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Measles containing vaccines indicators

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Burden & epidemiology

Number of new cases per year (last 3-5 years)

In 2024 and 2025, 476 412 and 411 913 measles cases were reported to WHO, respectively. However, modelled estimates suggested a far higher number with approximately 11 million cases estimated to occur in 2024 worldwide. This highlights substantial under-reporting due to limited surveillance sensitivity.1, 2

In 2025, 27 840 cases of rubella were reported globally to WHO.[3] Congenital rubella syndrome (CRS) is of public health importance due to its teratogenic effects on the fetus during pregnancy, with 746 cases reported to WHO in 2025.[4, 5] However, modelling estimates suggest approximately 100 000 infants are born with CRS globally each year. The true burden of CRS is likely substantially underestimated because of absent or limited surveillance and case detection.[6]

In 2025, 234 954 cases of mumps were reported to WHO.[7] It is endemic globally and cases occur pre- and post-vaccine introduction. Mumps is not a notifiable disease; therefore, data are limited and most estimates are generated from high-income countries (HICs) with longstanding vaccination programmes.[8]

Please consult the relevant position papers for epidemiological burden information on varicella.

Proportion of the population affected by the disease or infected with the antigen

In 2024, measles cases increased by 86% in the WHO Eastern Mediterranean Region (EMR), 47% in the European Region (EUR), and 42% in South-East Asian Region (SEAR) compared with 2019. Notably, the African Region (AFR) experienced a 40% decline in cases and 50% decline in deaths over this period, partly due to increasing immunization coverage.[9]

The age distribution of cases of measles varies depending on the birth rate as well as population immunity, which consequently depends on the vaccination coverage in each age strata.[1]

Like measles, the age distribution of cases of rubella also depends on birth rate and population immunity, which is influenced by the year of vaccine introduction, age range for the pre-introduction catch-up campaign and coverage. Rubella primarily affects children and young adults, with around 50% of infections being asymptomatic.[10] Susceptible women of childbearing age remain of highest concern due to a 90% chance of CRS in the fetus if it occurs during the first trimester of pregnancy.[11]

The highest incidence of mumps occurs in children 5–9 years of age in unvaccinated populations, however in vaccinated populations with sub-optimal vaccine coverage, the burden shifts to older age groups.[8] Complications are more frequent with increasing age and include orchitis (inflammation of the testicles) [12% to 66% of cases]), aseptic meningitis (1% to 10%) and

deafness (4%).[12]

Please consult the relevant position papers for more detailed epidemiological burden information on varicella.

Serogroup or serotype distribution (for serogroup- or serotype-specific vaccines)

Measles vaccines target all genotypes, although the dominant wild-type measles genotypes B3 and D8 account for the great majority of contemporary transmission.[13]

Rubella vaccines target all genotypes.[11]

Mumps virus is considered serologically monotypic, although 12 wild-type genotypes have been characterized in circulation.[8]

Please consult the relevant position papers for epidemiological burden information on varicella.

Number of deaths from the disease per year

In 2024, there were an estimated 95,000 measles deaths globally, mostly among unvaccinated or under vaccinated children under the age of five years.[14]

Rubella rarely causes death in uncomplicated cases but during pregnancy may cause miscarriage, fetal death, or stillbirth.[15] There are no reliable estimates of the annual number of deaths specifically caused by rubella.[16]

Mumps rarely causes death in uncomplicated cases but can lead to encephalitis, which accounts for most fatal cases. Encephalitis is estimated to occur in about 1 in 1000 cases.[8]

Please consult the relevant position papers for epidemiological burden information on varicella.

Case Fatality ratio (number of deaths / number of new cases, in %)

The Case-Fatality Ratio (CFR) for measles varies widely, depending on age, nutritional status and access to optimal medical care.[13] It is generally estimated at 0.1–5% but may reach 10–30%

during outbreaks among particularly vulnerable populations.[17]

There are no reliable estimates of the CFR for uncomplicated rubella as it rarely causes death.[15]

There are no reliable estimates of the CFR for uncomplicated mumps as it rarely causes death.[18]

Please consult the relevant position papers for more detailed epidemiological burden information on varicella.

Outbreak, epidemic or pandemic risk

Measles is an outbreak-prone disease. In 2024, annual data reported through the Joint Reporting Form (JRF) showed that 59 countries in all WHO regions except the Region of the Americas (AMR) experienced large or disruptive measles outbreaks. The 58 outbreaks recorded in 2023 were significantly more than the 21 and 37 outbreaks recorded in 2021 and 2022, respectively.[14]

Outbreaks of rubella continue to occur in areas and populations with low vaccine coverage or immunity gaps. CRS rates are highest in low-income countries (LICs) in WHO AFR and SEAR.[3]

Mumps is highly contagious and endemic worldwide with outbreaks occurring approximately every five years in unvaccinated and under-vaccinated populations.[19] Recent outbreaks amongst young adults (in post-secondary education and military barracks) have suggested that immunity to mumps may wane over time.[19, 20]

Please consult the relevant position papers for epidemiological burden information on varicella.

Contribution of the vaccine to achievement of the national, regional or global disease goals

WHO aims to achieve and sustain measles elimination through the Measles and rubella strategic framework: 2021-2030. This requires achieving and maintaining ≥95% population immunity through two doses of measles-containing vaccine, closing immunity gaps, maintaining high-quality surveillance, and rapidly detecting and responding to outbreaks.[21]

Modelled estimates indicated approximately 11 million measles cases in 2024, which is a 71% reduction from 38 million cases in 2000 but an 8% increase over 2019 pre-pandemic levels (10.2

million cases). This rebound was driven by increased numbers in the WHO Eastern Mediterranean Region (EMR= (+86%), European Region (EUR) (+47%) and SEAR (+42%) while decreases have been observed in other regions since 2019, particularly in AFR (-40%).[22]

The estimated number of deaths from measles decreased from 777 000 in 2000 to 107 000 in 2019 and 95 000 in 2024, representing an overall 88% decrease between 2000 and 2024 and an 11% decrease since 2019.[22]

Along with measles, WHO aims to achieve regional rubella elimination, including prevention of CRS. The goal is to maintain high population immunity through vaccination, sensitive surveillance, and outbreak detection and response.[21] The number of reported rubella cases globally has declined by 66%, from 94 277 in 2012 to 31 593 in 2024, with widespread vaccination introduction. Modelled estimates suggest that CRS cases declined by approximately 70% during the same period.[23]

In September 2024, SAGE recommended lifting the previous requirement that countries achieve >=80% measles-containing-vaccine coverage before introducing rubella-containing vaccines. Countries that have not introduced rubella-containing vaccines should consider doing so using established measles platforms, accompanied by strategies to attain and sustain high coverage.[24] Suboptimal post-introduction coverage may result in shifting the burden to older age groups increasing the risk for rubella infection among nonimmune women of childbearing age.[25]

Currently, there is no established WHO global or regional mumps elimination or eradication target, however, there is recommendation that countries should have a well-established, effective childhood vaccination programme.[8, 26] The number of reported mumps cases globally has declined by approximately 57% from 544 093 in 2000 to 234 954 in 2025, with widespread use and uptake of the vaccine.[24] The incidence of mumps in the United States dropped by 99% between 1967 and 1993 after the mumps vaccine was introduced.[27, 28]

Please consult the relevant position papers for epidemiological burden information on varicella.

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Benefits of the intervention

Serogroup or serotype coverage by vaccines considered (for serogroup- or serotype-specific vaccines)

Most live attenuated measles vaccines originate from the Edmonston strain of measles virus. Well known vaccine strains derived from the original Edmonston isolate include the Schwarz, Edmonston–Zagreb, AIK-C and Moraten strains, all in use since the 1960s. Nucleotide sequence analysis of selected genes has shown minimal (<0.6%) differences among these strains.[29]

Rubella virus has a single serotype. Most currently licensed rubella vaccines are based on the live attenuated RA 27/3 strain, which protects against circulating rubella.[30]

Currently available licensed mumps vaccines are not selected according to serotype or circulating genotype as evidence supports broad cross-protection.[31] There is some evidence of breakthrough infections caused by antigenic differences between genotypes.[32] Therefore, mumps containing vaccines use various strains of the virus for vaccine development. To date, 12 strains have been used for vaccine development but only three are WHO prequalified.[31]

Please consult the relevant position papers for intervention benefit for varicella.

Efficacy and effectiveness estimates (e.g. against infection, disease, hospitalization, death), including in different populations

WHO considers neutralizing antibody measured using the plaque reduction neutralization test (PRNT) the most reliable serological correlate of protection for measles. A level around 120 mIU/mL has been associated with protection against clinical measles and is often used as a surrogate to estimate vaccine efficacy.

A single dose of measles vaccine administered at 8-9 months of age elicits protective antibody levels in 89.6% (IQR 82–95%) of subjects. Following a second dose at 15-18 months of age, a median of 97% (IQR 87–100%) of primary non-responders develop protective levels of antibody.[33]

In a review of field studies the vaccine effectiveness of a single dose of MCV administered at 9–11 months of age was 84% (IQR 72–95%); when administered at 12 months of age or later, the median vaccine effectiveness was 92.5% (IQR, 84.8–97%).[29, 34]

Meta-analyses show 99% seroconversion (95% CI: 98–99%) after a single dose of rubella-containing vaccine in children aged 9–18 months. After two doses, 100% (95% CI: 99–100%) of children were seropositive. Pooled vaccine effectiveness was 97% (95% CI: 92–99%) against rubella infection.[35]

Meta-analyses show very high seroconversion after a single dose of mumps vaccine for all three WHO prequalified products (Jeryl–Lynn: 94% [95% CI: 90–97%]; RIT 4385: 93% [95% CI: 88–97%]; Leningrad–Zagreb: 97% [95% CI: 92–100%]).[36]

Among WHO-prequalified mumps vaccine strains, the most extensive effectiveness evidence is available for Jeryl–Lynn vaccine strains. One-dose effectiveness against clinical mumps was approximately 76% (RR 0.24, 95% CI: 0.08–0.76; 6 cohort studies, 9,915 participants), and two-dose effectiveness was approximately 86% (RR 0.12, 95% CI: 0.04–0.35; five cohort studies, 7 792 participants). Separate pooled clinical-effectiveness estimates are not available for RIT 4385 as it is derived from the Jeryl-Lynn vaccine and is expected to provide similar protection. Historical studies of Leningrad-Zagreb also reported efficacy up to 97–100%.[36, 20]

Please consult the relevant position papers for varicella.

Duration of protection and waning of immunity in general and risk groups

Although the duration of protection following measles vaccination is more variable than following wild-type virus infection, evidence indicates that a single dose of correctly administered measles vaccine which elicits a protective antibody response will provide lifelong protection for most healthy individuals. While secondary vaccine failures are reported, declining immunity does not appear to play a major role in measles virus transmission.[37]

Protection from rubella-containing-vaccine is long-lasting. Evidence from five RCTs and nine observational studies showed 88–100% seropositivity maintained 1–20 years after one or two doses. Following two doses, detectable antibodies persisted for up to 20 years.[38]

Vaccine-induced duration of protection against mumps is long-lasting after one or two doses and has been shown to persist for up to 10 years.[39] However, a positive mumps-specific IgG result may not consistently confirm protection. Yet, a negative IgG can rule out protection. Individuals who received two doses were less likely to experience severe and complicated cases of mumps during outbreaks.[40] The mechanisms of waning protection of mumps-containing vaccines are still unclear. A third dose may be considered during outbreaks in populations identified as being at increased risk of mumps.[40]

Please consult the relevant position papers for intervention benefit for varicella.

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Safety of the intervention

Type, including severity, consequences and frequency of short- and long-term adverse events following vaccination

Adverse reactions following measles vaccination are generally mild and transient. Within 24 hours of vaccination, vaccine recipients may experience slight pain and tenderness at the site of injection, which usually resolves in 2–3 days. Approximately 7–12 days after vaccination, systemic reactions occur in about 5–15% of recipients including fever of >39 °C for 1–2 days. A transient rash occurs in about 2% of recipients. Adverse events, apart from anaphylactic reactions, are less likely to occur after second vaccination.[29] Serious adverse events can also occur due to administration errors.

Rubella-containing vaccines have an excellent safety profile. In a systematic review of 40 RCTs with 34 332 participants, only 140 serious adverse events were reported with no deaths or permanent disabilities considered attributable to the vaccine. Serious events were extremely rare and included febrile seizures (25 cases; 0.07%), idiopathic thrombocytopenic purpura (4 cases; 0.01%) and isolated reports of other neurological or inflammatory conditions.[30]

Adverse events to mumps vaccine are generally rare and mild, however, they are usually co-administered with MMR and therefore difficult to attribute specific mumps components. Aseptic meningitis risk is strain-specific and has been associated with Urabe and Leningrad–Zagreb

vaccines (aRR: 6.4; 95% CI: 0.3–124.4).[39]

Please consult the relevant position papers for intervention safety for varicella.

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Values and preferences

Perception of the target population on the risk of disease

In low and middle-income countries where measles was historically associated with a high CFR, measles is commonly perceived as a serious disease. However, in higher-income countries, hesitant/refusing parents commonly perceived measles as low-risk, mild, treatable, or unlikely to occur. Perceptions changed during an outbreak when the risk of infection increased.[41]

Rubella is commonly perceived as a mild illness characterized by childhood fever and rash, particularly in low- and middle-income countries.[15, 42] The misconception of the severity of risk during pregnancy can lead to vaccination coverage gaps, which have been noted among adolescent and adult males.[43]

Mumps is commonly perceived as a mild, self-limiting childhood illness characterized by parotitis, fever, and malaise. Although most infections are self-limiting, the risk of complications increases with age, including orchitis, aseptic meningitis, encephalitis, and hearing loss. Consequently, perceived disease severity may be low despite the potential for substantial morbidity, particularly during outbreaks among adolescents and young adults.[20, 39]

Please consult the relevant position papers for intervention perception for varicella.

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Acceptability to stakeholders

Acceptability of the vaccine and of vaccination against the disease

In low- and middle-income countries where measles mortality is high, measles vaccination is acceptable to most key stakeholders.[44]

Rubella vaccine is provided together with measles, mumps, and varicella in various combinations. Therefore, acceptability is generally high because it does not require an additional injection or visit.[45] As of 2025, 179 out of 194 Member States have introduced an RCV and global coverage is estimated at 73%. The remaining countries are mostly LICs and serve as reservoirs for the virus.[16]

Acceptability of mumps vaccine is generally high as it is administered as part of measles-containing combination vaccines (MMR or MMRV) and does not require an additional injection of vaccination visit. As of 2025, 124 WHO Member States have introduced mumps-containing vaccine into their routine immunization programmes. However, there remains some low- and middle-income countries that continue to use MR vaccine only.[39] Decisions to include mumps-containing vaccines usually rely on country epidemiology, health system capacity, and competing priorities.[39]

Please consult the relevant position papers for intervention safety for varicella.

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Financing & funding

Estimated financial cost of materials per vaccine dose (syringes, needles, safety box) (in USD)

Price for one auto-disable (AD) syringe and needle

- As of October 2025, the UNICEF procurement price for 2026 ranges from US$ 0.023 to US$ 0.046, depending on supplier and product.[46]
- The 2026 PAHO Revolving Fund for Access to Vaccines price ranges from US$ 0.03 to US$ 0.04, depending on supplier and product.[47]

Price for one 5-litre safety box

- The UNICEF procurement price for 2026 ranges from US$ 0.375 to US$ 0.860, depending on supplier and product.[48]
- The 2026 PAHO Revolving Fund for Access to Vaccines price ranges from US$ 0.41 to US$ 0.47, depending on supplier and product.[47]

Each 5-litre safety box can hold around 100 syringes.

Estimated vaccine financial cost per dose (in USD)

Measles monovalent

The 2026 UNICEF prices for a monovalent measles vaccine range from US$ 0.34 to US$ 0.62 per dose.[49]

For self-procuring MICs, the country-reported cost for 2025 per dose for measles monovalent range from US$ 0.32 to US$ 7.91 depending on supplier and presentation.[50]

Measles Rubella (MR)

As of December 2025, UNICEF-awarded prices per dose range from US$ 0.927 to US$ 1.176 depending on supplier and presentation.[51]

As of July 2026, PAHO Revolving Fund prices for MR vaccines range from US$ 0.94 to US$ 3.56.[52]

For self-procuring MICs, the country-reported cost for 2025 per dose for MR range from US$ 0.45 to US$ 4.98.[53]

Measles Mumps Rubella (MMR)

As of December 2025, UNICEF-awarded prices for MMR vaccines range from US$ 1.95 to US$ 8.50 depending on supplier and presentation.[54]

As of July 2026, PAHO Revolving Fund prices for MMR vaccines, prices range from US$ 1.87 to US$ 8.50 depending on supplier and presentation.[52]

For self-procuring MICs, the country-reported cost for 2025 per dose for MMR range from US$ 3.15 to US$ 13.17. For self-procuring HICs, the country-reported cost for 2025 per dose range from US$ 6.23 –21.95.[53]

Measles Mumps Rubella Varicella (MMRV)

Please consult the relevant position papers for vaccine financial cost per dose for varicella.

Estimated financial cost per person vaccinated (in USD)

The cost of delivery can vary greatly depending on the strategies, financing elements included (cost of vaccine procurement, cost of delivery), and the country context.

A cost-effectiveness analysis assessing MR vaccination scale-up over 2018–2047 reported estimates of MR vaccination costs for: routine delivery between US$ 2.76 and US$ 4.33, with incremental costs of rubella only between US$ 0.33 and US$ 1.13; and SIA campaigns between US$ 1.38 and US$ 2.98 with incremental costs of rubella only to be US$ 0.33.[55]

One study in an upper-middle-income-country estimated routine delivery of one dose of MMR to be US$ 43.72 in 2015.[56] However, another study in a lower-middle-income-country assessing MR SIA campaigns ranged from US$ 0.14 to US$ 0.32 for the ministry of health without the cost of the vaccine and US$ 0.16 - 0.34 for funding from WHO/Gavi in 2017.[57]

Please consult the relevant position papers for financial cost per person for varicella.

Cost-effectiveness ratio

Given the low cost of the vaccine and the high burden of disease, including outbreak management, measles vaccines are considered to be one of the most cost-effective vaccines.[29]

In upper-middle-income countries (UMICs) and industrialized countries with vaccination coverage >= 80%, caring for CRS is costly and therefore rubella vaccination has been shown to be cost-effective. Economic evaluations have not been conducted in LICs.[15]

The incremental cost-effectiveness of replacing MR with MMR depends on country-specific factors. Economic evidence is currently limited to HICs (Japan, US) and one UMIC (Fiji).[39, 58, 59] Economic evaluation from Fiji estimated a cost-benefit ratio of 2.64 in favour of a 2-dose MMR schedule.[60]

Please consult the relevant position papers for cost-effectiveness ratio for varicella.

Cost–effectiveness varies considerably by several factors, including, the burden of disease, vaccination coverage, vaccine price, delivery costs, delivery approaches, and schedules. Caution is recommended when comparing estimates of cost-effectiveness for different interventions evaluated by different methods and in different contexts (e.g., with different concurrent health interventions and standards of care).

Is there a Gavi programme to support the introduction of this vaccine? If a Gavi programme is available, what support is available to countries?

Yes, Gavi supports a first and/or second dose of MR vaccines; as well as follow-up campaigns to address gaps in the population not reached through routine immunization and catch-up campaigns before MR vaccine is introduced into the routine system. Support is conditional on countries conducting a one-time, wide-age-range catch-up campaign to rapidly establish population immunity and reduce the risk of increasing rubella susceptibility among women of childbearing age. Gavi support includes the procurement of MR vaccines, injection supplies, operational costs for introduction and campaigns, technical assistance, and country co-financing.[61]

No dedicated Gavi programme supports routine introduction of the mumps or varicella antigen.

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Market (feasibility)

Available vaccines, licensing status, prequalification status, presentation, formulation, dosage and route of administration

There are three WHO-prequalified measles monovalent vaccines available in 1-, 2-, 5-, 10-, and 20- dose presentations manufactured by Serum Institute of India Pvt. Ltd., Biological E. Limited, and PT Bio Farma (Persero).[62]

There are seven MR WHO-prequalified vaccines available in 1-, 2-, 5-, and 10-dose presentations manufactured by Serum Institute of India Pvt. Ltd., GlaxoSmithKline Biologicals SA, and Merck Sharp & Dohme LLC.[62]

There are seven MMR WHO-prequalified vaccines available in 1-, 2-, 5-, and 10-dose presentations manufactured by Serum Institute of India Pvt. Ltd., and Biological E. Limited.[62]

Please refer to WHO Prequalification of Vaccines database for information on varicella antigen.

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Service delivery (feasibility)

Number of doses and timing of administrations

Measles-containing vaccines are administered in a 2-dose schedule to ensure immunity among individuals who do not respond to the first dose. In countries with ongoing measles transmission, the first dose is recommended at nine months of age and the second at 15–18 months. In countries with low transmission, the first dose may be administered at 12 months, with the second dose given according to the national schedule. The minimum interval between doses is four weeks.[63]

Due to the high response rate, a single dose of rubella-containing-vaccine is sufficient for long lasting protection. A second dose is often given due to programmatic reasons and co-administration with measles, which has proven to be safe. Vaccination is recommended from nine months and can also be administered to older age groups.[11]

Mumps-containing-vaccines are typically administered in a 2-dose schedule, co-administered as MMR or MMRV. Dose schedules are dependent on the national epidemiological and vaccine programme policy. The first dose is given at 9 – 12 months of age and the second dose administered during the second year of life or at school entry. The minimum interval between doses is four weeks.[11] Routine administration of a third dose is only considered during outbreaks in populations at increased risk.[64]

Please consult the relevant position papers for varicella antigen.

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Logistics (feasibility)

Cold chain volume required per vaccine dose (in cm3)

Cold chain volume required varies by product and presentation:

Measles 1-dose presentations: 21.1 cm3/ dose
5-dose presentations: 2.67-4.22 cm3/ dose
10-dose presentations: 1.78-3.14 cm3/dose

MR 1-dose presentations: 14.09 – 21.09 for vials and 7.8 - 12.528 for ampoules (in secondary packaging).

MR 5-dose presentations:
2.67 – 4.218 for vials and 3.25 – 5.481 for ampoules (in secondary packaging)

MR 10-dose presentations:
1.78 – 2.109 for vials and 2.12 – 3.1424 for ampoules (in secondary packaging)

MMR 1-dose presentations:
9.29 – 21.09 for vials and 12.528 – 20.23 for ampoules (in secondary packaging).

MMR 5-dose presentations:
4.218 for vials and 5.481 for ampoule (in secondary packaging).

MMR 10-dose presentations:
2.109 for vials and 3.1424 for ampoule (in secondary packaging)[65]

For specific product characteristics see the comparison table.[66]

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