2021 Annual Status Update on Measles and Rubella Elimination

Germany

Dear NVC and national technical counterparts, dear colleagues,

We kindly ask you to follow the definitions (please see Annex 1.1) and instructions provided in this form, and to enter numbers or text as required in each segment (table, text box, other).

If you are using your own definitions and indicators, please provide an explanation and clarification why and how these could be considered equivalent to or as an adequate replacement for the WHO definitions and indicators.

If the NVC would like to provide additional data and information to the RVC, please submit them as separate document(s).

In 2020, the World Health Organization reformed its IT systems and internet platforms for data submission and exchange in 2020 to increase security, and a new SharePoint for the European Regional Verification Commission for Measles and Rubella Elimination was created. However, due to shifting of resources and time constrains in countries and at the WHO Regional Office related to the COVID-19 pandemic response, it was not possible to prepare instructions and conduct training for NVCs and national colleagues.

Therefore, we kindly request you to submit your ASU and all relevant additional documents as attachments to an e-mail to RVC Secretariat, using address **eurvc@who.int**. You may also copy any of VPI technical officers cooperating with you in preparation of the ASU and verification process. Please follow up with us to confirm that we received your ASU and any other issue that may need our support or attention.

This update is to be submitted to the WHO Regional Office for Europe by **6 June 2022.**

The National Verification Committee (NVC) conclusion on measles and rubella elimination status in 2021

Please provide your statement on the status of measles and rubella viruses' circulation in your country, based on the information provided by the national surveillance and immunization systems. Tick one of the boxes below as deemed appropriate and provide rationale (main facts that led to the NVC's conclusion) in the text box below. If you have difficulties in deciding which one of the three status definitions for measles and rubella elimination applies, please leave the boxes unchecked and explain in the text box.

Measles

☐ Endemic

☒ Elimination/Interrupted endemic transmission

☐ Re-established endemic transmission

The NVC conclusion is based on the following:

The data for this report was compiled on March 1, 2022.

Based on the available data, NVC categorized the status of measles virus circulation in Germany for 2021 as **"interrupted endemic transmission".**

1.) Epidemiological surveillance in 2021

In 2021, a total of **10 measles cases** (according to WHO case definition) were reported to the National Public Health Authority (Robert Koch Institute, RKI). Among these cases were 2 imported cases from Afghanistan. This results in an incidence of 0.1 per 1 million inhabitants, which represents an enormous decrease of cases compared to 2019 and 2020 (n=432 autochthonous cases; 5.2 per 1 million inhabitants and n=66 autochthonous cases; 0.8 per 1 million inhabitants, respectively). The decrease can most likely be explained by antipandemic measures against SARS-CoV-2. Epidemiological data clearly indicates **again an interruption of measles transmission in Germany in 2021.**

The 10 nationwide reported cases occurred in January, March and April and furthermore in November and December 2021. The data were transmitted from 6 of 16 federal states (North Rhine-Westphalia (3 cases), Hamburg (2 cases), Bavaria (2 cases) and Saxony, Hesse and Lower Saxony (1 case each, respectively)). The **age** of the cases ranged between 1 and 49 years. Five cases were adults aged 19 years and older, 5 cases occurred in children (1 to 6 years old). Three of the 10 official cases were confirmed with PCR (two genotyped), 3 cases were serologically confirmed and 4 cases were only clinical confirmed cases.

Data regarding **vaccination status** were available for all measles cases. Three cases were unvaccinated, while 2 cases received one and 5 cases two vaccinations against measles. No deaths due to acute measles were reported. SSPE is a notifiable disease in Germany with the new **Measles Protection Act** which entered into force on March 1, 2020. So far, no SSPE cases were reported.

No outbreaks with cases according to case definition were reported by the local public health authorities (see also on page 4). All 10 cases according to case definition were notified as **sporadic cases**.

Genotype was available for 2 of the 10 cases, that met clinical case definition. In these 2 cases the N-450 sequence variant B3 6464 was detected. Both cases were imported from Afghanistan in December 2021. Both cases were 3 years old. According to the respective local public health authorities, it seemed that the children were infected in Afghanistan and on the way to Germany. One child probably received two vaccinations during the first year of life. The second child was unvaccinated.

According to the RKI's assessment considering laboratory results and vaccination status, for 5 of the 10 cases acute measles seemed possibly questionable. In one case, vaccinated twice with negative IgM, a positive IgG titre remained constant in two consecutive samples. One case, vaccinated once and with no laboratory confirmation of acute measles, had a high IgG titre some years before. Three cases were vaccinated twice and acute measles were not laboratory confirmed.

In addition to official cases according to case definition (n=10 in 2021), the RKI receives data on probable measles cases every year that have been laboratory confirmed (mostly by serology) but with symptoms that did not meet the clinical case definition or with unknown clinical symptoms. According to WHO and the German case definition these cases **are not counted and are not included into official statistics of the RKI**. For the first

time, these cases (n=73 in 2021) have been evaluated for this report in the "Quality of epidemiological surveillance" section (see below).

Quality of epidemiological surveillance in 2021

Since 2001 a standardised surveillance system for notifiable diseases has been implemented (see also on page 11). For the management and transmission of case-based reports, local and state public health authorities use either a software program developed by RKI or commercially offered software programs for reporting. Case definitions and guidelines concerning the management and transmission of reports are provided by RKI. Since then, nationwide notification data enable us to draw representative, valid, and consistent conclusions about the epidemiology of measles in Germany. Secondary data (like open commentaries, press releases, discussions at conferences, and personal communication with colleagues at different levels) allow us to understand contextual issues at regional and communal level.

For the first time we investigated suspected cases with laboratory confirmation, **that did not meet the case definition concerning clinical symptoms** and thus were not included into official statistics of the RKI (n=73). The aim of the investigation was to check, how many of these cases could likely be acute measles cases.

A large proportion of the suspected cases were automatically notified by laboratories after a positive IgM and acute measles were discarded later on due to several reasons (**n=64; 88%**). The examinations often took place in persons without any symptoms but in order to confirm immunity after vaccination according to Measles Protection Act. In other cases, symptoms occurred after vaccination. These cases were not acute measles cases and withdrawn. 19 of the 64 cases (30%) were reported as discarded.

Altogether **4 of the 73 cases** (6%) with laboratory confirmation (positive serology), clinical symptoms and vaccination status remained unknown and no further information was given (reporting week 11, 26, 30, 51). For the latter cases verification of immunity after vaccination is likely but acute measles cannot be ruled out. Furthermore, acute measles cannot be ruled out for **2 laboratory confirmed vaccinated cases** (positive serology, vaccinated once and twice, respectively) with modified minor symptoms, not meeting clinical case definition (disease onset week 2 and 5). For one of these cases (vaccinated twice) the laboratory results of the National Reference Centre MMR at RKI (NRC) were **compatible with acute measles and a secondary vaccination failure**. PCR revealed a negative result. Such cases with acute, albeit attenuated, measles disease can, rarely, be epidemiologically relevant, however no further cases were reported.

In 3 of the 73 cases that were notified with exanthema as clinical symptom only, and thus did not meet the case definition, **virus detection was successful and MV N-450 sequence variant B3 6481** could be determined by the NRC at RKI. All cases occurred in children (1 to 7 years old). Measles were imported from Afghanistan. **The cases were diagnosed at an US-air-base** (under US sovereignty) after the children were brought to Germany. In all 3 cases, disease onset was in September 2021. The US CDC sent an epidemiologist to assess the situation with about 9,000 evacuees at the air-base. Later on, a CDC mass vaccination (MMR plus V) took place. All Afghans remained on the air base grounds and were brought to the USA later.

The cases mentioned above illustrate, that modified measles cases, often due to vaccination and vaccination failure, are possibly not included into official statistics and remain partly undetected. **A less strict clinical case definition** should be considered as proposed recently*. A **modification of the German case definition** has been under discussion at the RKI for some time now (starting before COVID) in order to be able to recognize such cases and investigate transmission chains. The data illustrates further that people coming from politically unstable countries were an **important source of a (minor) measles importation** to Germany in 2021.

The provision of standard operating procedures concerning the management of measles as well as rubella and outbreaks lies within the responsibility of the federal states and local Public Health authorities. Standard operation procedures and guidelines for measles and rubella case management and outbreak control (e.g. management of cases, active case finding, active contact tracing, vaccinations, etc.) are regionally implemented.

Suspected measles or rubella cases should be notified within 24 hours to the local Public Health department. A standardized possibility to notify discarded cases via the electronic surveillance system has been implemented in 2021, which is a considerable improvement in terms of the quality indicators and brings first results. Furthermore, a laboratory-based sentinel detecting discarded measles cases was implemented in 2014. So far 24 laboratories located in 12 states generally participate. Four supra-regional specialised laboratories receive orders from all over Germany. **Data of the laboratory sentinel revealed a rate of 19 discarded cases/ 100,000 inhabitants in Germany:** Of 15,750 suspected measles cases nationwide, 15,685 (99,6%) were discarded and 21 were diagnosed as measles according to the results of the participating laboratories (serology or PCR). Discrepancies to the number of cases notified may for example result from subsequently discarded cases due to a false positive result, unspecific reactions, missing case definition, duplicate entries or report failures.

Furthermore, the National Reference Centre MMR (NRC) tested nationwide samples of discarded cases of measles for rubella and vice versa (see below).

It is expected that the diversity of circulating N-450 variants of MV will decrease in the future with increasing vaccination coverage, which will it make more difficult to differentiate between importation or circulation of MV strains. **Therefore, analysis of the N450-region alone is no longer appropriate in terms of the assessment of transmission chains. Involvement of data obtained by expanded sequencing (i.e. from the MF-NCR) is of increasing importance (see below) **.**

2. Molecular Surveillance (virological data of NRC)

The NRC investigated samples of 42 patients with suspected acute measles infection in 2021. Measles was laboratory-confirmed in 6 of the investigated 42 cases (16.3%). Of the 6 positive cases, 5 were confirmed by PCR, including the 3 cases mentioned above for whom further information provided to the NRC by the attending physician indicated the presence of typical measles symptoms. One case was confirmed by positive IgM in the ELISA only. PCR revealed a negative result. The results were compatible with a secondary vaccination failure (see above).

A **negative** result was obtained for **31 cases.** Further 4 cases were excluded due to the detection of vaccine virus. 1 **case** could not be categorized due to an **inconclusive** result. As the NRC partly reconfirms already laboratory confirmed measles cases of other laboratories mainly in terms of molecular detection (PCR and genotyping), the ratio of discarded and suspected cases is generally lower than of other laboratories in Germany.

In order to identify unrecognized measles cases, **a reciprocal testing** for measles was performed with samples **negatively tested for rubella virus infection**. All samples from **78 cases** with a negative result for rubella were tested later on for measles. We investigated 71 serum samples, 8 PCR samples including one submission with serum plus PCR sample. Serological testing of the 71 rubella IgM negative sera revealed no additional measles IgM positive case. Molecular testing of all 8 negative PCR materials did not provide an additional measles PCR positive case. **In summary, no additional measles case was confirmed in 2021 by sequential testing of samples of 78 rubella negative submissions at the NRC MMR.**

The MV genotype was determined in 5 of the 6 lab-confirmed cases. Five cases of genotype B3 were identified. The N-450 sequence variants B3-6481 (3 cases) and B3-6464 (2 cases) were detected.

3.) National Routine Immunisation Programme and activities to increase population immunity in 2021

Current German measles and rubella routine vaccination schedule:

Children and adolescents:
1. MMR between 11 and 14 months of life
2. MMR between 15 and 23 months of life
Catch-up as soon as possible until the age of 17 years

Adults, 18 years and more and born after 1970:
1. MMR if unvaccinated, unknown **vaccination status** or who received **only one** MMR vaccination during childhood. Women in childbearing age should have received a total of two vaccinations against rubella

Results from national school entrance examinations of 4-7 years old children in 2019 (**n=676,325;** most recent data, published in 2021) **suggest that MCV vaccination coverage is adequate. In 2019, the average nationwide MCV vaccination coverage in children entering school was 97.2** (2018: 97.2%) and **92.7** (2018: 93.1%) for one and two doses of MCV, **respectively.**

Most current data from country-wide health insurance claims indicate vaccination coverage against measles and rubella (MCV2) among 2-year old children born in 2018 is about 75.6% (data published in December 2021) with a significant improvement compared to the previous year, probably due to the measles protection act (70% in children born 2017). Furthermore, more MMR-vaccine was ordered, despite the pandemic, in 2020 compared to the years before. These figures indicate that MMR vaccinations, initially suspended in 2020, have been made up among children as well as among adults. This could possibly be explained by the Measles Protection Act, which came into force in March 2020.

The costs for vaccinations in children and adolescents as well as catch-up vaccinations for adults who are over the age of 18 and born after 1970 are covered by the statutory health insurance funds. Aside from vaccinations of asylum seekers (see below) and refugees (primarily offered at local level by Public Health authorities and mobile NGO teams), no supplemental immunization activities with MCV/RCV were conducted in Germany at national level in 2021.

4.) Asylum seekers/ refugees and migrants from EU[1]

Around 867,000 people migrated to Germany in 2020 and, of these, around 502,000 came from EU-countries (especially from Eastern Europe). People from outside the EU reach Germany particularly from Syria, Afghanistan and Iraq. The number of applications of arriving asylum seekers declined remarkably in recent years and rose again in 2021 (see on page 32). Asylum seekers are relocated to the federal states according to German law.

Supplementary vaccination activities are conducted at local level in all federal states (e.g. at shelters, through mobile teams, private sector etc.). According to the respective authorities, vaccinations, including MCV-vaccinations, are well accepted by asylum seekers and refugees. Representative country-wide or state-level vaccination coverage data are not available**.**

5.) Sustainability of and commitment to activities on MR elimination in 2021

The **Measles Protection Act** entered into force on March 1, 2020 (see ASU for 2020). Data showed that the measles protection act lead to an improvement in relation to vaccination rates of children in Germany despite the pandemic.

The performance and remuneration of vaccinations in Germany are codified inter alia in the Infection Protection Act and the Social Code Book. The monitoring of vaccine development, manufacturing, marketing, and approval as well as mandatory information and education of the population and the detection of possible vaccine side effects are regulated by legal requirements and conditions. Reimbursement for vaccinations is determined by law (required performance of the statutory health insurance).

In Germany the vast majority of vaccines are purchased in the private sector via statutory or private health insurance. Children are covered by their parents' health insurance. Coverage (statutory health insurance) or reimbursement (private health insurance), respectively, is based on the official vaccination recommendation of the German Standing Committee on Vaccination (STIKO) and the subsequent endorsement of the Federal Joint Committee. Other vaccines are paid by travellers (as travel-related immunisations are not free of charge) or provided by the federal states as part of special public health immunisation programs, e.g. in schools or catch-up programs.

6.) Characteristics and quality of data concerning measles cases for 2021

See 2)

7.) Main challenges

Since the COVID-19 pandemic, notification of measles cases dropped remarkedly and this is likely to be multicausal***. These changes could be driven by a true change in transmission dynamics, initiated by non-pharmaceutical interventions but could also related to differences in e.g. healthcare seeking behaviour, alternations in disease notifications, decreasing laboratory capacities and workload at public health authorities. Lack of laboratory capacities and a potential backlog in notifications have been ruled out by state public health authorities and the national reference laboratory. In the opinion of the state public health authorities the reduction in cases of measles could be most likely explained by a reduction of contacts and (national and international) mobility. It is necessary to investigate how the pandemic has affected the measles epidemic in Europe and whether it will have an impact on the distribution of genotypes in Europe.

The main challenge in Germany remained to minimize gaps in immunization and consolidate appropriate measures to assess transmission chains, especially during the COVID-19 pandemic. Any clinical suspicion of acute measles or rubella must be laboratory-confirmed, especially given the low incidences. In addition, the existing and anticipated refugee flows from politically unstable countries are a challenge that needs to be further addressed as soon as possible.

* Hübschen J, Gouandijika-Vasilache I, Dina J: Measles. Lancet, January 27, 2022. Published online: https://doi.ord/10.1016/S0140-6736(21)02004-3.

** Penedos AR, Myers R, Hadef B, Aladin F, Brown KE (2015) Assessment of the Utility of Whole Genome Sequencing of Measles Virus in the Characterisation of Outbreaks. PLoS ONE 10(11): e0143081. doi:10.1371/journal.pone.0143081

*** Ullrich A, Schranz M; Rexroth U, Hamouda O, Schaade L, Diercke M, Boender S: The impact of the COVID-19 pandemic and associated public health measures on other notifiable infectious diseases under national surveillance in Germany, week 1-2016 – week 32-2020. Lancet Regional Health - Europe 2021; Vol. 6, Jun 19;6:100103. https://pubmed.ncbi.nlm.nih.gov/34557831/

Rubella

☐ Endemic

☒ Elimination/Interrupted endemic transmission

☐ Re-established endemic transmission

The NVC conclusion is based on the following:

The data of this report was compiled on March 1, 2022.

Based on the available data, NVC again categorized the status of rubella virus circulation in Germany for 2021 as **"interrupted endemic transmission"** and elimination.

The low incidence and low number of rubella cases in Germany as well as retesting data, for example of the NRC MMR, suggest that rubella viruses are no longer circulating in Germany. The National Verification Committee assumed, that the endemic transmission of rubella has been interrupted in Germany since several years. Based on a retrospective review in 2020, the RVC concluded that the endemic transmission of rubella virus was interrupted in Germany for >12 months between 2017-2019. Rubella were therefore considered as eliminated in Germany since 2020. Data of 2021 does not show a re-established endemic transmission of rubella.

1.) Epidemiological surveillance of rubella and CRS in 2021

In total **9 rubella** cases were reported in 2021, of which 1 case was categorized as "imported". The number of notified rubella cases declined again compared to 2020 (n=18). This figure translates into an incidence of **0.1 per 1 million inhabitants**. 4 cases were clinically compatible cases and 5 cases were laboratory-confirmed (serology). No outbreaks of rubella were reported in 2021.

Cases were between 8 months and 58 years old. 6 cases were adults aged 20 years and older, and 3 cases were infants < 2 years of age. None of the suspected acute rubella diseases in the infants, but 5 of 6 rubella diseases of adult cases were laboratory-confirmed. Five cases were female, two cases in a child-bearing age between 15 and 49 years (lab confirmed).

The majority of cases was unvaccinated (n=6), including all infants. Vaccination status for 2 cases was unknown. One clinical compatible case received two vaccinations against rubella.

No cases of CRS according to reference definition were reported through the national disease surveillance system in 2021.

Since 2013 suspected cases that are clinically compatible to rubella as well as epidemiologically linked and laboratory-confirmed rubella cases and death from rubella are notifiable entities according to the German "Protection against Infection Act". Official case definition includes only laboratory-confirmed and epidemiological linked cases. CRS has been a notifiable disease according to "Protection against Infection Act" in Germany since 2001 (see on page 12).

Quality of epidemiological surveillance in 2021

Monitoring of rubella virus transmission is generally challenging due to often mild and unspecific clinical symptoms and the too low reliability of rubella virus IgM EIA testing, routinely used for case investigation (WHO: The Immunological Basis for Immunization Series. Module 11: Rubella).

During the last years before SARS-CoV-2 pandemic a significant increase in the number of samples of patients with suspected acute rubella sent to NRC MMR at RKI was observed. In 2020 and 2021 the number of samples decreased due to the pandemic and missing transmission. It is therefore very likely that the clinically compatible cases (as well as the laboratory confirmed cases) are caused by other pathogens.

In case of a positive IgM result, it is recommended in Germany to determine the avidity of rubella virus-specific IgG for confirmation or exclusion of a primary infection. Furthermore, rubella virus genome detection should be used in every case in order to improve the significance of case confirmation and enable genotyping (all tested samples negative; see below), thus no RV Genotype could be determined.

2. Molecular Surveillance (virological data)

The NRC MMR at RKI investigated samples from a total of **22 suspected rubella cases** in 2021. **A negative result was obtained for 20 cases** by PCR test for rubella virus genome detection or by rubella virus IgM serology. **Two of the suspected rubella cases were confirmed** by laboratory investigation at the NRC MMR. In the first positive case, rubella virus genome was detected by PCR in an immunocompromised patient (Morbus Bruton) with

persisting infection of rubella virus genotype 1E. The second positive result was obtained by rubella virus IgM serology using both, the EU-EIA-Ratio and EIA-Cap-Bio-Rad testing. In this case, the positive IgM serology might be explained by the fact that the patient got vaccinated (MMR) 167 days before the blood sample was taken. Along with this, rubella virus IgG serology was positive with marginal avidity. PCR material was not provided. The latter case has not been counted as acute rubella case.

In order to identify unrecognized rubella cases, a **reciprocal testing was performed** with samples negatively tested for measles. **43 samples** from 36 persons initially tested for both measles IgM and PCR (7 cases) or only measles PCR (15 cases) or only measles IgM (14 cases) with a negative result were selected for rubella testing. Serological testing of the 21 measles IgM negative cases revealed no additional rubella IgM positive case. Molecular testing of the 22 measles PCR negative cases did not provide an additional rubella PCR positive case. **In summary, no additional rubella case was confirmed in 2021 by sequential testing of samples from 36 persons at the NRC MMR.**

Samples of one case with suspected congenital rubella syndrome were submitted to the NRC. Further laboratory tests ruled out CRS.

3.) National Routine Immunisation Programme and activities to increase population immunity
Results of the national school entrance examinations of 4-7 years old children in 2019 (n=676,325; most recent data, published in 2021) suggest that RCV vaccination coverage is adequate. In 2019, the average nationwide RCV vaccination coverage in children entering school was **97.0%** (2018: 97,0%) and **92.6%** (2018: 92.9%) for one and two doses of RCV respectively.

4.) Sustainability of and commitment to activities on MR elimination
(See measles)

5.) Characteristics and quality of data for 2021 –
See 2.) and measles

6.) Main challenges
(see measles)

The conclusions are approved by the National Verification Committee (NVC) (see annex 3)

	Name	NVC status	Position	Organization	Contact details (email, tel.)	Signature
1	Prof. Dr. Heidemarie Holzmann	*Chair*	*Until 7-2021 Head of MMR NRC laboratory*	*Centre for Virology, Medical University of Vienna, Austria*	NAVKO-MR@rki.de	
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6	Dr. Cornelia Straßner	*Member*	*Research Fellow*	*Heidelberg University Hospital, Department of General Medicine and Health Services Research*	NAVKO-MR@rki.de	

The RVC sent you its conclusions and recommendations from 9th RVC meeting. In the text box below please provide the NVC and national technical counterparts' response to any RVC request for additional information or clarification.

Sections of the ASU form

Please complete sections 1-3, and us/add forms from Section 4 as needed, to report outbreaks and supplemental immunization activities (SIA).
Please use provided Excel file to help you analyse the data and complete the ASU, and then upload/send the Excel file to the RVC/Secretariat along with the ASU form.
Additional information to help you analyse the data and complete the forms is provided in Annex 1.

Section 1: Country measles and rubella profile for 2021
1.1 Epidemiologic analysis of measles, rubella and CRS
1.2 Laboratory performance - national framework for MR laboratory testing
1.3 Performance of measles and rubella surveillance against indicators
1.4 Population immunity to measles and rubella

Section 2: Update of general programme activities by components

Section 3: Activities of the National Verification Committee (NVC) and its Secretariat
3.1 Activities of the NVC in the year under review
3.2 The NVC Secretariat (list of national staff involved in preparation of ASU)

Section 4: Additional data on measles, rubella and CRS in 2021
4.1 Maps and epi curves with distribution of suspected and confirmed measles and rubella cases and measles and rubella outbreaks in 2020
4.2 Form for outbreak reporting (use one form per each of the detected outbreaks)
4.3 Form for technical report on SIA

Annex 1: WHO guiding documents and examples
1.1 Definitions
1.2 Description of "Indicators and targets" for measuring performance of measles and rubella surveillance
1.3 Sustain measles and rubella elimination after verification - Discussion points on risk for re-establishing endemic transmission of diseases

Abbreviations

ASU	Annual Status Update (form)
CRS	congenital rubella syndrome
EQA	external quality assurance
MCV	measles-containing vaccine
MeaNS	WHO Measles Nucleotide Surveillance online database (www.who-measles.org)
NVC	National Verification Committee
RCV	rubella-containing vaccine
RubeNS	WHO Rubella Nucleotide Surveillance online database (www.who-rubella.org)
RVC	Regional Verification Commission
SIA	Supplemental immunization activities

Section 1: Country measles and rubella profile for 2021

1.1 Epidemiologic analysis of measles, rubella and CRS

Progress towards measles and rubella elimination, 2019-2021 - Incidence of measles and rubella and total number of CRS cases in last three years

Incidence or number of cases	2019	2020	2021	Remarks
Measles incidence ***per 1 million population***	5.2 Numerator: 432	0.8 Numerator: 66	0.1 Numerator: 8	
Rubella incidence ***per 1 million population***	0.7 Numerator: 55	0.2 Numerator: 18	0.1 Numerator: 8	
Number of CRS cases	0	0	0	

Country population: **number (denominator) used to calculate incidence for 2021 in table above**: 83.155.031 as of 31.12.2020

*The numerator is the total number of measles/rubella cases including laboratory-confirmed, epidemiologically linked and clinically compatible cases **but excluding imported cases**. For CRS cases please provide total number of cases classified as CRS, **excluding imported cases**.*

1.1.1 Epidemiology of measles, rubella and CRS in 2021

a) Measles and rubella surveillance are organized as:

☒ Disease-specific surveillance (measles surveillance, rubella surveillance)

☐ Rash and fever surveillance (syndrome-based)

☐ Both types of the above surveillance systems are in place

☐ Other (please describe in text box below)

Measles: Since 2001 clinically compatible as well as epidemiologically linked and laboratory confirmed measles cases and death from measles are notifiable entities according to the German "Protection against Infection Act". Case definition according to WHO Euro Guidelines, surveillance standards and ECDC.
Rubella: Since 2013 clinically compatible as well as epidemiologically linked and laboratory confirmed rubella cases and death from rubella are notifiable entities according to the German "Protection against Infection Act". Case definitions according to WHO Euro Guidelines, surveillance standards and ECDC.
CRS: Since 2001 CRS is a notifiable disease according to "Protection against Infection Act" in Germany. The case definition for CRS was updated in 2013. Since then case definition according to WHO Euro Guidelines, surveillance standards and ECDC.

Public health authorities at all administrative levels are connected to an electronic surveillance system in Germany. Cases (including suspected cases) are submitted to public health authorities at local level by the laboratories and/or clinicians and are transmitted to subnational and national level according the case definitions of RKI (lab-confirmed, epi.-linked, clinically compatible; Link: https://www.rki.de/DE/Content/Infekt/IfSG/Falldefinition/Downloads/Falldefinitionen_des_RKI_2019.pdf?__blob=publicationFile).

b) Are specimens from ALL suspected cases routinely tested for both diseases by a laboratory?

☐ No

☐ Yes, for both diseases, in parallel or in sequence (if testing for one disease is negative)

☒ Yes, but partially/for some of cases (if there are national guidelines or proposed testing algorithm – please explain):

No general testing of the laboratories in parallel or in sequence for both diseases. However, sequential testing of nationwide specimen of suspected measles and rubella cases, which were sent to the National Reference Centre (NRC), was performed in 2021.

36 suspected measles cases with a negative result in PCR and/or serology were investigated for a rubella infection (sequential testing) and **no additional rubella case was detected by the NRC in 2021**.

Vice versa, sequential testing of 78 suspected rubella cases with a negative rubella result revealed **no additional acute case of measles by the NRC in 2021**.

c) Number of measles and rubella cases in 2021

	Total number of suspected cases (from diseases-specific and syndrome-based surveillance)	**Total number of cases classified as measles or rubella** (laboratory-confirmed, epidemiologically linked and clinically compatible cases)	**Number of discarded cases** (please indicate if these are discarded for both diseases)
Measles		**10**[6]	
Data of NRC[1,3]	42	6	36 discarded or not confirmed[5]
Lab Sentinel[2]	15,750	21[7]	15,685[4]
Rubella		**9**	
Data of NRZ[1,3]	22	1[8]	21
Lab Sentinel[2]	Not applicable	Not applicable	Not applicable

Value in cell "Total number of suspected cases" should be equal to the sum of values presented in "Total number of cases classified as measles or rubella" and "Total number of discarded cases". Include laboratory-confirmed, epidemiologically linked and clinically compatible cases, ***regardless of origin (include imported).***

If suspected cases are systematically investigated/tested for both diseases in your surveillance system (syndromic-based surveillance; simultaneous or sequential testing in laboratories), cases suspected for measles may be included in the total number of cases suspected for rubella, and conversely, cases suspected for rubella may be included as cases suspected for measles.

Comment Germany: Suspected cases are notifiable to the local Public Health department. According to case definition and law discarded measles or rubella cases are not reported to the state and national level.

1	As the National Reference Centre MMR (NRC) partly reconfirms already laboratory confirmed measles cases of other laboratories mainly in terms of molecular detection (PCR and Genotyping), the ratio of discarded and suspected cases is generally lower than of other laboratories in Germany
2	According to data of the laboratory-based sentinel detecting discarded cases. 24 laboratories all over Germany participate in the sentinel, partly getting samples from all over the country (see as well page 28)
3	Including data of discarded measles and rubella cases with sequential testing for rubella and measles (see above)
4	Inconclusive results of suspected measles cases in Lab Sentinel: 44 cases
5	Inconclusive result in 1 case for measles
6	73 cases were transmitted to the RKI (epidemiological surveillance) that did not correspond to the reference definition. We have analyzed these cases as well (see on page 4)
7	Discrepancies to the number of cases notified may for example result from subsequently discarded cases due to a false positive result, unspecific reactions, missing case definitions, duplicate entries or report failures.
8	Patient with a persistent rubella infection due to a genetically caused immunodeficiency (M. Bruton), counted as acute rubella case.

d) Number of measles cases, by case classification and origin of infection

Measles	Laboratory-confirmed (A)	Epidemiologically linked (B)	Clinically compatible (C)	Total (A+B+C)
Imported	0	0	0	**2**
Import-related (I)	0	0	0	**0**
Endemic (II)	0	0	0	**0**
Unknown origin (III)	4	0	4	**8**
Total (excluding imported cases) (I + II + III)	**4**	**0**	**4**	**8**

Note: Please use the Excel spreadsheet provided with this ASU, as it can help you in completing this table.

e) Number of rubella cases, by case classification and origin of infection

Rubella	Laboratory-confirmed (A)	Epidemiologically linked (B)	Clinically compatible (C)	Total (A+B+C)
Imported	1	0	0	**1**
Imported-related (I)	0	0	0	**0**
Endemic (II)	0	0	0	**0**
Unknown origin (III)	4	0	4	**8**
Total (excluding imported cases) (I + II + III)	**4**	**0**	**4**	**8**

Note: Please use the Excel spreadsheet provided with this ASU, as it can help you in completing this table.

f) Number of CRS cases, by case classification and origin of infection

CRS	Laboratory-confirmed (A)	Epidemiologically linked (B)	Clinically compatible (C)	Total (A+B+C)
Imported	0	0	0	**0**
Imported-related (I)	0	0	0	**0**
Endemic (II)	0	0	0	**0**
Unknown origin (III)	0	0	0	**0**
Total (excluding imported cases) (I + II + III)	**0**	**0**	**0**	**0**

Note: Please use the Excel spreadsheet provided with this ASU, as it can help you in completing this table.

1.1.2 Age and vaccination status of laboratory-confirmed, epidemiologically linked or clinically compatible cases of measles and rubella

a) Age and vaccination status of **measles** cases (including imported cases)

Measles	< 1 year	1-4 years	5-9 years	10-14 years	15-19 years	20-29 years	≥30 years	Unknown age	Total
0 doses	0	2	0	0	0	0	1	0	**3**
1 dose	0	0	1	0	1	0	0	0	**2**
2 or more doses	0	1	1	0	1	2	0	0	**5**
Unknown status	0	0	0	0	0	0	0	0	**0**
Total	**0**	**3**	**2**	**0**	**2**	**2**	**1**	**0**	**10**

b) Age and vaccination status of **rubella** cases (including imported cases)

Rubella	< 1 year	1-4 years	5-9 years	10-14 years	15-19 years	20-29 years	≥30 years	Unknown age	Total
0 doses	1	2	0	0	0	1	2	0	**6**
1 dose	0	0	0	0	0	0	0	0	**0**
2 or more doses	0	0	0	0	0	0	1	0	**1**
Unknown status	0	0	0	0	0	1	1	0	**2**
Total	**1**	**2**	**0**	**0**	**0**	**2**	**4**	**0**	**9**

1.1.3 List of administrative territories with measles and rubella cases

a) Total number of confirmed **measles** cases by month (classified as laboratory-confirmed, epidemiologically linked or clinically compatible), **regardless of origin (including imported cases (i); onset of disease)**

Administrative territory and its population size (as of 31.12.2020)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Baden-Württemberg *11.103.043*	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Bavaria *13.140.183*	0	0	0	0	0	0	0	0	0	0	**1**	**1 (i)**	**2**
Berlin *3.664.088*	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Brandenburg *2.531.071*	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Bremen *680.130*	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Hamburg *1.852.478*	**1**	**1**	0	0	0	0	0	0	0	0	0	0	**2**
Hesse *6.293.154*	0	0	0	0	0	0	0	0	0	0	0	**1 (i)**	**1**
Mecklenburg-West Po. *1.610.774*	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Lower Saxony *8.003.421*	0	0	0	0	0	0	0	0	0	0	**1**	0	**1**
North Rhine-Westphalia *17.925.570*	0	0	0	**1**	0	0	0	0	0	**1**	0	**1**	**3**
Rhineland-Palatinate *4.098.391*	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Saarland *983.991*	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Saxony *4.056.941*	0	0	0	0	0	0	0	0	0	**1**	0	0	**1**
Saxony-Anhalt *2.180.684*	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Schleswig-Holstein *2.910.875*	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Thuringia *2.120.237*	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Total *83.155.031*	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**3**	**10**

b) Total number of confirmed **rubella** cases (classified as laboratory-confirmed, epidemiologically linked or clinically compatible), **regardless of origin (including imported cases (i); onset of disease)**

Administrative territory and its population size (as of 31.12.2020)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Baden-Württemberg *11.103.043*	0	0	0	0	0	0	0	0	0	0	**1**	0	**1**
Bavaria *13.140.183*	0	**1**	0	0	0	0	0	0	0	0	0	0	**1**
Berlin *3.664.088*	0	0	0	0	0	0	0	0	0	0	0	0	0
Brandenburg *2.531.071*	0	0	**1**	0	0	0	0	0	0	0	0	0	**1**
Bremen *680.130*	0	0	0	0	0	0	0	0	0	0	0	0	0
Hamburg *1.852.478*	0	0	0	0	0	0	0	0	0	0	0	0	0
Hesse *6.293.154*	0	0	0	0	**1**	0	0	0	0	0	0	0	**1**
Mecklenburg-West Po. *1.610.774*	0	0	0	0	0	0	0	0	0	0	0	0	0
Lower Saxony *8.003.421*	0	0	0	0	0	0	0	0	0	0	0	0	0
North Rhine-Westphalia *17.925.570*	**1**	0	0	0	**2**	0	0	0	0	0	0	**1**	**4**
Rhineland-Palatinate *4.098.391*	0	0	0	0	0	0	0	0	0	**1 (i)**	0	0	**1**
Saarland *983.991*	0	0	0	0	0	0	0	0	0	0	0	0	0
Saxony *4.056.941*	0	0	0	0	0	0	0	0	0	0	0	0	0
Saxony-Anhalt *2.180.684*	0	0	0	0	0	0	0	0	0	0	0	0	0
Schleswig-Holstein *2.910.875*	0	0	0	0	0	0	0	0	0	0	0	0	0
Thuringia *2.120.237*	0	0	0	0	0	0	0	0	0	0	0	0	0
Total *83.155.031*	**1**	**1**	**1**	0	**3**	0	0	0	0	**1**	**1**	**1**	**9**

1.1.4 Outbreaks in 2021 and molecular epidemiology

***NOTE**: If genotyping data are available, please note that each outbreak or chain of transmission should have **only one genotype-variant**. If more than one genotype-variant is reported for an outbreak, this refers to more than one outbreak/chain of transmission and should be described as two separate outbreaks/chains of transmission in the table. Countries with comprehensive data are encouraged to use the additional Excel sheets provided as tool for better visualization.*
Please provide definition for an outbreak of measles and rubella used in your country in the text box below:

Definition of outbreak given by the Robert Koch Institute (RKI):
At least 2 measles or rubella cases (according to case and reference definition of RKI) with documentation of an epidemiological link. Definition of outbreaks generally results from the assessment of local public health authorities. Outbreaks are counted for the year in which the outbreak has been reported first.

1.1.4.1 Measles (official cases according case definition; n=10)

a) Measles outbreaks and sporadic cases in 2021 by availability of the genotype information

MEASLES	Genotyped	Not genotyped	Total
Number of **outbreaks/chains of transmission**	0	0	**0**
Number of **cases** that are part of outbreaks/chains of transmission (I)	0	0	0
Number of **sporadic cases** that are not part of outbreaks/chains of transmission (II)	2	8	**10**
Total number of **cases (I +II)**	**2**	**8**	**10**

*The value in the cell highlighted in orange should be the total number of **cases classified as measles** and the same as the value for the Total number of cases classified as measles in table 1.1.1.c*

Comment Germany: Genotype was **available for 2 of the 10 cases, which fulfilled clinical case definition.** For these two cases the **N-450 sequence variant B3 6464** was detected. Both cases imported measles from Afghanistan.

A MV genotype was also determined in 3 other cases, which **did not meet the clinical case definition**. All cases were children and came from Afghanistan, too. Cases were part of an outbreak which occurred on an American Air Base (under US sovereignty) and beyond in the USA. In these 3 cases the **N-450 sequence variant B3 6481** was detected by the National Reference Centre at RKI (see more information on page 4).

b) *Measles outbreaks in 2021 (list ALL outbreaks; if your country only reported sporadic measles cases and NO outbreaks, please go directly to table d)*

Outbreak ID	Name of the affected territory (national, or list of affected sub-national territories)	Duration (Date of onset of the first case, date of onset of the last case; or "ongoing") (dd/mm/yyyy)	Total number of cases in outbreak in 2021	First case by origin (Imported or not-imported)	Outbreak genotyped (Yes/No)	Outbreak report form attached to the ASU (Yes/No)
none						

c) Genotyped measles outbreaks/chains of transmission ***with cases according case definition***

Genotype-variant (MeaNS distinct sequence ID) as defined in Annex 1.	**Outbreaks (list all IDs)**	**Name of the affected territory (national, or list of affected subnational territories)**	**Total number of cases in 2021**	**Duration**		**Documented importation for first case (yes/no)**	**Are there sporadic cases with the same variant that are not part of the identified outbreak/chain of transmission?** ☐ **Yes** ☐ **No**	
				Date of onset of the first case (dd/mm/yyyy)	**Date of onset of the last case or 'ongoing' (dd/mm/yyyy)**		**If yes, how many cases?** (enter data at the bottom of the table)	
							Date of first sporadic case (dd/mm/yyyy)	**Date of last sporadic case (dd/mm/yyyy)**
none								
SUM - Total number of genotyped **outbreaks/chains of transmission**	0	SUM- Total number of **cases in outbreaks/chains of transmission**	0			SUM - Total number of **sporadic cases** with genotype	0 cases	

d) ***Measles sporadic cases*** *with different genotype-variant(s) than those reported in table c)*

*Please fill in this table **ONLY IF***
1) there were NO genotyped outbreaks at all reported in 2021 or
2) if NO outbreaks had the same genotype-variant(s).
Otherwise, please include the sporadic cases above in the last column of table c).

Genotype-variant (MeaNS distinct sequence ID) as defined in Annex 1	Case ID/ EpidNo	Name of subnational territory from where it was reported	Date of onset (dd/mm/yyyy)	Documented importation (yes/no)
B3 6464	23049801	Bavaria	17.12.2021	yes
B3 6464	22661387	Hesse	13.12.2021	yes
SUM - Total number of **cases**	2			

e) *Non-genotyped measles sporadic cases*

Case ID /Epid. No.	Name of subnational territory from where case was reported	Date of onset	Documented importation (yes/no)
16506376	Hamburg	08.01.2021	no
16966716	Hamburg	27.02.2021	no
17712663	North Rhine-Westphalia	10.04.2021	no
19822926	Saxony	27.10.2021	no
19829303	North Rhine-Westphalia	21.10.2021	no
20179970	Bavaria	02.11.2021	no
22301479	Lower Saxony	25.11.2021	no
22038727	North Rhine-Westphalia	07.12.2021	no
SUM - Total number of **cases**	**8**		

Remark Germany: Five cases possibly not acute Measles because: i) low and constant IgG, ii) high IgG titer in the past, iii) two vaccinations in the past and no laboratory confirmation of acute measles.

1.1.4.2 Rubella

a) Rubella outbreaks and sporadic cases in 2021 by availability of the genotype information

RUBELLA	Genotyped	Not genotyped	Total
Number of **outbreaks/chains of transmission**	0	0	**0**
Number of **cases** that are part of outbreaks/chains of transmission (I)	0	0	**0**
Number of **sporadic cases** that are not part of outbreaks/chains of transmission (II)	0	9	**9**
Total number of **cases (I + II)**	**0**	**9**	**9**

*The value of the cell highlighted in orange should be the total number of **cases classified as rubella** and the same as the value for the Total number of cases classified as rubella in table 1.1.1.c*

b) Rubella outbreaks in 2021 (list ALL outbreaks; if your country only reported sporadic rubella cases and NO outbreaks, please go directly to table d)

Outbreak ID	Name of the affected territory (national, or list of affected sub-national territories)	Duration (Date of onset of the first case, date of onset of the last case; or "ongoing")	Total number of cases in outbreak in 2021	First case by origin (Imported or not-imported)	Outbreak genotyped (Yes/No)	Outbreak report form attached to the ASU (Yes/No)
none						

c) Genotyped rubella outbreaks

Genotype-variant (RubeNS sequence ID)	**Outbreaks (list all IDs)**	**Name of the affected territory (national, or list of affected subnational territories)**	**Total number of cases in 2021**	**Duration**		**Documented importation for first case (yes/no)**	**Are there sporadic cases with the same variant that are not part of the identified outbreak/chain of transmission?** ☐ **Yes** ☐ **No** **If yes, how many cases?** (enter data at the bottom of the table)	
				Date of onset of the first case (dd/mm/yyyy)	**Date of onset of the last case or 'ongoing' (dd/mm/yyyy)**		**Date of first sporadic case (dd/mm/yyyy)**	**Date of last sporadic case (dd/mm/yyyy)**
none								
SUM - Total number of genotyped **outbreaks/ chains of transmission**	**0**	SUM - Total number of **cases in outbreaks/ chains of transmission**	**0**			SUM - Total number of **sporadic cases** with genotype	**0**	

Add as many rows as you need, or remove not used rows (e.g. only one genotype-variant detected)

d) ***Rubella sporadic cases*** *with different genotype-RubeNS sample ID than those reported in table c).*

Please fill in this table ***ONLY IF***
1) there were NO genotyped outbreaks at all reported in 2021 or
2) if NO outbreaks had the same genotype-variant(s).
Otherwise, please include the sporadic cases above in the last column of table c).

Genotype-variant (RubeNS sequence ID)	Case ID /Epid. No.	Name of subnational territory from where case was reported	Date of onset	Documented importation (yes/no)
none				
SUM - Total number of cases	**0**			

e) ***Non-genotyped rubella sporadic cases***

Case ID /Epid. No.	Name of subnational territory from where case was reported	Date of onset (dd/mm/yyyy)	Documented importation (yes/no)
16492686	North Rhine-Westphalia	15.01.2021	no
17074125	Bavaria	27.02.2021	no
17412207	Brandenburg	30.03.2021	no
18452934	North Rhine-Westphalia	22.05.2021	no
18491172	North Rhine-Westphalia	26.05.2021	no
18516427	Hesse	28.05.2021	no
19390258	Rhineland-Palatinate	04.10.2021	no
20543512	Baden-Wurttemberg	14.11.2021	no
22210276	North Rhine-Westphalia	12.12.2021	no
SUM - Total number of cases	**9**		

1.2 Laboratory performance - national framework for measles and rubella laboratory testing in 2021

a) Standard laboratory procedures for testing and case confirmation

Please select **ONE** of the following:

☒ IgM serology is the first line of laboratory investigation; case confirmation may rely on additional tests if needed.

☐ Molecular detection is the first line of laboratory investigation; serology may be additionally performed or not.

☐ Other case confirmation procedure, please specify:

Comment Germany: First line molecular detection is recommended by RKI. However, these recommendations are not yet implemented throughout Germany. Additional laboratory requests are usually directed to the National Reference Centre at RKI by the laboratories and National Public Health Services in terms of molecular detection (PCR and Genotyping).

b) Testing and confirmation of cases by laboratory proficiency

Select all that apply regarding testing of measles, rubella and CRS suspected cases (more than one may apply)

☒ Testing conducted by WHO-accredited measles–rubella reference laboratory/laboratories.

☒ Testing conducted by laboratories having an established quality assurance programme with oversight by a WHO-accredited laboratory.

☒ Testing conducted by laboratories having an established quality assurance programme and accredited by a national body/institution. Please specify

- **EQA programme for serology and molecular test performance** as ring trials organized by Instand e.V. and others
- **Name of national accrediting body:** German National Accreditation Body (DAkkS)
- **Accreditation standard(s):** DIN EN ISO 15189 and DIN EN ISO 17025

☐ Other (please comment/describe)

Comment Germany regarding laboratory confirmation and quality standards:
Tests results stem from around 2000 competent private and state laboratories distributed all over the country as well as from the National Reference Centre MMR at RKI.

It is mandatory for all medical laboratories to follow internal quality control procedures as laid down by Guideline of the German Medical Association (Bundesärztekammer; Rili-BÄK 2014*).

Testing for anti-Rubella and anti-Measles IgG and IgM is mandatory for each laboratory in Germany to be controlled by external quality assessment schemes twice a year. External quality assessment for molecular detection of rubella and measles viruses follows the same principles. It has to be noted that the guideline of the BÄK follows all principles of *European DIN EN ISO 15189 standard.* The proficiency tests are attended by the WHO accredited laboratory (National Reference Centre at RKI).

Moreover, laboratories are supposed to go through a challenging accreditation process by DAkkS on the basis of the European DIN EN ISO 15189 and DIN EN ISO/IEC 17025. Laboratories run the risk of not being reimbursed, if they have not implemented External Quality Assurance (EQA) schemes or pass the EQA with constant negative results.

In summary, German private labs are under a high and ongoing pressure to keep up high quality standards.

* Richtlinie der Bundesärztekammer zur Qualitätssicherung laboratoriumsmedizinischer Untersuchungen.
https://www.bundesaerztekammer.de/aerzte/qualitaetssicherung/richtlinien-leitlinien-empfehlungen-stellungnahmen/richtlinien-leitlinien-empfehlungen-zur-qualitaetssicherung/labor/

c) Number of suspected cases tested in 2021 by type of the laboratory

Systematic screening studies as well as any other results of general screenings of population should not be reported in this form (e.g. survey for rubella in pregnancy).

Laboratory performing the test	Number of suspected cases tested for measles	Number of suspected cases tested for rubella	Number of suspected cases tested for CRS
WHO-accredited lab(s) (NRC)	**42**	**22**	**2**
Proficient labs overseen by WHO-accredited lab Lab Sentinel (see on page 26)	no data 15,750	no data not applicable	no data not applicable
Nationally accredited labs	no data	no data	no data
Other labs	not applicable	not applicable	not applicable
Total	no data	no data	**0**

1.3 Performance of measles and rubella surveillance against indicators

Please use the Excel spreadsheet provided with this ASU 2021 to calculate rates or percentages required as surveillance indicators and insert the calculated values in the tables of this section. Please add any comments or clarifications in the "Remarks" column.

Comment Germany:

Definition of Timeliness: Percentage of measles and rubella routine reports submitted within 4 days after notification (legislation: 2-4 days) by each surveillance reporting unit to national level, divided by the number of all submitted reports during the reporting year.

Definition of viral detection: defined as outbreaks with laboratory-confirmed viral detection (PCR or MV Sequencing) of at least one included case according to reported cases.

Notification of discarded cases: Implementation of a standardized possibility to notify discarded cases via the electronic surveillance system with first results. As an alternative indicator, a laboratory-based sentinel was established in 2014 (see on page 26).

Timeliness of notification: Number of cases submitted within 48 hours after notification at communal level to national level with information about age, gender, date of disease onset, vaccination status, and place of exposure.

1.3.1 Measles surveillance performance indicators

a. Standard indicators

Indicator	Value for indicator	Numerator	Denominator	Remarks
Timeliness of reporting (to national level in %) (T) *Target: ≥80%* *A*(100)/B = T*	70%	7 *(A) = number of reports submitted by deadline*	10 *(B) = number of expected reports submitted*	
Completeness of reporting (to national level in %) (C) *Target: ≥80%* *D*(100)/B = C*	100%	10 *(D) = number of submitted reports*	10 *(B) = number of expected reports*	
Rate of laboratory investigations in % (L) *Target: ≥80%* *F*(100)/G = L*	60%	6 *(F) = number of suspected measles cases with adequate specimens collected and tested in a proficient laboratory*	10 *(G) = number of suspected measles cases*	
Rate of discarded cases (D) *Target: ≥2/100,000* *H*(100,000)/J = D*	19/100,000	No data *(H) = number of suspected measles cases investigated and discarded as non-measles*	No data *(J) = population*	See below
Representativeness of reporting discarded cases in % (R) *Target: ≥80%* *K*(100)/M = R*	%	No data *(K) = number of subnational administrative territories reporting the rate at least 2 per 100,000*	No data *(M) = number of subnational administrative territories*	See below
Viral detection in % (V) *Target: ≥80%* *P*(100)/Q = V*		Not applicable *(P) = number of chains of transmission of measles for which adequate samples* have *been submitted for viral detection/genotyping*	Not applicable *(Q) = number of chains of transmission identified*	
Origin of infection identified in % (O) *Target: ≥80%* *W*100/X = O*	20%	2 *(O) = number of measles cases for which the origin of infection (imported, import-related, endemic) has been identified*	10 *(X) = total number of measles cases*	
Timeliness of investigation in % (I) *Target: ≥80%* *Y*(100)/Z = I*	30%	3 *(Y) = number of measles cases with an adequate investigation*	10 *(Z) = number of suspected measles cases*	

b. Alternative indicators – If the above standard indicators could be calculated using the available data, there is no need to provide alternative indicators. If data is not available to calculate the standard indicators, NVC should use these alternative indicators to assess the performance of measles surveillance.

Indicator	Value for indicator	Numerator	Denominator	Remarks
Timeliness of notification (in %; alternative to *Timeliness and Completeness* indicator) (AA) *Target: ≥80%* *BB*(100)/Z = AA*	%	(CC) = number of reports submitted within 48 hours	*(Z) = number of suspected measles cases*	
Rate of cases tested negative for measles IgM (alternative to *Rate of Discarded Cases* indicator) (CC) *Target: ≥2/100,000* *DD*(100,000)/J = CC*	19/100,000	15,685 tested negative of 15,750 *(DD) = number of negative IgM test results*	83.155.031 (as of 31.12.2020) *(J) = population*	According to page 48. See comment below

Comment Germany:

A laboratory-based sentinel detecting discarded cases has been implemented in 2014. 24 laboratories participate, with partly functioning as specialized laboratories for measles and receiving **samples from all over Germany.**

Lab Sentinel for rubella: Concerning rubella, the NVC assumes a very high number of requests in the context of routine diagnosis of immunity against rubella e.g. during pregnancy (maternity screening). It is not possible to differentiate these requests from those made for the laboratory diagnosis of suspected acute rubella cases. Thus, NVC did not consider it meaningful to continue the data collection of excluded cases for the rubella by the Lab Sentinel.

1.3.2 Rubella surveillance performance indicators

a. Standard indicators

Indicator	Value for indicator	Numerator	Denominator	Remarks
Timeliness of reporting (to national level in %) (T) *Target: ≥80%* *A*(100)/B = T*	100%	9 *(A) = number of reports submitted by deadline*	9 *(B) = number of expected reports submitted*	
Completeness of reporting (to national level in %) (C) *Target: ≥80%* *D*(100)/B = C*	100%	9 *(D) = number of submitted reports*	9 *(B) = number of expected reports*	
Rate of laboratory investigations in % (L) *Target: ≥80%* *F*(100)/G = L*	56%	5 *(F) = number of suspected rubella cases with adequate specimens collected and tested in a proficient laboratory*	9 *(G) = number of suspected rubella cases*	
Rate of discarded cases (D) *Target: ≥2/100,000* *H*(100,000)/J = D*	/100.000	No data *(H) = number of suspected rubella cases investigated and discarded as non-measles*	No data *(J) = population*	See below
Representativeness of reporting discarded cases in % (R) *Target: ≥80%* *K*(100)/M = R*	%	No data *(K) = number of subnational administrative territories reporting the rate at least 2 per 100,000*	No data *(M) = number of subnational administrative territories*	See below
Viral detection in % (V) *Target: ≥80%* *P*(100)/Q = V*		Not applicable *(P) = number of chains of transmission of rubella for which adequate samples have been submitted for viral detection/genotyping*	Not applicable *(Q) = number of chains of transmission identified*	
Origin of infection identified in % (O) *Target: ≥80%* *W*100/X = O*	0%	0 *(O) = number of rubella cases for which the origin of infection (imported, import-related, endemic) has been identified*	9 *(X) = total number of rubella cases*	
Timeliness of investigation in % (I) *Target: ≥80%* *Y*(100)/Z = I*	44%	4 *(Y) = number of rubella cases with an adequate investigation*	9 *(Z) = number of suspected rubella cases*	

b. Alternative indicators – If the above standard indicators could be calculated using the available data, there is no need to provide alternative indicators. If data is not available to calculate the standard indicators, NVC should use these alternative indicators to assess the performance of measles surveillance.

Indicator	Value for indicator	Numerator	Denominator	Remarks
Timeliness of notification (in %; alternative to *Timeliness and Completeness* indicator) (AA) *Target: ≥80%* *BB*(100)/Z = AA*	%	Not applicable (CC) = number of reports submitted within 48 hours	Not applicable *(Z) = number of suspected rubella cases*	
Rate of cases tested negative for rubella IgM (alternative to *Rate of Discarded Cases* indicator) (CC) *Target: ≥2/100,000* *DD*(100,000)/J = CC*	91%	20 *(DD) = number of negative IgM test results*	22 *(J) = population*	According to data of NRC

1.4 Population immunity to measles and rubella

1.4.1 Routine vaccination coverage of measles- and rubella-containing vaccines

a. Summary of vaccination coverage, 2019–2021

Routine vaccination coverage	2019	2020	2021	Remarks
Measles-containing vaccine, 1st dose	97.2%	Only limited data expected during 2020 pandemic; data not yet available	Data not yet available	nationwide school entrance examination, children 4-7 years old
Measles-containing vaccine, 2nd dose	92.7%	Only limited data expected during 2020 pandemic; data not yet available	Data not yet available	nationwide school entrance examination, children 4-7 years old
Rubella-containing vaccine, 1st dose	97.0%	Only limited data expected during 2020 pandemic; data not yet available	Data not yet available	nationwide school entrance examination, children 4-7 years old
Rubella-containing vaccine, 2nd dose	92.6%	Only limited data expected during 2020 pandemic; data not yet available	Data not yet available	nationwide school entrance examination, children 4-7 years old

[1] *Vaccination coverage as in the official national routine immunization reports (JRF).*

b. Methods used to determine the immunization coverage

Please describe the methods by which routine immunization coverage is determined, including both numerator and denominator data. Please clearly indicate the source of population statistics[1].

1st dose	Description	Source of data	Comments
Numerator	**1) number of children at 4-7 years of age presenting vaccination document and having received at least 1 dose of MCV/ RCV**	**1) country-wide school-entrance examinations**	**1) updated annually; Data as of 2019, published in 2021[2]**
	2) number of children at 15 and 24 months of age and having received at least 1 dose of MCV/RCV	**2) cohort generated from analyses of country-wide health insurance claims data;**	**2) Project financed by MoH. Data published in 2021 [2]**
Denominator	**1) Children presenting vaccination documents for school entrance examination**	**1) country-wide school-entrance examinations**	
	2) Number of children in a cohort with physician contacts at beginning and end of follow-up period	**2) Cohort generated from analyses of country-wide health insurance claims data;**	

2nd dose	Description	Source of data	Comments
Numerator	1) number of children at 4-7 years of age presenting vaccination document and having received at least 2 doses of MCV/ RCV	1) country-wide school-entrance examinations	1) updated annually; data as of 2019, published in 2021[2]
	2) number of children at 15 and 24 months of age and having received at least 2 doses of MCV/RCV	2) cohort generated from analyses of country-wide health insurance claims data;	2) Project financed by MoH. Data published in 2021 [2]
Denominator	1) Children presenting vaccination documents for school entrance examination	1) country-wide school-entrance examinations	
	2) Number of children in a cohort with physician contacts at beginning and end of follow-up period	2) Cohort generated from analyses of country-wide health insurance claims data;	

[1] Data of Robert Koch Institute

[2] Rieck T, Feig M, Siedler A: Impfquoten von Kinderschutzimpfungen in Deutschland- aktuelle Ergebnisse aus der RKI-Impfsurveillance. Epid Bull 2021; 49: 6-29. | DOI 10.25646/935 (in German)

1.4.2 Additional data to determine the population immunity in 2021

Note: Additional data from rapid coverage monitoring, coverage surveys or seroprevalence studies, when available, should be included in the report. For published studies or final written reports, references may be appended to this report.

	Serological (S) or coverage (C) studies/surveys	Targeted territory or subpopulation	Results [1]
1	Number of children at 15 months of age with 1 dose of MCV or RCV (C); children born 2018	Cohort generated from analyses of country-wide health insurance claims data; data published in 2021	MCV/RCV1: 85.8%
2	Number of children at 24 months of age with at least 1 or 2 doses of MCV or RCV (C); children born 2018	Cohort generated from analyses of country-wide health insurance claims data; data published in 2021	MCV/RCV1: 92.5% MCV/RCV2: 75.6%

[1] Rieck T, Feig M, Siedler A: Impfquoten von Kinderschutzimpfungen in Deutschland- aktuelle Ergebnisse aus der RKI-Impfsurveillance. Epid Bull 2021; 49: 6-29. | DOI 10.25646/935 (in German)

1.4.3 Information of administrative territories with measles/rubella-containing vaccine routine coverage 2021

Are there any administrative territories with less than 90% coverage for either first and/or second dose of measles and/or rubella-containing vaccine in 2020? (Please check the appropriate box)

☐ No

☒ Yes (Please provide list of such territories in table below)

☐ Subnational coverage data are not collected or available

☐ No subnational administrative levels in the country

Please list all administrative territories (subnational levels) with first and/or second dose coverage.
Total number of subnational territories in the country in 2021: 16

	Territories with coverage less than 90%	Population size	Coverage 1st dose[1] (%)	Coverage 2nd dose[1] (%)
1.	Baden-Württemberg (MCV)	11,103,043	95.3	89.9
2.	Baden-Württemberg (RCV)	11,103,043	95.0	89.7

[1] Data of school entrance examinations 2019.

In 24-month-old children only Baden-Württemberg achieved a vaccination coverage below 90% for MCV1 according to the country-wide health insurance claims data. For MCV2 none of the states achieved a vaccination rate over 90% in this age group [1]. Nevertheless, vaccination coverage improved substantially in 2020 compared to 2019 due to the Measles Protection Act (below).

	Territories with coverage less than 90%	Population size (as of 2020)	Coverage 1st dose[1] (%)	Coverage 2nd dose[1] (%)
Coverage in 24-month-old-children				
			MMR1	**MMR2**
1.	Baden-Württemberg	*11.103.043*	**83.9**	**65.4**
2.	Bavaria	*13.140.183*	91.3	**73.8**
3.	Berlin	*3.664.088*	95.1	**78.7**
4.	Brandenburg	*2.531.071*	95.2	**75.1**
5.	Bremen	*680.130*	92.0	**71.1**
6.	Hamburg	*1.852.478*	93.6	**80.8**
7.	Hesse	*6.293.154*	94.3	**78.3**
8.	Mecklenburg-West Po.	*1.610.774*	94.9	**74.5**
9.	Lower Saxony	*8.003.421*	94.5	**79.7**
10.	North Rhine-Westphalia	*17.925.570*	94.7	**79.1**
11.	Rhineland-Palatinate	*4.098.391*	93.6	**77.7**
12.	Saarland	*983.991*	95.3	**79.9**
13.	Saxony[2]	*4.056.941*	91.1	**40.0**[2]
14.	Saxony-Anhalt	*2.180.684*	95.3	**76.9**
15.	Schleswig-Holstein	*2.910.875*	95.2	**82.1**
16.	Thuringia	*2.120.237*	93.5	**73.6**

[1] Rieck T, Feig M, Siedler A: Impfquoten von Kinderschutzimpfungen in Deutschland- aktuelle Ergebnisse aus der RKI-Impfsurveillance. Epid Bull 2021; 49: 6-29. | DOI 10.25646/935 (in German)

[2] Vaccination recommendations differ in Saxony (MCV1 with 13 to 24 months, MCV2 with 5 years).

1.4.4 Information about high-risk population groups in the country

*Please indicate population groups with a higher than expected risk of developing/transmitting measles and/or rubella due to insufficient level of vaccination coverage or known/possible measles or rubella transmission in the country of origin. Consider for example population groups for which vaccination coverage is influenced by religious beliefs or ethnicity, residence in specific geographic or administrative areas, refugee or migrant status etc. Include high-risk groups here even though supplementary activities may have been implemented to improve coverage in these groups – these activities should be reported in the text box under **1.4.5 c. Qualitative assessment of SIA**. If details about these populations are not available, please note in the last column (Remarks) that your country is aware of the presence of these population groups.*

☐ **No high-risk population groups**

Description of high-risk population groups (please specify here)	Estimated population size	Estimated % of total population	Estimated MR vaccination coverage	Remarks
Migration	2020: ~ 867,000 persons (in 2019: 1.13 Mio) migrated to Germany; of these ~ 502,000 from EU (~ 308,000 stemming from Romania, Poland and Bulgaria)[1] 2021: First term; as of December 2021: ~ 213,000 migrating to Germany from EU[2]		No data	
Every year a considerable number of migrants come to Germany for different reasons, many from EU. Number of migrants decreased until 2020. Since the reporting system does not provide data on the migration status of the Measles and Rubella cases, the impact of people with a migration background on the epidemiology of measles and rubella is not well-understood in Germany at state and national level. In 2021 no measles cases among migrants stemming from Eastern-Europe were transmitted to RKI.				

1) Federal Office for Migration and Refugees (BAMF). Das Bundesamt in Zahlen 2020. Asyl, Migration, Integration (October 2021). Available online: https://www.bamf.de/SharedDocs/Anlagen/DE/Statistik/BundesamtinZahlen/bundesamt-in-zahlen-2020.html?nn=284738 (16.02.2022) (in German)

2) Federal Office for Migration and Refugees (BAMF): Freizügigkeitsmonitoring: Migration von EU-Bürgern nach Deutschland. Bericht für das erste Halbjahr 2021 (December 2021). Link: https://www.bamf.de/DE/Themen/Forschung/Veroeffentlichungen/BerichtsreihenMigrationIntegration/Freizuegigkeitsmonitoring/freizuegigkeitsmonitoring-node.html (10.03.2022) (in German)

Description of high-risk population groups (please specify here)	Estimated population size	Estimated % of total population	Estimated MR vaccination coverage	Remarks
Asylum Seekers and Refugees	Official data from Germany (as of January 2022):[3] New asylum seeker applications: 2015: 477,000 2016: 746,000 2017: 223,000 2018: 186,000 2019: 166,000 2020: 122,000 2021: 191,000 Asylum applications are rising again. Most applications are submitted by people from Syria, Afghanistan and Iraq. Asylum seekers are distributed by law to all federal states.		RKI/ STIKO recommends vaccination against measles (MMR1) for all asylum seekers, who were born after 1970 as soon as possible; MMR2 for children[4] Realisation of vaccinations is organized differently in federal states. Vaccination gaps are closed at reception centres or later in regular care.	
No outbreak occurred in asylum seeker's shelters and habitations as reported by local Public Health authorities in 2021, but altogether 5 cases of measles in children coming from Afghanistan were detected in Germany in 2021 (data of RKI)				
Vaccine Hesitancy	See below		See below	See below
Data of a population-based survey: Attitudes, knowledge and behavior of adults and parents against vaccinations - Results of the 2020 representative survey on infection control, published in April 2021 by the Federal Centre for Health Education. People aged 16 to 85 years were interviewed (n=5,002)[5]: Results regarding **attitude against vaccines:** • 4% (in 2018: 6%) had opposing (2%) or rather opposing (2%) attitudes towards some vaccinations in general. Results regarding **attitude against measles vaccines:** • 90% (in 2018 91%) of parents of children between 0-13 years old stated that vaccinating children against measles is (very) important. • 88% of all respondents born after 1970 (vaccination target group; 83% in 2018) believed that vaccination against measles is (very) important. • 40% (in 2018 28%) of the respondents born after 1970 had been informed about the STIKO recommendation to vaccinate adults born after 1970.				

3) Federal Office for Migration and Refugees (BAMF): Available online: Aktuelle Zahlen zu Asyl (as of January 2022). Available online: https://www.bamf.de/SharedDocs/Anlagen/DE/Statistik/AsylinZahlen/aktuelle-zahlen-januar-2022.html?nn=284722 (15.02.2022) (in German)

4) RKI/STIKO: [Vaccination concept for asylum seekers]. Available online: http://www.rki.de/DE/Content/Infekt/EpidBull/Archiv/2015/41/Art_01.html (15.02.2022) (in German)

5) Federal Centre for Health Education (BZgA): Einstellungen, Wissen und Verhalten von Erwachsenen und Eltern gegenüber Impfungen - Ergebnisse der Repräsentativbefragung 2020 zum Infektionsschutz. Available online: https://www.bzga.de/forschung/studien/abgeschlossene-studien/studien-ab-1997/impfen-und-hygiene/infektionsschutz-einstellungen-wissen-und-verhalten-von-erwachsenen-und-eltern-gegenueber-impfunge-2/ (15.02.2022) (in German)

1.4.5 Information on additional immunization activities in 2021

a. Actions taken to improve the level of immunization coverage in selected territories and/or in high-risk population groups in 2021

Actions taken at national level:

Measles Protection Act (entered in force on March 1, 2020)
https://www.bundesgesundheitsministerium.de/en/press/2019/measles-protection-act.html#c16712

- Before being accepted into child daycare facilities, schools or other community facilities, all children who are at least one year old must prove that they have received the measles vaccine recommended by the Standing Committee on Vaccination.

- Persons born after 1970 who wish to work in these facilities must also provide proof of full measles vaccine protection. The same applies to persons working in medical facilities.

- Persons living in refugee and asylum-seeker accommodation and those employed there must also be vaccinated.

- Unvaccinated children can be barred from attending child daycare facilities. Unvaccinated personnel may not be employed in community or healthcare facilities.

- Parents who fail to vaccinate their children attending community facilities can expect to be fined up to 2,500 euros. The fine can also be imposed on the management of daycare facilities that admit unvaccinated children. The same applies to unvaccinated personnel in community and healthcare facilities, as well as refugee accommodation centres and residents of the latter.

- SSPE will be a notifiable disease in Germany

- In future, all doctors (with the exception of dentists) may administer vaccines.

- Digital immunisation documentation is also to be available. Patients can also be automatically reminded of appointments for follow-up and booster shots.

- So as to enable the Public Health Services once again to increase voluntary serial vaccination in schools, the health insurance funds will be required to reach agreements with the Public Health Services on reimbursing the cost of these vaccinations.

- The Federal Centre for Health Education will be stepping up its efforts to provide information on protective vaccines. To this end, the Federal Centre for Health Education will receive an additional 2 million euros per year.

- Health insurance funds are to offer bonuses to insured persons for taking up protective vaccines and early detection measures (health check-ups and cancer screening).

- See more information: www.masernschutz.de

- **Financing of individual catch-up immunisations** is guaranteed with recommendations of the Standing Committee on Vaccination in Germany for all people born after 1970.

- **The German "National Immunisation Steering Committee**" (NaLI) suggested the following measures (process ongoing):

- Overview of regional measles data, vaccination activities, and of the regional implementation of the measles protection law on the new NaLI website www.nali-impfen.de.
- Improvement of standard vaccinations of healthcare workers (HCW); conception of online workshops for members of Health Departments, HCW and others.
- Improvement of vaccination rates of adults and adolescents, especially of women in childbearing age.
- Strengthening vaccination trainings during medical studies in Germany: In the revised "National Competence-Based Catalogue of Learning Objectives in Medicine (NKLM)", the subject "vaccination" was strengthened and expanded in the learning content of medical studies. In addition, NKLM will be a binding part of the medical licensing regulations in the future.

- **German Federal Centre for Health Education** (BZgA): In 2021, the Federal Centre for Health Education continued communication activities on vaccination against measles. These activities predominantly address young adults, adolescents and parents.
  - Regular updating and promotion of the website: www.masernschutz.de (in cooperation with Federal Ministry of Health, Robert Koch Institute, Federal Institute for Vaccines and Biomedicines); website with detailed information about the measles protection law
  - Explainer Videos about the recommendations for measles-vaccination is available online (https://www.impfen-info.de/mediathek/filme/) and YouTube
  - Power-Point-presentation designed for physicians to give lectures on benefits and risks of vaccination is published online

- Actions taken at regional level (Overview on NaLI-website: https://www.nali-impfen.de/impfen-in-deutschland/impfsituation-in-den-bundeslaendern/) (in German). Actions severely limited because of SARS-CoV-2 pandemic:

- Establishment of recall systems for vaccinations or check-ups for children and adolescents

- Facilitated access to vaccination of high-risk population groups

- Partly web-based education projects targeting children and adolescents

b. Supplemental immunization activities (SIA)

Were supplementary immunization activities with measles/rubella – containing vaccine conducted in 2020 (please check the appropriate box)?

☒ **YES** ☐ **NO**

If supplementary immunization activities were conducted, please summarize results in the table below and complete the SIA Technical Report form (Section 4.3, one for each of SIA)

SIA conducted as national or subnational	Type of SIA (e.g. catch-up, mop-up, follow-up)	Vaccine used (M, MR, MMR)	Dates (start-end)	Age range of target group	Target population size	Coverage achieved (%)
subnational	Mop-up	MMR		Born after 1970	Asylum-seekers and refugees	

Independent monitoring of SIAs is an objective measure of SIA quality. The SIA guidelines developed for injectable vaccines (using measles- and rubella-containing vaccines) can be used as a reference. These are available at http://www.who.int/immunization/diseases/measles/SIA-Field-Guide.pdf?ua=1,&ua=1

c. Qualitative assessment of SIA

According to administrative coverage and monitoring results (if done), provide qualitative assessment of SIA that was conducted. Indicate whether there were any geographic clusters and/or high-risk groups where SIA coverage was less than 90%.

Text

Section 2: Update of activities in country towards measles and rubella elimination

Please indicate in the table below any programmatic changes related to measles, rubella and CRS that took place in your country in 2020. Please describe ongoing or new activities in the country regarding CRS surveillance.

Area of work	Remarks
Strategies (considering national and WHO regional strategies; any changes or new strategies introduced)	No
Immunization requirements and schedule, routine and supplemental	No
Surveillance and reporting	Implementation of standardized possibility to notify discarded cases via the electronic surveillance system. Discussion in order to improve quality of surveillance and sensitivity of surveillance is ongoing. – Discussion of recommendations to classify measles and rubella cases at communal or regional level according to WHO to improve rate of classifications of reported measles and rubella cases – Discussion of the measles and rubella case definitions in order to record representative data about discarded cases via the electronic surveillance system for Germany and collect reliable data about measles cases with clinical symptoms, which do not meet case definitions
CRS-specific activities (ongoing and new)	No
Other	No

Section 3: Activities of the National Verification Committee (NVC) and its Secretariat

3.1 Activities of the NVC in the year under review

Please provide a brief summary of the NVC activities conducted in the year under review (you may extend your answer to include conducted and planned activities in the current year). Include key issues addressed, and list any concerns that have arisen (e.g. NVC concerns about the national programme, challenges in organizing and/or holding regular NVC meetings)

	Activity	Date (Month/Year)	Highlights	Challenges
1	15th regular meeting of the NVC (Web Conference)	4.2021	Discussion and adoption of the ASU 2020 for Germany:	Commission clearly assumes interruption of endemic transmission of measles in Germany in 2020. Expressed concern that the SARS-CoV-2 pandemic could worsen vaccination rates in Germany and that the number of cases will possibly rise again in the near future.
2	Annual report of the NVC on the status of MR elimination in Germany in 2020 has been submitted to WHO Euro in time	5.2021		

The NVC Secretariat (list of national staff involved in preparation of ASU)

	Name	Function in national health system*	Position	Organization	Contact details (e-mail, tel.)
1	**Dr Dorothea Matysiak-Klose**	Surveillance	Epidemiologist Immunisation Unit	Robert Koch Institute (RKI)	NAVKO-MR@rki.de
2	**Dr Sabine Santibanez**	Molecular Surveillance	MMR National and Regional Reference Centre	RKI	NAVKO-MR@rki.de
3	**Prof. Dr Annette Mankertz**	Molecular Surveillance	Head of MMR National and Regional Reference Centre	RKI	NAVKO-MR@rki.de
4	**Dr Anette Siedler**	Surveillance	Epidemiologist Immunisation Unit	RKI	NAVKO-MR@rki.de
5	**PD Dr Ole Wichmann**	Surveillance, National Immunization Programme	Immunization Program Manager, Head of Immunisation Unit	RKI	NAVKO-MR@rki.de

* Key national public health experts who are responsible for or involved in operational aspects of immunization programme, surveillance, measles/rubella reference laboratory and other programme areas.

Section 4: Additional data on measles, rubella and CRS in 2020

4.1 Maps and epi curves with distribution of suspected and confirmed measles and rubella cases and measles and rubella outbreaks in 2020

The RVC has noted that the collection and submission of more detailed subnational data (graphs and maps, epi curves with suspected/confirmed cases, epi curves with different genotypes) would facilitate the verification process. Therefore, if available (especially if already included in the routinely collected and analysed data) and feasible, please provide:

a) Maps with distribution of confirmed and suspected measles and rubella cases by subnational administrative territories, preferably at the level of districts or equivalent basic administrative level (or any other territorial presentation of data);

b) Epi-curves with distribution of cases (time/place).

c) Outbreak reports

If it is technically challenging to insert them into this form, please upload/send them as supplementary documents.

See Annexes:

Annex 1: Maps Localisation of cases MR Germany 2021

Annex 2: Supplementary Epidemiological data MR Germany 2021

Annex 3: Signatures of the members of NVC

Annex 1: WHO guiding documents and examples

*1.1 Definitions**

Disease elimination: the absence of endemic measles or rubella cases in a defined geographical area for a period of at least 12 months, in the presence of a well-performing surveillance system.

Verification of regional elimination: Regional elimination can be declared after 36 or more months of the absence of endemic measles or rubella in all Member States.

Disease eradication: worldwide interruption of measles or rubella transmission in the presence of a verified, well-performing surveillance system.

Endemic transmission: a chain of measles virus transmission that is continuous for ≥ 12 months within a country. To the greatest extent possible, this chain of transmission should be defined based on genotyping evidence along with epidemiological investigation. It is often the case that chains of transmission are unclear for measles, given the infectivity and mass movements of people.

Re-establishment of endemic transmission: a situation in which epidemiological and laboratory evidence indicate the presence of a chain of transmission of a measles or rubella virus variant that continues uninterrupted for a period of 12 months or more in a defined geographical area where disease was previously eliminated.

Outbreak or chain of transmission: 2 or more measles or rubella cases which are temporarily related and epidemiologically or virologically linked, or both.

Classification of cases:

Suspected measles case: a case with signs and symptoms consistent with measles clinical criteria:

- fever *and*
- maculopapular rash *and*
- cough or coryza (runny nose) or conjunctivitis (red eyes).

Suspected rubella case: a case with signs and symptoms consistent with rubella clinical criteria:

- maculopapular rash *and*
- cervical, suboccipital or post-auricular adenopathy, or arthralgia/arthritis.

***Note**: According to "Guidance for evaluating progress towards elimination of measles and rubella", Weekly epidemiological record, No. 41, 2018, 93, 541-552.*
(https://apps.who.int/iris/bitstream/handle/10665/275392/WER9341.pdf?ua=1)

***Suspected case of measles or rubella** – A patient in whom a health-care worker suspects measles or rubella infection, or a patient with fever and maculopapular (non-vesicular) rash.*

Laboratory-confirmed measles case: a suspected case that meets the laboratory criteria for measles case confirmation.

Laboratory-confirmed rubella case: a suspected case that meets the laboratory criteria for rubella surveillance case confirmation.

Epidemiologically linked measles case: a suspected case that has not been adequately tested by laboratory and that was in contact with a laboratory-confirmed measles case 7–18 days before the onset of rash.

Epidemiologically linked rubella case: a suspected case that has not been adequately tested by laboratory and that was in contact with a laboratory-confirmed rubella case 12–23 days prior to onset of the disease.

Clinically compatible measles case: a suspected case that has not been adequately tested by laboratory and has not been epidemiologically linked to a confirmed measles case.

Clinically compatible rubella case: a suspected case that has not been adequately tested by laboratory and has not been epidemiologically linked to a confirmed rubella case.

Endemic case: Confirmed case of measles or rubella resulting from endemic transmission of measles or rubella.

Imported case: a case exposed outside the country during the 7-18 days (measles) or 12-23 days (rubella) prior to rash onset as supported by epidemiological and/or virological evidence.

Import-related case: a locally acquired measles or rubella infection occurring as part of a chain of transmission originating in an imported case, as supported by epidemiological and/or virological evidence. (Note: if transmission of import-related cases persists for 12 months or more, cases are no longer considered as import-related but as endemic).

Unknown origin case: A confirmed measles or rubella case for which no epidemiological or virological link to importation or endemic transmission can be established after a thorough investigation.

Discarded case: a suspected case that was investigated and discarded, either through negative results of adequate laboratory testing for measles and rubella or by an epidemiological link to a laboratory-confirmed case of another disease; in addition, IgM-positive cases in recent vaccine recipients can be discarded if they meet all of the following criteria:

- history of vaccination with relevant vaccine 7 days to 6 weeks prior to specimen collection;
- onset of rash 7−14 days after vaccination;
- no evidence of virus transmission revealed by active search in community;
- no history of travel to areas in which the virus is known to be circulating.

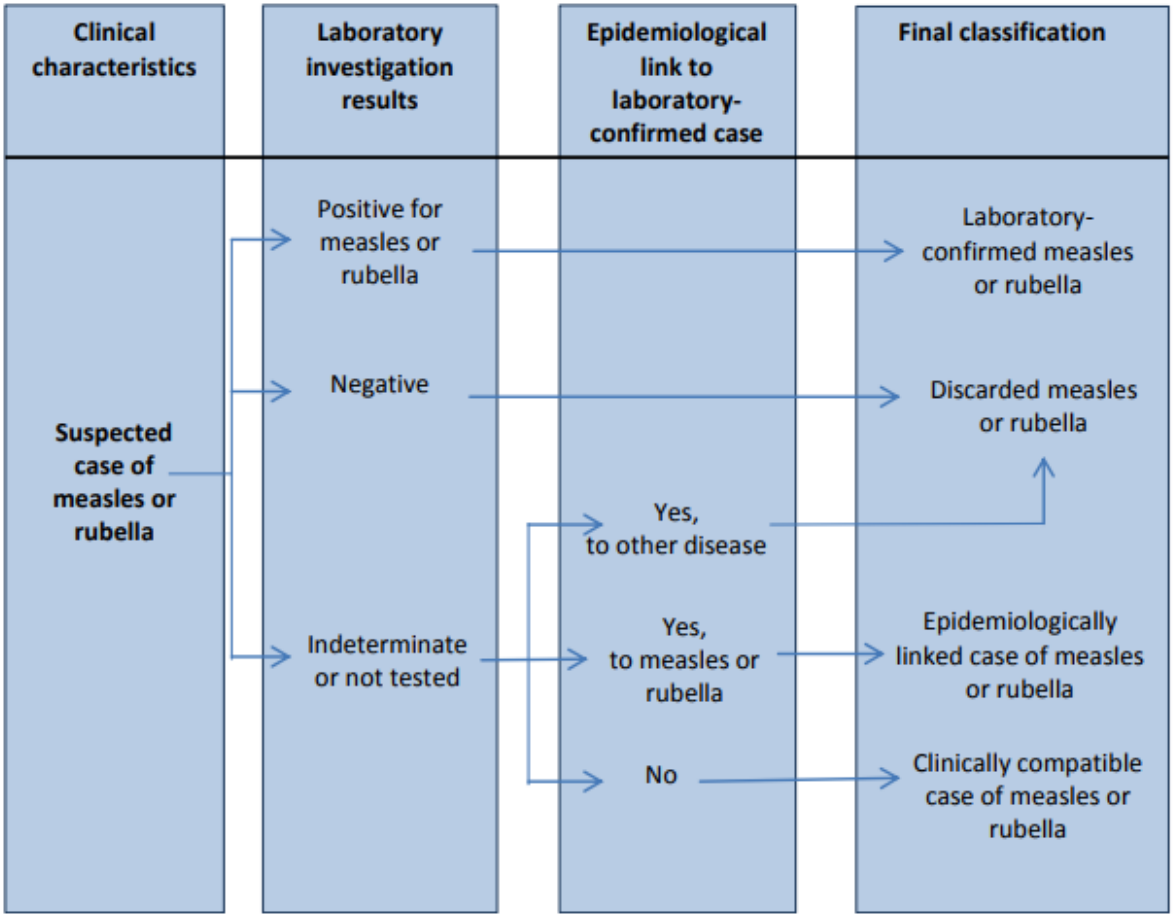
Genotype: Operational taxonomic unit defined on the basis of nucleotide variation between viral strains. Measles virus genotypes are defined on the genetic analysis of the N-450 sequence, which is the most variable region of the measles virus genome. Rubella virus genotypes are defined on genetic analysis of the E1- 739 sequence.

MeaNS Distinct Sequence ID (measles only): is a 4-digit identifier assigned to a given N-450 sequence in MeaNS database, in addition to its unique identifiers (Sample ID and Sequence ID). All the identical N-450 sequences will harbour the same MeaNS Distinct Sequence ID, while having different Sample IDs and Sequence IDs. Some of the Distinct Sequence IDs will be assigned a named strain (see examples below). genotype, distinct seq ID and when available, named strains, are the data expected in tables 1.1.4.1 c and d.

Named strain (measles only): Measles virus variant specifically identified in MeaNS as a representative N-450 sequence due to its important prevalence within the database (usually associated with widespread transmission). It allows describing viral diversity with finer resolution within a single genotype. Examples of named strains are shown below.

MeaNS ID	WHO name	Genotype	Distinct Seq ID	Named Strain
139793	MVs/Derby.GBR/19.19/	B3	**4298**	MVs/Kabul.AFG/20.2014/3
144562	MVs/Reading.GBR/2.20/	B3	**6254**	*no named strain for this Distinct Seq ID*
144929	MVs/London.GBR/5.20/	D8	**4683**	MVs/Gir Somnath.IND/42.16/
135047	MVs/Harrow.GBR/3.19/	D8	**5676**	*no named strain for this Distinct Seq ID*

Case classification algorithm for measles and rubella



**Definitions are based on:*

Surveillance Guidelines for Measles, Rubella and Congenital Rubella Syndrome in the WHO European Region - Update December 2012
http://www.euro.who.int/__data/assets/pdf_file/0018/79020/e93035-2013.pdf?ua=1

Eliminating measles and rubella. Framework for the verification process in the WHO European Region
http://www.euro.who.int/__data/assets/pdf_file/0009/247356/Eliminating-measles-and-rubella-Framework-for-the-verification-process-in-the-WHO-European-Region.pdf?ua=1

World Health Organization. Vaccine-preventable Diseases Surveillance Standard. Measles.2018
https://www.who.int/immunization/monitoring_surveillance/burden/vpd/WHO_SurveillanceVaccinePreventable_11_Measles_R2.pdf?ua=1

World Health Organization. Vaccine-preventable Diseases Surveillance Standard. Rubella. 2018
https://www.who.int/immunization/monitoring_surveillance/burden/vpd/WHO_SurveillanceVaccinePreventable_20_Rubella_R2.pdf?ua=1

1.2 Description of "Indicators and targets" for measuring performance of measles and rubella surveillance

Indicator	Description	Target and Notes
Timeliness of reporting (to national level) (T)	**Percentage** of measles or rubella routine surveillance reports [a] submitted to the national level by the deadline [b]	**Target: ≥80%**
Example:	**A** Number of reports submitted by the deadline **B** Number of expected reports	***T=(A*100)/B (%)***
Completeness of reporting (to national level) (C)	**Percentage** of measles or rubella routine surveillance reports[a] submitted to the national level	**Target: ≥80%**
Example:	**E** Number of submitted reports **B** Number of expected reports	***C=(E*100)/B (%)***
Rate of laboratory investigations (L)	**Percentage** of cases suspected for measles or rubella with adequate specimens[c] collected and tested in a WHO accredited or proficient laboratory[d] *Note: **Exclude** from the denominator any suspected cases not tested by a laboratory and (a) confirmed by epidemiological linkage, or (b) discarded as non-measles/non-rubella by epidemiological linkage to a laboratory-confirmed case of another communicable disease or epidemiological linkage to a measles or rubella IgM-negative case*	**Target: ≥80%**
Example:	**F** Number of suspected measles or rubella cases with adequate specimens collected and tested in a proficient laboratory **G** Number of suspected cases	***L=(F*100)/G (%)***
Rate of discarded cases (D)	**The rate** of suspected measles or rubella cases investigated and discarded as non-measles or non-rubella cases using laboratory testing in a proficient laboratory and/or epidemiological linkage to another confirmed disease	**Target:** At least 2 discarded measles or rubella cases per 100 000
Example:	**H** Number of suspected measles or rubella cases investigated and discarded as non- measles or non-rubella cases **J** Population	***D=(H*100 000)/J***
Representativeness of reporting discarded cases (R)	**Percentage** of subnational administrative territories (e.g. at the province level or its administrative equivalent) reporting the rate of discarded cases (D) at least 2 per 100 000 population per year	**Target: ≥80%**
Example:	**K** Number of subnational administrative territories reporting the rate of discarded cases (D) at least 2 per 100 000 population per year **M** Number of subnational administrative territories	***R=(K*100)/M (%)***
Viral detection (V)	**Percentage** of laboratory-confirmed chains of transmission of measles or rubella with samples adequate for viral detection collected and tested in an accredited laboratory[e]	**Target: ≥ 80%**
Example:	**P** Number of chains of transmission of measles or rubella for which adequate samples have been submitted for viral detection / genotyping **Q** Number of chains of transmission identified	***V=(P*100)/Q (%)***
Origin of infection identified (O)	**Percentage** of measles or rubella cases for which the origin of infection (e.g. imported, import-related or endemic) has been identified	**Target: ≥ 80%**
Example:	**W** Number of measles or rubella cases for which the origin of infection (e.g. imported, import-related or endemic) has been identified **X** The total number of measles or rubella cases	***O=(W*100)/X (%)***
Timeliness of investigation (I)	**Percentage** of suspected measles or rubella cases with an adequate investigation [f] initiated within 48 hours of notification	**Target: ≥ 80%**
Example:	**Y** Number of measles or rubella cases with an adequate investigation **Z** Number of suspected measles or rubella cases, respectively	***I=(Y*100)/Z (%)***

[a] Regular monthly or weekly reports, including "zero" reports to be submitted by each surveillance reporting unit to national level. This does not refer to lab reporting of cases.

[b] The deadline to submit data on the previous months or week to be defined by Member State

[c] A single clinical sample obtained at the first contact with the health-care system at any time within 28 days after rash onset is considered adequate for surveillance purposes.

[d] Laboratory that is WHO accredited and/or has an established quality assurance programme with oversight by a WHO accredited laboratory.

[e] Measles and rubella viruses can be detected in nasal secretions, urine, serum and whole blood, and dry blood spots up to seven days after onset of the rash and in oral fluid for even longer.

[f] An adequate investigation includes the collection of at least the following essential data elements from each suspected measles/rubella case: case identifier, age (or date of birth), date of rash onset, date of specimen collection and vaccination status. Countries may wish to collect other data that may be important for epidemiologic investigation

Alternative indicators

The following two indicators should be used by countries that are unable to report standard indicators on timeliness of reporting and/or rate of discarded cases as described above.

Timeliness of notification (Tn)	**Alternative to Timeliness and Completeness of reporting** **Percentage** of measles or rubella case-based reports to surveillance system submitted within 48 hours of the rash onset	**Target: ≥80%**
Example:	A Number of reports submitted within 48 hours B Number of suspected cases	***Tn=(A*100)/B (%)***
Rate of cases tested negative for measles or rubella IgM (N)	**Alternative to Rate of discarded cases** **The rate** of cases of measles or rubella-like illnesses (MLI/RLI) whose specimens tested IgM negative in a proficient laboratory	**Target:** At least 2 MLI/RLI cases tested negative per 100 000 population (nationwide)
Example:	A Number of measles or rubella cases tested negative for measles or rubella IgM B Population	***N=(A*100 000)/B***

1.3 Sustaining measles and rubella elimination after verification - Discussion points on risk of re-establishing endemic transmission of diseases

Countries verified by the RVC as having achieved interruption of endemic measles and rubella transmission for a period of 36 months should assess their risks for re-establishing endemic transmission of diseases. Recognizing that the risk of importation will exist as long as measles and rubella viruses are present and circulating in other countries, each **national public health system's priorities are high immunity of the population, sensitive surveillance system and established conditions and capacities for prompt and comprehensive outbreak response.**

Below is a list of possible challenges and suggestions for sustaining elimination status, developed based on recognized and reported situations in countries. It is not a comprehensive list of all issues and it is not intended to be used as a tool with measurable indicators or thresholds. We expect that the National Verification Committee and national technical staff (the NVC's Secretariat) will use it to review whether these challenges are present in the country; whether they are recognized and being addressed, or whether there is a plan to address them; and what role the NVC can play or is playing in supporting the national public health system dealing with these issues, with expected technical inputs from and involvement of the national technical advisory bodies and structures.

Immunity/susceptibility of population

- National immunization programme performance in recent years and routine immunization coverage
  - Monitor rates and trends related to coverage, timelines of immunization (according to age-specific recommendations), and potential variation in coverage per vaccine dose (due to implementation, availability, acceptance or other reasons) with first and/or second dose.
  - Define the most affected by suboptimal coverage or downward trends (e.g. territories, populations, minorities/ethnic groups, social-economic groups).
  - Clarify the main reasons for this situation, list ongoing and planned activities to deal with this situation and discuss further and additional steps (benefits of intervention in policy segment, influencing decision-makers, or addressing the public) to reach/keep coverage at 95% or higher with both doses.

- Susceptible population among adolescents and adults
  - Review available data or estimate the size of the susceptible population among adolescent and adults (not immunized or immunized with just one dose due to absence of immunization programme, different requirements and schedule, gaps in vaccine supply) and any supplemental immunization activity taken or planned (army service, university entry requirements, for specific occupations or work in health and educational system, for international travel etc.)
  - Review possibility of aggregation of susceptible individuals or possible increased contacts among susceptible individuals due to social or family relations (economic migration, education institutions, family of susceptible adults and newborns, parents and children contacts in kindergartens).
  - Review internal (inside country) migration and moving of susceptible individuals (countries with historical difference in immunization programme for different territories, or with different coverage at different subnational territories).
  - Identify the proportion of adolescents and adults who are born in other countries and who were immunized according to immunization programmes of those countries, and review their immunization programmes (coverage may be higher or lower, immunization and two-dose schedule introduced earlier or later than in your country).

- Specific subgroups of population with low immunization coverage or that are not immunized
  - Identify all such groups and the reasons for their low immunization coverage (access, denial, refusal, poor services). Have adequate steps and strategies to address their needs been taken, or planed?
  - If needed, plan additional activities to better define these groups and the best approach to increase their coverage.

Surveillance

- High sensitivity of health care system/health care workers to measles/rubella/CRS in absence of diseases
  - Check whether health care workers (HCW) are trained and systematically reminded to stay vigilant and suspect measles/rubella/CRS, through diseases-specific reporting, or syndromic surveillance, or as part of programmes for surveillance and reporting of congenital malformation. If some challenges are recognized, check whether specific actions are conducted and planned, and if not, plan for actions to be discussed.
- Adequate quality of surveillance
  - Assess reliability and adequacy of diseases surveillance against global measles and rubella surveillance indicators. If global surveillance indicators are not implementable or are incompatible with the current health system structure and procedures, other indicators should be considered in order to assess quality of surveillance. A high-quality surveillance is the one that have every suspected case of measles, rubella and CRS (appearing anywhere in the country during the year) reported, investigated and confirm or discard.
  - Ensure that all segments of surveillance (clinical, epidemiological and laboratory) are coordinated and cooperate, and that every suspected case is investigated adequately and timely to identify details of genotype and lineages of the viruses.
- Ensure that surveillance data are systematically used and analysed to detect and define susceptible individuals and groups, and that adequate measures to immunize them are taken/planned.

Outbreak response

- Ensure that lessons learned from previous outbreaks are/will be used to improve outbreak response.
- Check that all stakeholders understand that an outbreak is an emergency and its control is a high priority.
- Check that all requirements for adequate, timely response are in place, including
  - legislation allowing timely intervention;
  - up to date technical guidelines and protocols;
  - health care workers and all other critical participants in outbreak response are trained and aware of their role and responsibility;
  - sufficient resources (financial, human, vaccine, logistics) are or can quickly become available in short period,
  - prepared and trained advocacy and communication teams who have developed materials, messages and tailored ways of communication (different for different target populations);
  - planned and prepared cooperation with partners (governmental sectors, private sector, NGOs, donors, media).
- Use outbreak analysis systematically to define susceptible individuals and undertake adequate measures to immunize them to prevent similar events in future.