, ND, Mary S. McCabe, RN, BS, MS, Michelle Melisko, MD, Jose G. Montoya, MD, Kathi Mooney, RN, PhD, Mary Ann Morgan, PhD, FNP-BC, Javid J. Moslehi, MD, Tracey O'Connor, MD, Linda Overholser, MD, MPH, Electra D. Paskett, PhD, Jeffrey Peppercorn, MD, MPH, Muhammad Raza, MD, M. Alma Rodriguez, MD, Karen L. Syrjala, PhD, Susan G. Urba, MD, Mark T. Wakabayashi, MD, MPH, Phyllis Zee, MD, Nicole R. McMillian, MS, and Deborah A. Freedman-Cass, PhD

Abstract

Cancer survivors are at an elevated risk for infection because of immune suppression associated with prior cancer treatments, and they are at increased risk of complications from vaccinepreventable diseases. This section of the NCCN Guidelines for Survivorship provides recommendations for the prevention of infections in survivors through education, antimicrobial prophylaxis, and the judicious use of vaccines. These guidelines provide information about travel and gardening precautions and safe pet care/avoidance of zoonosis, and include detailed recommendations regarding vaccinations that should be considered and encouraged in cancer and transplant survivors.

Cancer survivors are at elevated risk for infection because of immune suppression associated with previous cancer treatments, such as chemotherapy, radiation, corticosteroids, certain surgeries, and stem cell transplantation. In fact, antibody titers to vaccine-preventable diseases decrease after anticancer treatment.^{1,2} In addition, survivors are at increased risk of complications from vaccine-preventable diseases, such as those caused by human papillomaviruses (HPV) and influenza viruses.^{2,3}

Many infections in survivors can be prevented by the use of vaccines. However, a recent report of data from the Behavioral Risk Factor Surveillance System (BRFSS) found that 42% of survivors did not receive an influenza vaccination in 2009, and 52% reported never receiving a pneumococcal vaccination.⁴ Analysis of the SEER-Medicare database showed that breast cancer survivors, aged 65 years or older, were less likely to receive an influenza vaccination than matched noncancer controls.⁵ A separate analysis of the SEER-Medicare database by another group found similar results.⁶

Vaccines represent a unique challenge in cancer and transplant survivors because they may not trigger the desired protective immune responses because of possible residual immune

	Aggressive Prostate Cancer				
Crystal S. Denlinger, MD linger et al. deficits.	Bayer HealthCare; ImClone Systems Incorporated; MedImmune Inc.; OncoMed Imadditional certain Pharmaceuticals; Merrimack Pharmaceuticals; and Pfizer Inc	Eli Lilly and Company vaccines, such as those th	None nat are live	None attenuated (1/9/14 Page eg, zoster;
Don Dizon, MD	None	None	None	American Journal of Clinical Oncology; ASCO; UpToDate	4/4/14
Debra L. Friedman, MD, MS	None	None	None	None	5/26/13
Mindy Goldman, MD					Pending
Lee W. Jones, PhD	None	None	None	None	2/2/12
Allison King, MD	None	None	None	None	8/12/13
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Elizabeth Kvale, MD	None	None	None	None	10/7/13
Terry S. Langbaum, MAS	None	None	None	None	8/13/13
Kristin Leonardi-Warren, RN, ND	None	None	None	None	1/6/14
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Mary Ann Morgan, PhD, FNP-BC	None	None	None	None	5/5/14
Javid J. Moslehi, MD	None	ARIAD Pharmaceuticals, Inc.; Millennium Pharmaceuticals, Inc.; Novartis Pharmaceuticals Corporation; and Pfizer Inc.	None	None	1/27/14
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Electra D. Paskett, PhD	Merck & Co., Inc.	None	Pfizer Inc.	None	5/7/14
Jeffrey Peppercorn, MD, MPH					Pending
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M. Alma Rodriguez, MD	Amgen Inc.; Ortho Biotech Products, L.P.	None	None	None	4/4/14
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Mark T. Wakabayashi, MD, MPH	None	None	None	None	6/19/13
Phyllis Zee, MD	Philips/Respironics	Merck & Co., Inc.; Jazz Pharmaceuticals; Vanda Pharmaceuticals; and Purdue Pharma LP	None	None	3/26/14

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measles, mumps, rubella [MMR]), are contraindicated in actively immunosuppressed survivors because of an increased risk of developing the disease and/or prolonged shedding from the live organism given in the vaccine.

Risk Assessment and Screening for Immunizations and Prevention of Infections

Survivors are at elevated risk for infections if their cancer treatment included chemotherapy, monoclonal antibodies, radiation, corticosteroids, splenectomy, and/or hematopoietic cell transplantation (HCT; which includes peripheral blood stem cell transplantation, bone marrow transplantation, and cord blood transplantation). Risk is also elevated if the survivor has prior or current exposure to endemic infections or epidemics, or has a history of blood transfusion.

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• in s. last	rvivors who received anti-B-cell antibody therapy, vaccination should be delayed for at least 6 months after chemotherapy and to lose of such therapy.
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Interventions for Prevention of Infections

Infection in survivors can be prevented by education, antimicrobial prophylaxis, and the judicious use of vaccines.

Antimicrobial Prophylaxis and Education

Survivors should be educated about safe pet care/the avoidance of zoonosis, travel precautions, and gardening precautions.^{8–13} Safe pet care tips include washing hands with soap and running water after handling animals and their feces. If possible, survivors should avoid direct contact with animal feces. Travel precautions include education on the need for pretravel vaccines, prophylaxis against specific infections, and education on how to prevent waterborne, airborne, and zoonotic infections. Travelers may find useful information at http://wwwnc.cdc.gov/travel/yellowbook/2014/chapter-8-advising-travelers-with-specific-needs/immunocompromised-travelers or through consulting a travel clinic. Gardening precautions include wearing gloves to avoid cuts and punctures that could be delayed in healing or could become infected with fungus or staphylococcus/streptococcus that may be present on thorns, and wearing a protective mask to avoid inhalation of spores.

For information regarding antimicrobial prophylaxis, please see the NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines) for Prevention and Treatment of Cancer-Related Infections (to view the most recent version of these guidelines, visit NCCN.org).

Immunizations

Vaccination, or "active immunization," involves administration of all or part of a microorganism or a modified product of a microorganism (eg, a toxoid, a purified antigen, or an antigen produced by genetic engineering) to produce an immunologic response that mimics that of natural infection but usually presents little or no risk to the recipient. The use of vaccines that do not contain live organisms should be considered and encouraged in all

cancer and transplant survivors who have completed therapy at least 3 months before the planned vaccine administration. In general, the usual doses and schedules are recommended, as outlined by the Advisory Committee on Immunization Practices.^{14,15} The Infectious Diseases Society of America has outlined guidance for vaccination in immunocompromised patients, including those with cancer and those post-HCT.¹⁶ The NCCN Survivorship Panel outlined immunization guidelines specific to survivors of hematologic malignancies and solid tumors, with separate guidelines for survivors who received HCT. In survivors who received anti–B-cell antibody therapy, vaccination should be delayed for at least 6 months after chemotherapy or the last dose of such therapy to allow for reconstitution of the B-cell population. More details are available in the guidelines (NCCN.org).

Before vaccination, immune system viability and history of allergic reactions to vaccines should be assessed. Baseline WBC counts should be in the normal range or within reasonable limits before starting vaccinations, unless they are elevated because of disease status. The survivor should not be on immunosuppressive drugs or chemotherapy, and ongoing infection should not be present.

The following vaccines should be considered and encouraged for all survivors, administered according to the usual doses and schedules: influenza vaccine (only inactivated or recombinant); pneumococcal vaccine (PPSV-23/PCV-13); tetanus, diphtheria, pertussis (Tdap); and HPV (in survivors aged 26 years).^{17–19} These vaccines do not contain live organisms; instead they contain inactivated organisms, purified antigens, bacterial components, or genetically engineered recombinant antigens. The effectiveness of these vaccinations might be suboptimal because of lingering immune suppression.⁷ However, in the absence of known harm, their administration may be worthwhile with the hope of achieving some protection.

Other vaccines, as listed in the guidelines, should be considered in consultation with an infectious disease or travel medicine specialist if unique circumstances in the survivor's lifestyle, upcoming travel, or local epidemic/risks merit their use.

Influenza Vaccines—Annual influenza vaccination is recommended for all cancer and transplant survivors. Live attenuated influenza vaccines should generally be avoided in this population. Preferred vaccines include inactivated influenza vaccines (ie, trivalent [IIV3] standard-dose, trivalent [IIV3] high-dose, and quadrivalent [IIV4] standard-dose) or, for individuals with egg allergies, recombinant influenza vaccine (ie, trivalent [RIV3]).^{15,20} To date, no evidence shows superiority of any one of these vaccines.

Live Viral Vaccines—Vaccines that contain live attenuated organisms (eg, live-attenuated influenza vaccine; MMR; oral polio vaccine [OPV]) are contraindicated in actively immunocompromised survivors because of a proven or theoretical increased risk of disease and prolonged shedding from the live organism present in the vaccine. They should not be offered to actively immunocompromised survivors unless cleared by a clinician experienced in vaccine use or by an infectious disease specialist. However, live viral vaccines can be administered to immunocompetent survivors 3 or more months after treatment, but consultation with an infectious disease specialist or clinician familiar with vaccination in

patients with cancer is recommended. An exception is the live-attenuated influenza vaccine, which should be avoided in survivors because safer alternatives exist (see earlier discussion).

Healthy immunocompetent individuals who live in a household with immunocompromised survivors can receive the following live vaccines: MMR, rotavirus vaccine in infants aged 2 to 7 months, varicella vaccine (VAR), and zoster vaccine. However, OPV should not be administered to individuals who live in a household with immunocompromised survivors. Highly immunocompromised survivors should avoid handling diapers of infants who have received the rotavirus vaccine for 4 weeks after vaccination. Immunocompromised survivors should avoid contact with persons who develop skin lesions after receipt of VAR or zoster vaccine until the lesions clear.

Zoster (Shingles) Vaccine—A single dose of zoster (shingles) vaccine is recommended for survivors aged 60 years or older without active or ongoing immunodeficiency, no history of cellular immunodeficiency or HCT, or who have not received chemotherapy or radiation within the past 3 months, and it can be given at least 4 weeks before initiation of chemotherapy or immunosuppressive drugs.^{16,21,22} Zoster vaccination should also be considered for survivors aged 50 to 59 years with a history of varicella or zoster infection (VZV) or VZV seropositivity with no previous doses of varicella vaccine. The zoster vaccine should be avoided in immunocompromised survivors, but can be considered in transplant survivors without active graft-versus-host disease or enhanced immunosuppression 24 or more months after transplantation.

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NCCN Survivorship Panel Members

*,a,cCrystal S. Denlinger, MD/Chair†

Fox Chase Cancer Center

*,c,dJennifer A. Ligibel, MD/Vice Chair†

Dana-Farber/Brigham and Women's Cancer Center

^fMadhuri Are, MD£

Fred & Pamela Buffett Cancer Center at The Nebraska Medical Center

^{b,e}K. Scott Baker, MD, MS€

Fred Hutchinson Cancer Research Center/Seattle Cancer Care Alliance

*, ^cWendy Demark-Wahnefried, PhD, $RD \ge$

University of Alabama at Birmingham Comprehensive Cancer Center

*,b,d,g Don Dizon, MD†

Massachusetts General Hospital Cancer Center

^{b,d}Debra L. Friedman, MD, MS€‡

Vanderbilt-Ingram Cancer Center

 *,g Mindy Goldman, MD Ω

UCSF Helen Diller Family Comprehensive Cancer Center

*,c,dLee Jones, PhD∏

Memorial Sloan Kettering Cancer Center

^bAllison King, MD€₽‡

Siteman Cancer Center at Barnes-Jewish Hospital and Washington University School of Medicine

^eGrace H. Ku, MDξ‡

UC San Diego Moores Cancer Center

*,b,hElizabeth Kvale, MD£

University of Alabama at Birmingham Comprehensive Cancer Center

^aTerry S. Langbaum, MAS¥

The Sidney Kimmel Comprehensive Cancer Center at Johns Hopkins

^gKristin Leonardi-Warren, RN, ND#

University of Colorado Cancer Center

^bMary S. McCabe, RN, BS, MS#

Memorial Sloan Kettering Cancer Center

^{b,c,d,g}Michelle Melisko, MD[†]

UCSF Helen Diller Family Comprehensive Cancer Center

*,eJose G. Montoya, MDΦ

Stanford Cancer Institute

^{a,d}Kathi Mooney, RN, PhD#

Huntsman Cancer Institute at the University of Utah

^{c,e}Mary Ann Morgan, PhD, FNP-BC#

Moffitt Cancer Center

Javid J. Moslehi, MDλÞ

Vanderbilt-Ingram Cancer Center

d,hTracey O'Connor, MD†

Roswell Park Cancer Institute

^cLinda Overholser, MD, MPHÞ

University of Colorado Cancer Center

^cElectra D. Paskett, PhDE

The Ohio State University Comprehensive Cancer Center - James Cancer Hospital and Solove Research Institute

Jeffrey Peppercorn, MD, MPH[†]

Duke Cancer Institute

^{f,h}Muhammad Raza, MD‡

St. Jude Children's Research Hospital/The University of Tennessee Health Science Center

M. Alma Rodriguez, MD‡

The University of Texas MD Anderson Cancer Center

*,fKaren L. Syrjala, PhD0

Fred Hutchinson Cancer Research Center/Seattle Cancer Care Alliance

*,fSusan G. Urba, MD†£

University of Michigan Comprehensive Cancer Center

 g Mark T. Wakabayashi, MD, MPH Ω

City of Hope Comprehensive Cancer Center

*,^hPhyllis Zee, MD $\Psi\Pi$

Robert H. Lurie Comprehensive Cancer Center of Northwestern University

NCCN Staff: Nicole R. McMillian, MS, and Deborah A. Freedman-Cass, PhD

KEY:

*Writing Committee Member

Subcommittees: ^aAnxiety and Depression; ^bCognitive Function; ^cExercise; ^dFatigue; ^eImmunizations and Infections; ^fPain; ^gSexual Function; ^hSleep Disorders

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