Smallpox and Monkeypox Vaccine (Live) (Lexi-Drugs)

Brand Names: US

Jynneos

Brand Names: Canada

Imvamune

Pharmacologic Category

Vaccine; Vaccine, Live, Non-Replicating (Viral)

Dosing: Adult

Primary immunization

Primary immunization:

Jynneos:

Primary vaccination: **Note:** Intradermal administration is preferred in the United States for the current outbreak to extend vaccine supply; SUBQ administration is recommended for persons with a history of keloid scars (CDC 2022c). For postexposure prophylaxis, administration within 4 days of exposure is the most effective. If given 4 to 14 days after exposure, the vaccine may reduce symptoms but not prevent disease (CDC 2022a).

Intradermal: 0.1 mL per dose given as 2 doses separated by 4 weeks (FDA 2022).

SUBQ: 0.5 mL per dose given as 2 doses separated by 4 weeks (CDC/ACIP [Rao 2022]). **Note:** The second dose may be administered intradermally if necessary (CDC 2022c).

Booster dose (off-label): **SUBQ:** 0.5 mL every 2 years for persons at continued risk of exposure for more virulent strains (eg, *Variola virus, Monkeypox virus)* or at least every 10 years for less virulent strains (eg, *Vaccinia virus*, *Cowpox virus*) (CDC/ACIP [Rao 2022]).

Imvamune (Canadian product):

Primary vaccination:

Preexposure prophylaxis: **SUBQ:** 0.5 mL per dose given as 2 doses separated by 4 weeks (NACI 2022)

Postexposure prophylaxis: **SUBQ**: 0.5 mL as a single dose. If risk of exposure continues, may consider a second 0.5 mL dose after 28 days. **Note:** Administer as soon as possible and within 4 days of exposure; may consider use up to 14 days after exposure (NACI 2022).

Booster dose: **SUBQ:** 0.5 mL every 2 years if the person remains at increased risk of exposure.

Interchangeability: Jynneos or Imvamune may be used as a booster dose for those persons who received a primary series with the smallpox vaccine (ACAM2000) and who are at continued risk for exposure (CDC/ACIP [Rao 2022]; NACI 2022).

Dosing recommendations for deviations in dosage or storage:

Recommendations for Deviations in Smallpox and Monkeypox Vaccine Usage[a,b]	
Deviation	**Adjustment**

[a] CDC 2022a.

[b] Dose administered up to 4 days before the minimum interval is considered a valid dose; do not repeat.

Dose	
Dose too high	Do not repeat dose. Counsel recipient regarding adverse event potential.
Dose too low – Intradermal (eg, injection-site leakage, syringe leakage)	Repeat dose immediately (no minimum interval); administer ≥2 inches away from the previous site of administration. If vaccine leakage after 2 intradermal injections on same day, then administer 0.5 mL SUBQ.
Dose too low – SUBQ (eg, 0.1 mL dose given SUBQ when intradermal route intended, syringe leakage)	Repeat dose immediately with the correct dose and intended route of administration (no minimum interval); administer ≥2 inches away from the previous site of administration. Alternatively, if a partial dose was administered, may administer the remainder of the dose (on the same clinic day) to equal a full dose.
Half-dose volume administered inadvertently	If same clinic day, administer another half dose (2 doses counted as full dose). If different day, repeat dose.
Dosing interval	
Dose administered too early (ie, more than 4 days prior to the recommended interval)[b]	For patients who are not immunocompromised, do not repeat dose. For patients who are severely immunocompromised, administer a repeat dose ≥28 days from dose given in error.
Dose administered after recommended interval	Do not repeat dose or restart the series; no maximum interval. Give second dose as soon as possible.
Storage	
Improper storage or handling of vaccine (eg, temperature	Contact manufacturer; if no stability data, repeat dose immediately (no minimum interval).

Recommendations for Deviations in Smallpox and Monkeypox Vaccine Usage[a,b]	
Deviation	**Adjustment**
excursion, dose administered past expiration date)	

* See Dosage and Administration in AHFS Essentials for additional information.

Dosing: Older Adult

Refer to adult dosing.

Dosing: Altered Kidney Function: Adult

There are no dosage adjustments provided in the manufacturer's labeling.

Dosing: Hepatic Impairment: Adult

There are no dosage adjustments provided in the manufacturer's labeling.

Dosing: Pediatric

Note: Safety and effectiveness have not been assessed in ages <18 years; emergency use authorization is based on adult data and historical use of live vaccinia virus smallpox vaccine in pediatric populations.

Primary immunization:

Jynneos:

Primary vaccination: **Note:** Authorized route of administration varies based on age; use caution when ordering and administering. For patients <18 years of age, only SUBQ administration is authorized. For patients ≥18 years of age, intradermal administration is preferred in the United States for the current 2022 outbreak to extend vaccine supply. For persons with a history of keloid scars, SUBQ administration is recommended regardless of age (CDC 2022c). For postexposure prophylaxis, administration within 4 days of exposure is the most effective. If given 4 to 14 days after exposure, the vaccine may reduce symptoms but not prevent disease (CDC 2022a).

SUBQ:

Infants, Children, and Adolescents: SUBQ: 0.5 mL per dose given as 2 doses separated by 4 weeks (FDA 2022; manufacturer's labeling). **Note:** In individuals ≥18 years, the second dose may be administered intradermally if necessary (CDC 2022c).

Intradermal:

Adolescents ≥18 years: Intradermal: 0.1 mL per dose given as 2 doses separated by 4 weeks (FDA 2022; Frey 2015).

Booster dose: Limited data available: Adolescents ≥18 years: SUBQ: 0.5 mL every 2 years for persons at continued risk of exposure for more virulent strains (eg, variola virus, monkeypox virus) or at least every 10 years for less virulent strains (eg, vaccinia virus, cowpox virus) (CDC/ACIP [Rao 2022]).

Imvamune (Canadian product): **Note:** Canadian product administration is SUBQ for all approved ages.

Primary vaccination:

Preexposure prophylaxis: Adolescents ≥18 years: SUBQ: 0.5 mL per dose given as 2 doses separated by 4 weeks (NACI 2022).

Postexposure prophylaxis: Adolescents ≥18 years: SUBQ: 0.5 mL as a single dose. If risk of exposure continues, may consider a second 0.5 mL dose after 28 days. **Note:** Administer as soon as possible and within 4 days of exposure; may consider use up to 14 days after exposure (NACI 2022).

Booster dose: Adolescents ≥18 years: SUBQ: 0.5 mL every 2 years if the person remains at increased risk of exposure.

Interchangeability: Jynneos or Imvamune may be used as a booster dose (as age-appropriate) for those persons who received a primary series with the smallpox vaccine (ACAM2000) and who are at continued risk for exposure (CDC/ACIP [Rao 2022]; NACI 2022).

Dosing recommendations for deviations in dosage or storage:

Recommendations for Deviations in Smallpox and Monkeypox Vaccine Usage[a]

Deviation	**Adjustment**

[a] CDC 2022a.

[b] Dose administered up to 4 days before the minimum interval is considered a valid dose; do not repeat.

Dose	
Dose too high	Do not repeat dose. Counsel recipient regarding adverse event potential.
Dose too low – Intradermal (eg, injection site leakage, syringe leakage)	Repeat dose immediately (no minimum interval); administer ≥2 inches away from the previous site of administration. If vaccine leakage after 2 intradermal injections on same day, then administer 0.5 mL SUBQ.
Dose too low – SUBQ (eg, 0.1 mL dose given SUBQ when intradermal route intended, syringe leakage)	Repeat dose immediately with the correct dose (no minimum interval); administer ≥2 inches away from the previous site of administration. Alternatively, if a partial dose was administered, may administer the remainder of the dose (on the same clinic day) to equal a full dose.

Recommendations for Deviations in Smallpox and Monkeypox Vaccine Usage[a]	
Deviation	**Adjustment**
Half-dose volume administered inadvertently	If same clinic day, administer another half dose (2 doses counted as full dose). If different day, repeat dose.
Dosing interval	
Dose administered too early (ie, more than 4 days prior to the recommended interval)[b]	For patients who are not immunocompromised, do not repeat dose. For patients who are severely immunocompromised, administer a repeat dose ≥28 days from dose given in error.
Dose administered after recommended interval	Do not repeat dose or restart the series; no maximum interval. Give second dose as soon as possible.
Storage	
Improper storage or handling of vaccine (eg, temperature excursion, dose administered past expiration date)	Contact manufacturer; if no stability data, repeat dose immediately (no minimum interval).

Dosing: Altered Kidney Function: Pediatric

There are no dosage adjustments provided in the manufacturer's labeling.

Dosing: Hepatic Impairment: Pediatric

There are no dosage adjustments provided in the manufacturer's labeling.

Use: Labeled Indications

Smallpox and monkeypox, prevention: Prevention of smallpox and monkeypox disease in adults determined to be at high risk for smallpox or monkeypox infection. **Note:** Jynneos is available under emergency use authorization for persons <18 years of age (FDA 2022).

Preexposure prophylaxis:

The Advisory Committee on Immunization Practices recommends vaccination for the following persons at risk for occupational exposure to orthopoxviruses (CDC/ACIP [Rao 2022]):

• Research laboratory personnel working with orthopoxviruses

• Clinical laboratory personnel performing diagnostic testing for orthopoxviruses

• Designated public health and health care worker response team members

• Health care personnel who administer the live smallpox vaccine (ACAM2000) or who care for patients infected with orthopoxviruses (eg, Monkeypox) (per shared clinical decision making)

The Canadian National Advisory Committee on Immunization (NACI) recommends vaccination for persons at high risk for occupational exposure to orthopoxviruses in a laboratory setting. In addition, NACI also makes recommendations on populations who may be offered vaccination, based on monkeypox exposure risk; see recommendations for details (NACI 2022).

Postexposure prophylaxis: The CDC and NACI recommend vaccination as postexposure prophylaxis following exposure or possible exposure to monkeypox virus; see current public health updates for recommendations and details (CDC 2022a; NACI 2022).

* See Uses in AHFS Essentials for additional information.

Clinical Practice Guidelines

ACIP, "General Best Practice Guidelines for Immunization"

ACIP, "Smallpox Vaccine in Laboratory and Health Care Personnel," March 2016

CDC, "Interim Clinical Considerations for Use of JYNNEOS and ACAM2000 Vaccines during the 2022 U.S. Monkeypox Outbreak," 2022

CDC, "Health Information for International Travel (Yellow Book), 2020" 2019

CDC, “JYNNEOS Vaccine,” 2022

CDC/ACIP, "Use of JYNNEOS (Smallpox and Monkeypox Vaccine, Live, Nonreplicating) for Preexposure Vaccination of Persons at Risk for Occupational Exposure to Orthopoxviruses: Recommendations of the Advisory Committee on Immunization Practices — United States," 2022

NACI, "Interim Guidance on the Use of Imvamune in the Context of Monkeypox Outbreaks in Canada," 2022

Administration: Subcutaneous

Swirl vial gently for ≥30 seconds before each use. For SUBQ administration, inject preferably into the upper arm (typically over the triceps area) (FDA 2022). Do not administer intravascularly. Do not mix with other vaccines or injections; separate needles and syringes should be used for each injection. To prevent syncope-related injuries, patients should be vaccinated while seated or lying down (ACIP [Kroger 2022]). US law requires that the date of administration, the vaccine manufacturer, lot number of vaccine, Vaccine Information Statement edition date and date it was provided, and the administering person's name, title, and address be entered into the patient's permanent medical record.

Inappropriate administration technique:

If administered into a site other than the triceps for SUBQ administration or the inner side of the forearm for intradermal administration, do not repeat dose (CDC 2022a).

If incorrect route of administration results in a lower than intended dosage (eg, SUBQ administration of the intradermal dose of 0.1 mL), then immediately repeat dose using the intended route of administration (≥2 inches away from the unintended site placement). If other incorrect route (eg, IM administration), do not repeat dose (CDC 2022a).

Administration: Intradermal

Swirl vial gently for ≥30 seconds before each use. For intradermal administration, inject preferably into the inner side of the forearm. Alternatively, may administer in the upper back (below the scapula) or deltoid area. After administration, formation of a wheal is desired but not required (CDC 2022c). Extract doses from vial preferably using a low dead-volume syringe and/or needle. If standard syringes and needles are used, there may not be sufficient volume for all stated doses. Do not pool partial doses remaining in vials into a full dose (FDA 2022). Do not mix with other vaccines or injections; separate needles and syringes should be used for each injection. To prevent syncope-related injuries, patients should be vaccinated while seated or lying down (ACIP [Kroger 2022]). US law requires that the date of administration, the vaccine manufacturer, lot number of vaccine, Vaccine Information Statement edition date and date it was provided, and the administering person's name, title, and address be entered into the patient's permanent medical record.

Inappropriate administration technique:

If administered into an incorrect site, do not repeat dose (CDC 2022a).

If incorrect route of administration results in a lower than intended dosage (eg, SUBQ administration of the intradermal dose of 0.1 mL), then immediately repeat dose using the intended route of administration (≥2 inches away from the unintended site placement). If other incorrect route (eg, IM administration), do not repeat dose (CDC 2022a).

Administration: Pediatric

Parenteral: Swirl vial gently for ≥30 seconds before each use. In pediatric patients, authorized route of administration varies based on age (SUBQ vs intradermal); use caution. Do not administer IM or intravascularly

SUBQ: Infants, Children, and Adolescents:

Infants: Inject preferably over the anterolateral thigh (CDC 2022c; FDA 2022).

Children and Adolescents: Inject preferably into the upper arm (typically over the triceps area) (CDC 2022c; FDA 2022).

Intradermal: Adolescents ≥18 years: Inject preferably into the inner side of the forearm. Alternatively, may administer in the upper back (below the scapula) or deltoid area. After administration, formation of a wheal is desired but not required (CDC 2022c). Extract doses from vial preferably using a low dead-volume syringe and/or needle. If standard syringes and needles are used, there may not be sufficient volume for all stated doses. Do not pool partial doses remaining in vials into a full dose (FDA 2022).

Do not mix with other vaccines or injections; separate needles and syringes should be used for each injection. To prevent syncope-related injuries, patients should be vaccinated while seated or lying down (ACIP [Kroger 2022]). US law requires that the date of administration, the vaccine manufacturer, lot number of vaccine, Vaccine Information Statement edition date and date it was provided, and the administering person's name, title, and address be entered into the patient's permanent medical record.

Inappropriate administration technique:

If administered into an incorrect site, do not repeat dose (CDC 2022a).

If incorrect route of administration resulting in a lower than intended dosage (eg, SUBQ administration of the intradermal dose of 0.1 mL), then immediately repeat dose using the intended route of administration (≥2 inches away from the unintended site placement). If other incorrect route (eg, IM administration), do not repeat dose (CDC 2022a).

Storage/Stability

Note: For information related to improper storage or handling of vaccine (eg, temperature excursion, dose administered past expiration date), contact manufacturer.

Store intact vials frozen at −25°C to −15°C (−13°F to 5°F) and in the original package to protect from light. Once thawed, the vaccine is stable for 8 weeks when stored at 2°C to 8°C (36°F to 46°F) (**Note:** Prior to August 2022, the manufacturer's labeling stated thawed vaccine was stable for 12 hours when stored at 2°C to 8°C [36°F to 46°F]); do not refreeze. In-use vials (after first puncture) may be stored for up to 8 hours at 2°C to 8°C (36°F to 46°F).

Imvamune vaccine (Canadian product): Store intact vial frozen at −90°C to −15°C (−130°F to 5°F). May also be stored refrigerated at 2°C to 8°C (36°F to 46°F) for up to 2 weeks. After thawing, the vaccine is stable for 2 weeks when refrigerated at 2°C to 8°C (36°F to 46°F). Do not refreeze. Store in original packaging to protect from light. Additional storage information is available at https://recalls-rappels.canada.ca/en/alert-recall/imvamune-vaccine-updated-storage-conditions-and-shelf-life.

Preparation for Administration: Adult

Allow to thaw and reach room temperature before use. Do not use if particulate matter or discoloration is present (vaccine is a milky, light yellow to pale white suspension). Swirl gently for ≥30 seconds prior to use. For intradermal administration, extract doses from vial preferably using a low dead-volume syringe and/or needle. If standard syringes and needles are used, there may not be sufficient volume for all stated doses. Do not pool partial doses remaining in vials into a full dose.

Preparation for Administration: Pediatric

Parenteral: Allow to thaw and reach room temperature before use. Do not use if particulate matter or discoloration is present (vaccine is a milky, light yellow to pale white suspension). Swirl gently for ≥30 seconds prior to use. For intradermal administration (ages ≥18 years only), extract doses from vial preferably using a low dead-volume syringe and/or needle. If standard syringes and needles are used, there may not be sufficient volume for all stated doses. Do not pool partial doses remaining in vials into a full dose (FDA 2022).

Medication Patient Education with HCAHPS Considerations

What is this drug used for?

• It is used to prevent smallpox and monkeypox disease.

All drugs may cause side effects. However, many people have no side effects or only have minor side effects. Call your doctor or get medical help if any of these side effects or any other side effects bother you or do not go away:

• Injection site pain, redness, or swelling

• Itching

• Muscle pain

• Headache

• Nausea

• Loss of strength and energy

• Chills

WARNING/CAUTION: Even though it may be rare, some people may have very bad and sometimes deadly side effects when taking a drug. Tell your doctor or get medical help right away if you have any of the following signs or symptoms that may be related to a very bad side effect:

• Signs of an allergic reaction, like rash; hives; itching; red, swollen, blistered, or peeling skin with or without fever; wheezing; tightness in the chest or throat; trouble breathing, swallowing, or talking; unusual hoarseness; or swelling of the mouth, face, lips, tongue, or throat.

Note: This is not a comprehensive list of all side effects. Talk to your doctor if you have questions.

Consumer Information Use and Disclaimer: This information should not be used to decide whether or not to take this medicine or any other medicine. Only the healthcare provider has the knowledge and training to decide which medicines are right for a specific patient. This information does not endorse any medicine as safe, effective, or approved for treating any patient or health condition. This is only a limited summary of general information about the medicine's uses from the patient education leaflet and is not intended to be comprehensive. This limited summary does NOT include all information available about the possible uses, directions, warnings, precautions, interactions, adverse effects, or risks that may apply to this medicine. This information is not intended to provide medical advice, diagnosis or treatment and does not replace information you receive from the healthcare provider. For a more detailed summary of information about the risks and benefits of using this medicine, please speak with your healthcare provider and review the entire patient education leaflet.

Prescribing and Access Restrictions

Jynneos is part of the US federal government's Strategic National Stockpile. Additional information is available at https://www.fda.gov/emergency-preparedness-and-response/mcm-issues/smallpox-preparedness-and-response-updates-fda and https://www.cdc.gov/poxvirus/monkeypox/considerations-for-monkeypox-vaccination.html.

Contraindications

Serious hypersensitivity to any component of the formulation (CDC/ACIP [Rao 2022]).

Canadian labeling: Additional contraindications (not in US labeling): Acute febrile illness if used for nonemergency (preexposure) prophylaxis.

Warnings/Precautions

Concerns related to adverse effects:

• Anaphylactoid/hypersensitivity reactions: Immediate treatment (including epinephrine 1 mg/mL) for anaphylactoid and/or hypersensitivity reactions should be available during vaccine use (ACIP [Kroger 2022]).

• Syncope: Syncope has been reported with use of injectable vaccines and may result in serious secondary injury (eg, skull fracture, cerebral hemorrhage); typically reported in adolescents and young adults and within 15 minutes after vaccination. Procedures should be in place to avoid injuries from falling and to restore cerebral perfusion if syncope occurs (ACIP [Kroger 2022]).

Concurrent drug therapy issues:

• Vaccines: In order to maximize vaccination rates, the Advisory Committee on Immunization Practices (ACIP) generally recommends simultaneous administration (ie, >1 vaccine on the same day at different anatomic sites) of all age-appropriate vaccines (live or inactivated) for which a person is eligible at a single clinic visit, unless contraindications exist. The ACIP prefers each dose of a specific vaccine in a series come from the same manufacturer when possible (ACIP [Kroger 2022]). Because of the potential risk for myocarditis related to the mRNA COVID-19 vaccine and the unknown risk related to Jynneos or Imvamune, consider separating the orthopoxvirus vaccine by 4 weeks from the mRNA COVID-19 vaccine (especially for adolescent/young adult males). However, separation of vaccines is not recommended during an orthopoxvirus outbreak (CDC/ACIP [Rao 2022]).

Special populations:

• Altered immunocompetence: The vaccine has been shown to be safe to administer in persons with an immunocompromising condition if no contraindications exist. Immunocompromised persons may have a diminished immune response to the vaccine; consider risk:benefit ratio (CDC/ACIP [Rao 2022]). For management of postexposure to smallpox virus, vaccination with the live, nonreplicating vaccine (eg, Jynneos) is recommended in patients who are severely immunodeficient (including HIV infection with CD4 cell counts between 50 to 199 cells/mm^3)(CDC/ACIP [Petersen 2015]). However, for routine immunization in applicable individuals, consider deferring immunization during periods of severe immunosuppression (eg, patients receiving chemo/radiation therapy or other immunosuppressive therapy [including high-dose corticosteroids]); may have a reduced response to vaccination. In general, household and close contacts of persons with altered immunocompetence may receive all age-appropriate vaccines (ACIP [Kroger 2022]; IDSA [Rubin 2014]).

Dosage form specific issues:

• Chicken egg protein: Jynneos is produced using chicken embryo fibroblast cells; use with caution in patients with a history of severe allergic reaction to chicken or egg protein **and** who are currently avoiding exposure to all chicken or egg products (CDC 2022c).

• Ciprofloxacin: Manufactured with ciprofloxacin.

• Gentamicin: Manufactured with gentamicin.

Other warnings/precautions:

• Effective immunity: Vaccination may not result in effective immunity in all patients. Response depends upon multiple factors (eg, type of vaccine, age of patient) and may be improved by administering the vaccine at the recommended dose, route, and interval. Vaccines may not be effective if administered during periods of altered immune competence (ACIP [Kroger 2022]).

* See Cautions in AHFS Essentials for additional information.

Pregnancy Considerations

Outcome data following maternal exposure to this vaccine is limited (Volkmann 2021). However, maternal smallpox or monkeypox infection is associated with adverse maternal and fetal outcomes (Mbala 2017).

Infection with the monkeypox virus may lead to adverse pregnancy outcomes, including spontaneous pregnancy loss, stillbirth, and transmission of the monkeypox virus to the fetus or newborn. When a pregnant patient is diagnosed with monkeypox, neonatal health care providers should be informed of the diagnosis (CDC 2022b; Mbala 2017).

Smallpox infection during pregnancy increases the risk of severe maternal disease (including hemorrhagic smallpox) and death; the fatality rate in unvaccinated pregnant patients can be up to 70%. Pregnant health care workers should avoid direct patient care during an initial emergency response to a smallpox outbreak (CDC [Petersen 2015]).

Pregnancy is not a specific contraindication for vaccination (CDC/ACIP [Rao 2022]). The smallpox and monkeypox vaccine is a nonreplicating live viral vaccine; pregnant patients who otherwise meet the criteria for monkeypox vaccination can be vaccinated following a discussion of the risks and benefits of pre- or postexposure prophylaxis (CDC 2022b). Following vaccination, patients should continue to avoid conditions with high-risk exposure while pregnant (CDC/ACIP [Rao 2022]).

Breastfeeding Considerations

It is not known if the vaccine virus is present in breast milk.

According to the manufacturer, the decision to breastfeed following vaccination should consider the risk of infant exposure, the benefits of breastfeeding to the infant, and the benefits of treatment to the mother. Breastfeeding is not a specific contraindication for vaccination (CDC/ACIP [Rao 2022]). The smallpox and monkeypox vaccine is a nonreplicating live viral vaccine and is not expected to have a risk of transmission to a breastfed infant. Lactating patients who otherwise meet the criteria for monkeypox vaccination can be vaccinated following a discussion of the risks and benefits of pre- or postexposure prophylaxis (CDC 2022b).

Patients diagnosed with monkeypox infection should not have direct skin-to-skin contact with their newborn. Patients should observe recommendations for isolation, and breastfeeding should be delayed until criteria for discontinuing isolation are met. Patients can pump and discard breast milk until they no longer have symptoms or require isolation. During this time, infants should be fed with formula or pasteurized donor milk by a healthy caregiver (CDC 2022b).

Adverse Reactions (Significant): Considerations

Cardiovascular effects

Cardiovascular effects, including **ECG abnormality** (**abnormal T waves on ECG**, **increased ST segment on ECG**, **inversion T wave on ECG**), **palpitations**, and **tachycardia** have been reported with smallpox and monkeypox vaccination. Asymptomatic troponin increases ≤2 times ULN have also been reported; the clinical significance is unclear. Other cardiovascular effects, including myocarditis and pericarditis potentially leading to cardiomyopathy (nonischemic/dilated), have been reported following other smallpox vaccinations ([Ref]).

Adverse Reactions

The following adverse reactions and incidences are derived from product labeling and the FDA issued emergency use authorization (EUA) unless otherwise specified. Refer to EUA for information regarding reporting adverse reactions (FDA 2022). Adverse reactions reported in adults for SUBQ and intradermal routes of administration, unless otherwise noted.

>10%:

Gastrointestinal: Change in appetite (15% to 20%), nausea (10% to 23%)

Local: Erythema at injection site (SUBQ: 61% to 81%; intradermal: 100%), induration at injection site (SUBQ: 45% to 70%; intradermal: 100%), injection-site pruritus (SUBQ: 32% to 49%; intradermal: 89%), local swelling (underarm: 6% to 11%), pain at injection site (SUBQ: 80% to 91%; intradermal: 65%), swelling at injection site (SUBQ: 52% to 67%)

Nervous system: Chills (≤15%), fatigue (30% to 51%), headache (28% to 43%)

Neuromuscular & skeletal: Arm and/or wrist pain (underarm pain: 18% to 21%), arthralgia (9% to 18%), myalgia (22% to 43%)

1% to 10%:

Cardiovascular: Cardiac disorder (SUBQ: 1% to 2%; including ECG abnormality [abnormal T waves on ECG, increased ST segment on ECG, inversion T wave on ECG], palpitations, tachycardia, troponin increased in blood specimen)

Miscellaneous: Fever (SUBQ: ≤2%)

* See Cautions in AHFS Essentials for additional information.

Allergy and Idiosyncratic Reactions

- Aluminum Allergy With Vaccines
- Aminoglycoside Allergy

Metabolism/Transport Effects

None known.

Drug Interactions Open Interactions

Note: Interacting drugs may **not be individually listed below** if they are part of a group interaction (eg, individual drugs within "CYP3A4 Inducers [Strong]" are NOT listed). For a complete list of drug

interactions by individual drug name and detailed management recommendations, use the Lexicomp drug interactions program by clicking on the "Open Interactions" button above.

Acetaminophen: May diminish the therapeutic effect of Vaccines. Management: Consider avoiding routine prophylactic use of acetaminophen before or during vaccine administration when possible. Acetaminophen is still recommended to treat fevers and/or pain that occurs after vaccination. *Risk D: Consider therapy modification*

Brincidofovir: May diminish the therapeutic effect of Smallpox and Monkeypox Vaccine (Live). *Risk C: Monitor therapy*

Cladribine: May diminish the therapeutic effect of Vaccines (Inactivated/Non-Replicating). Management: Give inactivated vaccines at least 2 weeks prior to initiation of cladribine when possible. Patients vaccinated less than 14 days before initiating or during cladribine should be revaccinated at least 3 months after therapy is complete. *Risk D: Consider therapy modification*

Corticosteroids (Systemic): May diminish the therapeutic effect of Vaccines (Inactivated/Non-Replicating). Management: Administer vaccines at least 2 weeks prior to immunosuppressive corticosteroids if possible. If patients are vaccinated less than 14 days prior to or during such therapy, repeat vaccination at least 3 months after therapy if immunocompetence restored. *Risk D: Consider therapy modification*

COVID-19 Vaccine (mRNA): Smallpox and Monkeypox Vaccine (Live) may enhance the adverse/toxic effect of COVID-19 Vaccine (mRNA). Specifically, the risk of myocarditis may be increased. Management: Consider waiting 4 weeks after receipt of the smallpox and monkeypox vaccine before receiving an mRNA COVID-19 vaccine. No minimum interval is necessary between receipt of an mRNA COVID-19 vaccine and the smallpox and monkeypox vaccine. *Risk D: Consider therapy modification*

Elivaldogene Autotemcel: May enhance the adverse/toxic effect of Vaccines. Specifically, there may be a greater risk for contracting an infection from any live vaccine. Elivaldogene Autotemcel may diminish the therapeutic effect of Vaccines. Management: Administration of vaccines is not recommended in the 6 weeks before myeloablative conditioning, and until hematologic recovery after elivaldogene autotemcel treatment. *Risk X: Avoid combination*

Fingolimod: May diminish the therapeutic effect of Vaccines (Inactivated/Non-Replicating). Management: Vaccine efficacy may be reduced. Complete all age-appropriate vaccinations at least 2 weeks prior to starting fingolimod. If vaccinated during fingolimod therapy, revaccinate 2 to 3 months after fingolimod discontinuation. *Risk D: Consider therapy modification*

Immunosuppressants (Cytotoxic Chemotherapy): May diminish the therapeutic effect of Vaccines (Inactivated/Non-Replicating). Management: Give inactivated vaccines at least 2 weeks prior to initiation of chemotherapy when possible. Patients vaccinated less than 14 days before initiating or during chemotherapy should be revaccinated at least 3 months after therapy is complete. *Risk D: Consider therapy modification*

Immunosuppressants (Miscellaneous Oncologic Agents): May diminish the therapeutic effect of Vaccines (Inactivated/Non-Replicating). Management: Give inactivated vaccines at least 2 weeks prior to initiation of immunosuppressants when possible. Patients vaccinated less than 14 days before initiating

or during therapy should be revaccinated at least 3 after therapy is complete. *Risk D: Consider therapy modification*

Immunosuppressants (Therapeutic Immunosuppressant Agents): May diminish the therapeutic effect of Vaccines (Inactivated/Non-Replicating). Management: Give inactivated vaccines at least 2 weeks prior to initiation of immunosuppressants when possible. Patients vaccinated less than 14 days before initiating or during therapy should be revaccinated at least 2 to 3 months after therapy is complete. *Risk D: Consider therapy modification*

Methotrexate: May diminish the therapeutic effect of Vaccines (Inactivated/Non-Replicating). Management: Administer vaccines at least 2 weeks prior to methotrexate initiation, if possible. If patients are vaccinated less than 14 days prior to or during methotrexate therapy, repeat vaccination at least 3 months after therapy if immunocompetence restored. *Risk D: Consider therapy modification*

Propacetamol: May diminish the therapeutic effect of Vaccines. Management: Consider avoiding routine prophylactic use of propacetamol before or during vaccine administration when possible. Propacetamol is still recommended to treat fevers and/or pain that occurs after vaccination. *Risk D: Consider therapy modification*

RiTUXimab: May diminish the therapeutic effect of Vaccines (Inactivated/Non-Replicating). Management: Give inactivated vaccines at least 2 weeks prior to initiation of rituximab when possible. Patients vaccinated less than 14 days before initiating or during therapy should be revaccinated at least 6 months after therapy is complete. *Risk D: Consider therapy modification*

Siponimod: May diminish the therapeutic effect of Vaccines (Inactivated/Non-Replicating). Management: Avoid administration of vaccines (inactivated) during treatment with siponimod and for 1 month after discontinuation due to potential decreased vaccine efficacy. *Risk D: Consider therapy modification*

Monitoring Parameters

Monitor for anaphylaxis and syncope for 15 minutes following administration (ACIP [Kroger 2022]). Observe for 30 minutes after vaccination in patients with a history of severe allergic reaction to gentamicin, ciprofloxacin, or to chicken or egg protein (and who are currently avoiding exposure to all chicken or egg products) (CDC 2022c). If seizure-like activity associated with syncope occurs, maintain patient in supine or Trendelenburg position to reestablish adequate cerebral perfusion (ACIP [Kroger 2022]).

Advanced Practitioners Physical Assessment/Monitoring

US federal law requires entry into the patient's medical record. Monitor for hypersensitivity and syncope for at least 15 minutes following administration. Treatment must be immediately available in event of anaphylactic or serious allergic reactions. If seizure-like activity associated with syncope occurs, maintain patient in supine position to reestablish adequate cerebral perfusion.

Nursing Physical Assessment/Monitoring

US federal law requires entry into the patient's medical record. Assess hypersensitivity history and health status prior to administration. Monitor for hypersensitivity and syncope for at least 15 minutes

following administration. If seizure-like activity associated with syncope occurs, maintain patient in supine position to reestablish adequate cerebral perfusion. Treatment must be immediately available in event of anaphylactic or serious allergic reactions. Monitor for fever and rash.

Dosage Forms: US

Excipient information presented when available (limited, particularly for generics); consult specific product labeling.

Suspension, Subcutaneous:

Jynneos: 0.5 mL (0.5 mL) [contains serratia marcescens nuclease (benzonase)]

Dosage Forms: Canada

Excipient information presented when available (limited, particularly for generics); consult specific product labeling.

Suspension, Subcutaneous:

Imvamune: 0.5 mL (0.5 mL) [contains benzonase]

Generic Available (US)

No

Pricing: US

Suspension (Jynneos Subcutaneous)

0.5 mL (per 0.5 mL): $0.00

Disclaimer: A representative AWP (Average Wholesale Price) price or price range is provided as reference price only. A range is provided when more than one manufacturer's AWP price is available and uses the low and high price reported by the manufacturers to determine the range. The pricing data should be used for benchmarking purposes only, and as such should not be used alone to set or adjudicate any prices for reimbursement or purchasing functions or considered to be an exact price for a single product and/or manufacturer. Medi-Span expressly disclaims all warranties of any kind or nature, whether express or implied, and assumes no liability with respect to accuracy of price or price range data published in its solutions. In no event shall Medi-Span be liable for special, indirect, incidental, or consequential damages arising from use of price or price range data. Pricing data is updated monthly.

Mechanism of Action

Vaccination elicits humoral and cellular immune responses to orthopoxviruses. Smallpox and monkeypox vaccine is a live, third-generation smallpox vaccine containing Modified Vaccinia Ankara, which is replication deficient and cannot cause disease in humans or reproduce in human cells.

Pharmacokinetics

Onset of action: Peak antibody response for Jynneos is typically achieved 2 weeks after completion of the 2-dose series (CDC/ACIP [Rao 2022]).

Dental: Local Anesthetic/Vasoconstrictor Precautions

No information available to require special precautions

Dental: Effects on Dental Treatment

No significant effects or complications reported

Dental: Effects on Bleeding

No information available to require special precautions

Related Information

- Centers for Disease Control and Prevention (CDC) and Other Links
- Immunization Administration Recommendations

Index Terms

Imvamune; Live Smallpox and Monkeypox Vaccine; Modified Vaccinia Ankara; Monkeypox and Smallpox Vaccine; MVA Vaccine; MVA-BN; Smallpox and Monkeypox Vaccine (Nonreplicating)

FDA Approval Date

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