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**Wales Measles and Rubella
Elimination Task Group
Action Plan 2019-2021**

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Executive Summary

Measles is a serious illness that was once a common childhood infection in Wales. Before vaccination began in the UK in 1968, almost every child caught measles and around 100 died from the infection each year. Rubella was also once endemic. This action plan aims to help continue to keep children in Wales safe from measles, rubella and mumps.

Children in Wales have been offered vaccination against measles for over 50 years, and it is over 30 years since the Measles Mumps and Rubella (MMR) vaccine programme was introduced. It is estimated that the UK vaccination programme has prevented 20 million cases and 4,500 deaths from measles, and 1,300 Congenital Rubella Syndrome births and 25,000 terminations.

Eliminating measles and rubella forms part of European and global plans to improve health and reduce inequalities. In 2017 the WHO confirmed that Wales and the UK had eliminated the circulation of measles based on data for 2014-2016, following confirmation in 2016 of the elimination of rubella in the UK. That significant achievement was the result of the efforts of many professionals delivering NHS services and achieving high vaccine uptake, and high levels of trust by parents in those professionals. However in 2019 WHO reported that UK measles elimination status has been lost due to measles circulation becoming re-established in 2018. Measles and rubella remain endemic in many other countries, so the diseases remain a threat to people in Wales.

To be confident of maintaining elimination Wales must aim to achieve 95% uptake of a full two dose course of MMR by the fifth birthday. Currently uptake in Wales at five years of age is 97% for one dose of MMR and 92% for two doses. In school age children aged 5-16 years uptake of one dose of MMR was above 95% except at 15 and 16 years and for two doses below 95% in all school years. Welsh data suggest young people born between 1995 and 2004 (aged 16 to 24 years in 2019) are the most susceptible. Inequalities are seen in vaccine uptake by deprivation and area of residence.

This action plan is based on a comprehensive expert review and makes recommendations for system-wide interventions and identifies actions that will support achieving a high uptake of MMR vaccination. It also recommends a catch up programme in schools, and in general practice for young people 16-24 years of age. In order to achieve and maintain elimination of measles and rubella and control of mumps action needs to be taken during 2019-21 by those who lead and deliver immunisation services in Wales.

Introduction

In Wales the first routine vaccinations against measles were introduced in 1968 and against rubella in 1970. The introduction of measles, mumps and rubella (MMR) vaccine for infants in 1988 and a second pre-school dose in 1996, with three national catch up campaigns over three decades alongside the continued efforts of local NHS services, have made these once common childhood infections extremely rare in Wales today.

Mortality from measles has fallen globally since the first introduction of measles containing vaccines in the 1960s as a result of significant national and international initiatives to improve the availability of free vaccination. However, measles still causes more than 100,000 deaths worldwide each year, and remains a threat to the population of Wales. Elimination of measles and rubella is now a global aspiration.

This report describes the progress made so far in Wales, and sets out recommendations to ensure the continued elimination of measles and rubella, and the control of mumps.

Elimination of measles and rubella

Measles is a serious disease caused by one of the most infectious viruses known. A range of complications can follow measles infection including pneumonia (up to 1 in 17 cases), convulsions (1 in 200 cases), encephalitis (1 in 1,000 cases) and the fatal degenerative brain condition sub-acute sclerosing pan-encephalitis.¹ It is estimated that one death occurs for every 5,000 cases in the UK.² An estimated 20 million cases and 4,500 deaths have been prevented in the UK since the introduction of measles vaccination in 1968.³

Rubella is a viral infection that usually causes mild illness, but can result in serious complications including thrombocytopenia (1 in 3,000 cases) and encephalitis (1 in 6,000 cases). If infection occurs during pregnancy rubella can cause fetal loss and Congenital Rubella Syndrome (CRS) involving a range of birth defects including blindness, deafness, cardiac abnormalities and inflammatory lesions in the brain.¹ Vaccination against rubella is estimated to have prevented 1.4 million cases of rubella and to have averted 1,300 CRS births and 25,000 terminations in the UK.³

Following the success of efforts to eliminate polio, it is a core goal of the World Health Organisation's (WHO) European Vaccine Action Plan 2015 – 2020 to

¹ Ramsay M (Ed) (2017) Immunisation against infectious disease. London: Public Health England, 209. (Available at <https://www.gov.uk/government/collections/immunisation-against-infectious-disease-the-green-book>, accessed 01/07/2019)

² Miller CL (1985) Deaths from measles in England and Wales, 1970–83. *BMJ* 290(6466): 443–4.

³ UK Measles and Rubella Elimination Strategy 2019. London: Public Health England, 11. (Available at <https://www.gov.uk/government/publications/measles-and-rubella-elimination-uk-strategy>, accessed 01/07/2019)

eliminate transmission of measles and rubella from Europe by 2020.⁴ All European member states have signed up to this goal. Elimination of both of these diseases is possible as there is no animal or environmental reservoir for the viruses, we have accurate diagnostic tests, and safe and highly effective vaccines are widely available. Based on UK data from 2014-2016 WHO Europe reported in 2017 that the UK was one of 31 European member states to have eliminated endemic transmission of measles and rubella.⁵ However in 2019 WHO determined that elimination status for measles in the UK had been lost due to re-established circulation of measles for more than 12 months during 2017-2018.

Ensuring high levels of uptake of two doses of MMR in the population is the most effective way of eliminating these diseases. The WHO recommend that countries achieve at least 95% coverage with two routine doses of measles containing vaccine (or measles-rubella containing vaccine as appropriate) in each district and nationally.⁶ The combined MMR vaccine is a very effective, safe and affordable vaccine. The effectiveness of a single dose of MMR is around 90% against measles, 95-100% against rubella and 61-91% against mumps.¹ In Wales ensuring that coverage of two doses of MMR vaccine exceeds 95% in children by school entry is key in eliminating transmission and preventing outbreaks. Maintaining coverage levels above 95% in all school-aged children and making catch-up immunisation available to young people who did not receive two doses in childhood are also essential.

Although there is currently no endemic transmission of measles or rubella in Wales, there remain outbreaks caused by imported disease. While coverage of two doses of MMR vaccine falls short of 95% in some areas, and pockets of unvaccinated individuals vulnerable to measles remain, the potential for outbreaks following imported cases will continue. The risk of larger outbreaks will increase as the number of unvaccinated individuals accumulates, and previous experience from the UK has shown that if MMR coverage falls measles can again become endemic.⁶

Measles and rubella elimination task group

In response to the continued challenges of measles and rubella control and elimination the Public Health Wales Vaccine Preventable Disease Programme convened a Measles and Rubella Elimination Task Group (METG). With a broad membership of individuals with key expertise from across NHS Wales its remit was

⁴ European Vaccine Action Plan 2015-2020 (2014). Copenhagen: WHO Regional Office for Europe. (Available at: <http://www.euro.who.int/en/health-topics/disease-prevention/vaccines-and-immunization/publications/2014/european-vaccine-action-plan-20152020-2014>, accessed 01/07/2019)

⁵ Sixth meeting of the European regional verification commission for measles and rubella elimination (2017). Copenhagen: WHO Regional Office for Europe. (Available at: <http://www.euro.who.int/en/health-topics/communicable-diseases/measles-and-rubella/activities/regional-verification-commission-for-measles-and-rubella-elimination-rvc>, accessed 01/07/2019)

⁶ Azaria P, MacMahon E (2006) Measles in the United Kingdom: can we eradicate it by 2010? *BMJ* 2006;333:890. (Available from: <https://doi.org/10.1136/bmj.38989.445845.7C>, accessed 01/07/2019)

to examine system-wide factors which will lead to improved control of measles, rubella and mumps in Wales, in particular through improving and maintaining high levels of MMR vaccination coverage.

The METG membership represented all health boards and organisations with key roles in the control of infectious disease Wales. A similar group was convened in 2004-05 and its report formed the basis of recommendations incorporated into Welsh Health Circular WHC 2005 081, which has provided a reference point for NHS policy for follow up of children who missed MMR since that time.

In January 2019 the UK Measles and Rubella Elimination Group, which included representation from Public Health Wales, published a UK strategy.³ It identified four core components for maintaining elimination of these diseases:

- 1. Achieve and sustain $\geq 95\%$ coverage with two doses of MMR vaccine in the routine childhood programme (<5 years old)*
- 2. Achieve $\geq 95\%$ coverage with two doses of MMR vaccine in older age cohorts through opportunistic and targeted catch-up (>5 years old)*
- 3. Strengthen measles and rubella surveillance through rigorous case investigation and testing $\geq 80\%$ of all suspected cases with an Oral Fluid Test (OFT)*
- 4. Ensure easy access to high-quality, evidence-based information for health professionals and the public*

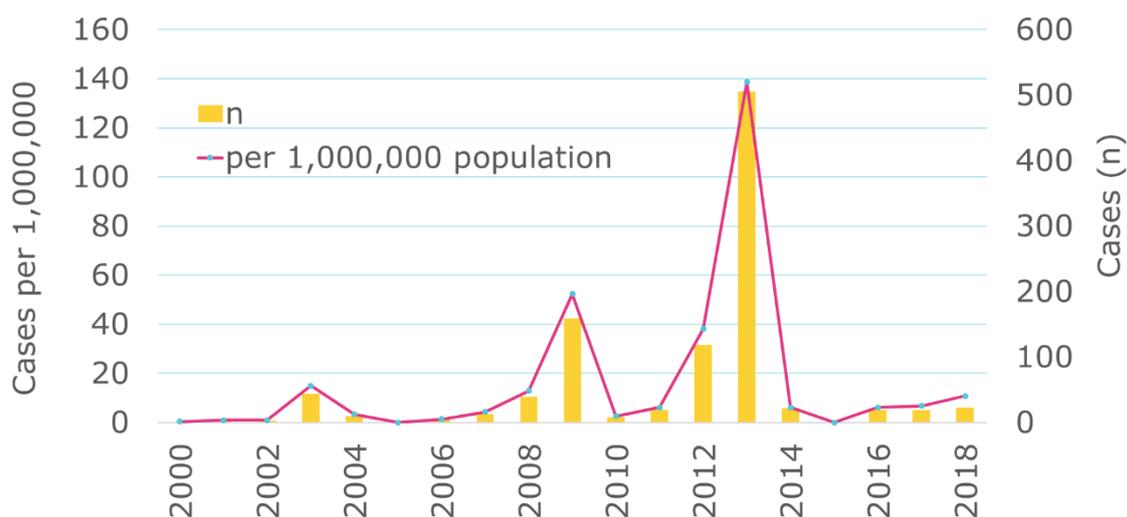
This report from the Wales METG sets out recommendations and actions for achieving the four core components of the UK strategy, which in turn supports the WHO European Vaccine Action Plan 2015-20.

Measles and Rubella in Wales 2000-2018

From 2000 to 2008 there were low numbers of measles cases confirmed in Wales, mainly related to small outbreaks. In 2005-06 a national MMR catch up campaign was undertaken for those age 11-25 years, delivered through secondary schools, general practices, colleges and universities in Wales (WHC 2005 081). In total 126,657 secondary school pupils in 293 schools were identified who had missed either one or both doses of MMR, and of these 53,708 (42.4%) individuals received one or more doses of MMR. In addition 7,112 students in colleges and universities were also given MMR. In total 60,820 children and students were immunised with one or more catch up doses of MMR during the campaign.

In 2008-09 measles incidence increased before falling again in 2010-11. There was a marked increase in cases of measles in Wales in 2012-13 and a very large outbreak centred on Swansea and surrounding areas (Figure 1).

Figure 1 Confirmed cases of measles in Wales 2000-2018

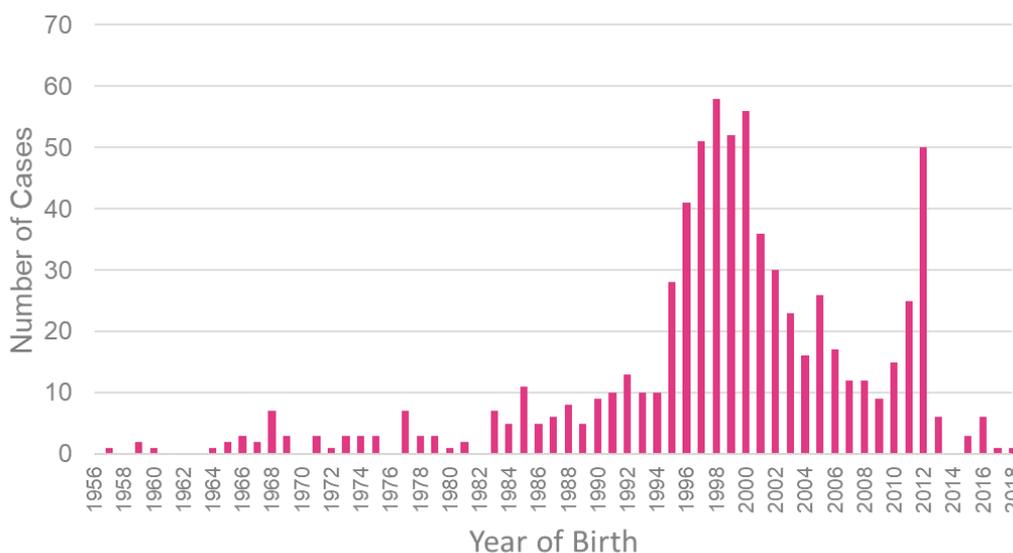


During the 2012-13 outbreak there were 1,211 reported cases of measles (437 confirmed). The outbreak mainly affected school children (median case age 13.5 years). It resulted from the importation of measles into an area with large numbers of susceptible children and teenagers following years of sub-optimal uptake of MMR vaccination in that area. The accumulation of susceptible children and teenagers was a legacy of vaccine hesitancy following publication in 1998 of flawed, discredited and since retracted research claiming a link between MMR and autism. There was intense adverse media coverage of that publication that peaked in 2002. Within the Swansea area there were additional anti-MMR campaigns, widely publicised by a local newspaper. Although policy and local interventions had helped improve public confidence and uptake of scheduled MMR vaccinations, many of those who missed scheduled vaccinations during 1997-2003 remained unvaccinated.

In order to control the outbreak, and reduce the potential for future outbreaks, a national MMR catch-up campaign was conducted in 2013. This campaign was targeted at schoolchildren through school immunisation sessions, but offered MMR vaccine to others through general practices and ad-hoc community clinics, including prisoners and health care workers. The catch-up delivered an additional 77,805 MMR vaccination doses in total.

Figure 2 shows that those most likely to catch measles in Wales between 2010 and 2018 were born from 1995 to 2004, corresponding with the cohort scheduled to receive MMR affected by the decline in MMR uptake during the height of the adverse media coverage, aged 16 to 24 years in 2019. Analyses suggest that current population immunity levels are well below those required to interrupt measles transmission in many birth cohorts and confirm young people born between 1998/99 and 2003/04 (aged 16 to 21 years in 2019) are the most susceptible.³ Those too young to be routinely vaccinated can also be at risk during outbreaks, and the spike of cases in children born in 2012 indicates those infected in the 2012-13 measles outbreak who were too young to have received routine vaccination at the time.

Figure 2 Confirmed cases of measles in Wales 2010-2018, by year of birth



Since 2013 there have been low numbers of confirmed measles cases in Wales (Table 1). Cases were generally associated with small outbreaks in which most cases were older children, teenagers and young adults.

Table 1 Confirmed cases of measles in Wales 2014–2018, median, oldest and youngest ages

Year	2014	2015	2016	2017	2018
Cases (n)	22	0	19	19	23
Median age (y)	16	-	15	11	20
Youngest case (y)	5	-	0	0	0
Oldest case (y)	49	-	52	29	55

Recent outbreaks of measles in Wales have been small and followed importations of cases from other parts of the UK or Europe. There has only been limited onward spread, reflecting current high levels of population MMR coverage and rapid local outbreak control responses.

Rubella is currently very well controlled due to the introduction of rubella vaccination programmes in girls in 1970 and MMR universally in 1988. Since 2001, annual incidence of confirmed cases in the UK has been below one per million population. The last confirmed case of rubella in Wales was in 2005 and since then there have been low numbers of suspected cases notified annually, with none confirmed by testing. Screening for rubella susceptibility in pregnant women ceased in 2016 and was replaced with identifying those not fully immunised and offering MMR.

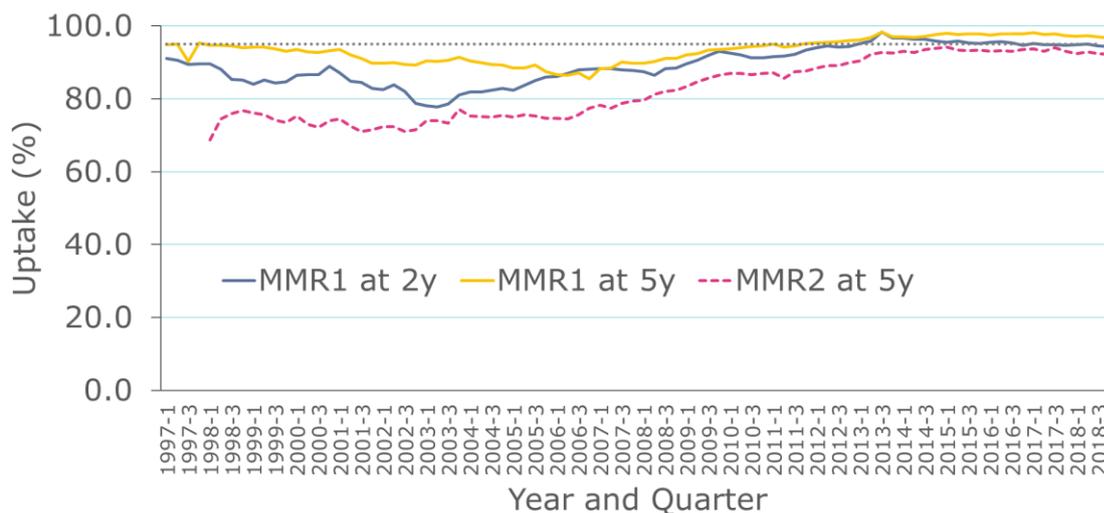
Cases of mumps fell to low levels in Wales during the 1990s, but rose again in the mid-2000s with outbreaks affecting secondary schools, universities and colleges. Mumps currently remains endemic at low levels in Wales, with notified cases below 10 per 100,000 population from 2014-18 with most confirmed cases aged 15-24 years.

MMR vaccination coverage

Coverage of MMR vaccination in children and teenagers in Wales is amongst the highest in Europe, but still falls short of the 95% target for both doses of MMR. As at the end of 2018, coverage of one MMR dose in children by their second birthday was 94%. By age 5 coverage of one MMR dose was 97%, and uptake of the complete two dose course was 92% (Figure 3).⁷ The improvement in coverage of the first dose of MMR in children seen between their second and fifth birthdays demonstrates the importance of routine catch-up and suggests that timeliness of vaccination and hesitancy, rather than vaccine refusal, is currently more significant as an issue in Wales.

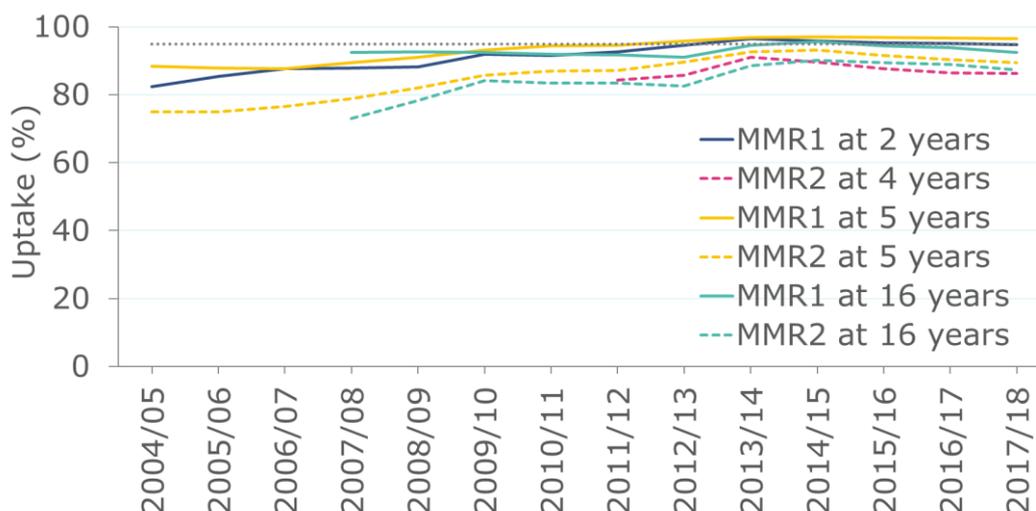
⁷ Public Health Wales Health Protection Division. Vaccine uptake in Children in Wales, October to December 2018: COVER report 129, March 2019. Cardiff: Public Health Wales. (Available at: <http://www.wales.nhs.uk/sites3/page.cfm?orgid=457&pid=54144#1> , accessed on 01/07/2019)

Figure 3 Quarterly reported coverage of MMR vaccination in Wales, in children reaching their 2nd and 5th birthdays, from 1997 to 2018 (dotted line indicates 95%)



In addition to ensuring high levels of MMR coverage in children prior to school entry, maintaining adequate coverage in schools also remains a priority, and Wales has also seen improvements in coverage in school age children over recent years (Figure 4).

Figure 4 Reported coverage of MMR vaccination in Wales, in children reaching their 2nd, 4th, 5th and 16th birthdays from 2004/05 to 2017/18 (dotted line indicates 95%)

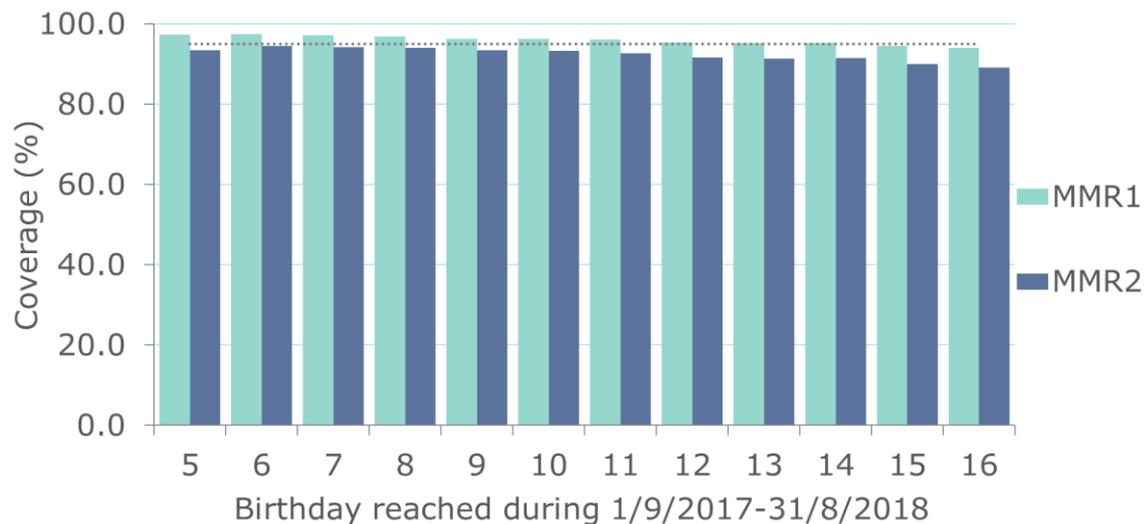


During the 2017-18 school year in Wales, there were 16,657 children (3.9%) aged five to 16 who had not received MMR vaccine.⁸ There were a further 14,861 (3.5%) who had only received one dose. Coverage of one dose of MMR was above 95% across school-year age groups except at the 15th and 16th birthdays. Coverage of

⁸ Public Health Wales Health Protection Division. MMR coverage in school-aged children in Wales Annual report 2017/18, April 2019. Cardiff: Public Health Wales.

two MMR doses was below 95% in all age groups, and coverage decreased with increasing age (Figure 5).

Figure 5 Coverage of MMR1 and MMR2 in school children, by age reached during the 2017-18 school year, as at January 2019 (dotted line indicates 95%)



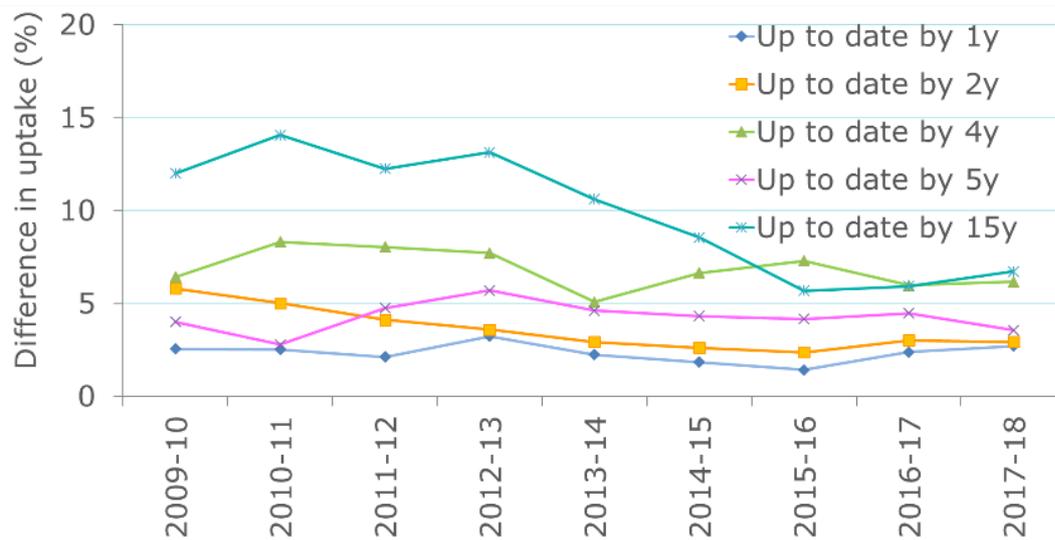
Although the majority of children who were missing routine vaccinations in 2012-13 have since caught up, there remain a significant number of older children and teenagers in Wales who are vulnerable to measles. In 2016 it was estimated that more than 22,000 children and young people aged five to 16 years were susceptible to measles infection in Wales, mainly though not having been vaccinated. The highest numbers of unvaccinated were teenagers. As young people approach adulthood, the opportunities for ensuring catch-up reduce. The complications of measles are more frequent in adults

Equity of vaccination

MMR coverage is not equitable across the population of Wales, with measurable differences in uptake between socioeconomic groups.⁹ Coverage and timeliness of uptake are lowest in areas of highest socioeconomic deprivation. The equity gap between uptake in areas of high and low deprivation increases for vaccines scheduled at older ages (Figure 6). However there has been progress since 2012-13 in narrowing the gap. Catch-up, both routine and in response to outbreaks, routine vaccination status checks including in older children and teenagers, and offering vaccination for older children and teenagers in school settings are key in reducing inequities.

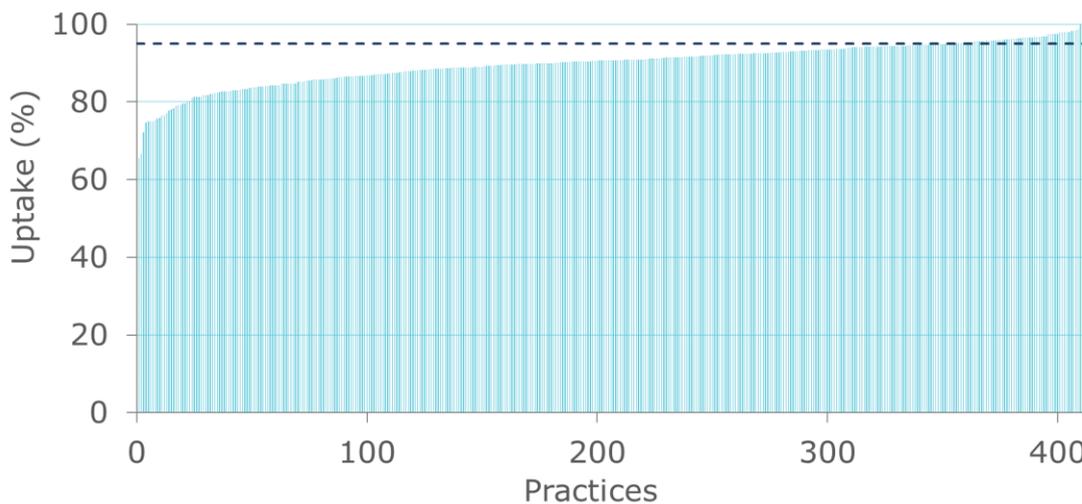
⁹ Public Health Wales Health Protection Division. Inequalities in uptake of routine childhood immunisations in Wales 2017-18, July 2018. Cardiff: Public Health Wales (Available at: <http://www.wales.nhs.uk/sites3/page.cfm?orgid=457&pid=54144#inequalities>, accessed on 01/07/2019)

Figure 6 The additional percentage of children who were up to date with routine vaccinations, by relevant birthdays, in the least deprived areas of Wales compared to the most deprived



Although uptake of two doses of MMR by five years of age is high in most general practices and very high in some, it remains below 95% for the majority of practices in Wales (Figure 7). There is a need to improve timeliness of vaccination in some general practices and provide effective catch-up in secondary school settings.

Figure 7 Uptake of two doses of MMR vaccine in Welsh general practices in children reaching their 5th birthday during October 2017 to September 2018 (dotted line indicates 95%)



Interventions reviewed

The METG worked under agreed terms of reference and established six sub-groups to systematically examine NHS systems and processes. The aim was to propose improvements with the potential for universal implementation by existing services.

The sub-groups systematically reviewed potential areas for intervention using an agreed template and also referred to existing NICE guidance on improving uptake. As part of the NICE review a health economics assessment showed that, because measles is such an infectious disease with significant morbidity and mortality, even relatively intense interventions to prevent measles, such as the follow up of those who have missed immunisation, is a highly cost effective use of NHS resources.¹⁰

The six sub-groups were:

1. Pre-school children and pregnancy
2. School aged children
3. Young people age 16-25
4. NHS occupational health
5. Case and outbreak management
6. Epidemiology and surveillance

Each sub-group systematically reviewed 16 areas:

- A. Map existing pathways of care or management (flowchart if possible)
- B. Optimising routine immunisation processes
- C. Management of children who have missed MMR
- D. Identification of groups with poor uptake or pockets of susceptible individuals
- E. Information Systems used and any identified shortfalls (Practices and Child Health)
- F. Training requirements
- G. Professional communications
- H. Monitoring outcomes for action at Cluster and HB level
- I. GP contractual issues (GMS)
- J. Role of nurseries and educational establishments
- K. Public information and publicity materials
- L. Media and communication
- M. Knowledge gaps
- N. Miscellaneous issues
- O. Professional guidance and standards
- P. Wider Public Health issues

¹⁰ National Institute for Clinical Excellence. PH21 Immunisations: reducing differences in uptake in under 19s. Section 3.16 (Available at: <http://www.nice.org.uk/guidance/ph21/resources/guidance-reducing-differences-in-the-uptake-of-immunisations-pdf>, accessed 01/07/2019)

Major themes of the review

Several overarching themes can be identified that will be significant factors in the control of measles, rubella and mumps over the coming years.

Inequalities

Significant progress has been made over the last decade in reducing inequalities in uptake in children in Wales, through the efforts of individual practitioners and through service improvements. However, socioeconomic and geographical inequalities remain a challenge.

People affected by misinformation about MMR

For a decade following adverse publicity surrounding since discredited research claiming a link between MMR vaccine and autism, many children missed receiving MMR in infancy and pre-school because of residual parental concern. Those individuals are now aged around 16-24 years, and the NHS has a time-limited opportunity to improve uptake in this group.

Hesitancy

The WHO has identified vaccine hesitancy among the top ten threats to global health.¹¹ There is some evidence this is currently affecting uptake in Wales, and its impact may increase. Resources exist to address parents' needs by training healthcare professionals in enhanced approaches to communication.

Research

The UK is a leader in research supporting immunisation programmes which has had a significant impact on disease control. Wales has unique data resources which provide opportunities to play a larger part in the research agenda.

Global progress towards eradication

Significant progress has been made in improving provision of immunisation globally, and WHO report that 85% of children now receive basic infant immunisations, including MR or MMR vaccine.¹² Along with national and international efforts to provide supplementary immunisation activities this has resulted in the elimination of polio from all countries except two, with the prospect of the total eradication of polio within a few years. The elimination of measles and rubella will require similarly sustained and focussed efforts to realise the aim of global eradication of these diseases.

¹¹ Ten threats to global health in 2019. Geneva: World Health Organization, 2019. Web page at <https://www.who.int/emergencies/ten-threats-to-global-health-in-2019>

¹² Strategic Advisory Group of Experts on Immunization. 2018 Assessment report of the Global Vaccine Action Plan. Geneva: World Health Organization, 2018 (Available at: https://www.who.int/immunization/global_vaccine_action_plan/sage_assessment_reports/en/, accessed 01/07/2019)

Recommendations

Immunisation services

Immunisations are provided in many settings, and service quality is key to high uptake. Most infant immunisations are provided in general practices by practice nurses with health visitors having an important role. School age children are mostly immunised in schools with practices having a role in opportunistic catch-up immunisation. MMR immunisation is also part of NHS occupational health services.

Twelve summary recommendations to the service are set out below. Activities identified by the METG which support these are detailed at Appendix 1.

- A. Review management in practices of the call and recall of children due MMR to ensure immunisation is given on time.
- B. Strengthen the role of health visitors in the follow up of case list children who have not received MMR.
- C. Ensure the availability of domiciliary immunisation in all health boards.
- D. Offer all school children missing MMR catch up immunisation with scheduled teenage immunisations.
- E. Improve use of routine contacts with school age children to check for missing immunisation.
- F. Strengthen immunisation messages through schools, Healthy Schools Schemes and the Healthy University and Colleges Network.
- G. Develop national standards, improve information and implement local processes to improve MMR uptake in NHS staff.
- H. Implement electronic data exchange between the Child Health Information System and General Practice systems and strengthen data sharing with local authorities.
- I. Provide a 'Vaccine Passport' for all 16 year olds detailing immunisation history and advising catch up of missing vaccines.
- J. Strengthen measles and rubella surveillance through rigorous case investigation and testing to meet WHO elimination criteria.
- K. Ensure easy access to high quality, evidence based information for health professionals and the public.
- L. Provide training for primary care professionals on managing vaccine hesitancy, and conduct research into factors affecting vaccine uptake in Wales.

National catch up campaign

Significant progress has been made over the last decade in improving uptake of MMR immunisation and reducing inequalities through provision of scheduled immunisations. However in order to maintain uptake of two doses of MMR vaccine above 95% in children and young people, supplementary catch up immunisation

campaigns are necessary from time to time, and were undertaken nationally in Wales in 1994, 2005 and 2013. Similar high-level actions are needed now.

It is recommended the following catch up activities are undertaken in 2019-21:

1. Contract with general practices to identify individuals 16-24 years of age missing MMR and actively invite for immunisation.
2. Identify primary schools in the lowest fifth for uptake of two doses of MMR and commission a catch up programme delivered by school health services.
3. Offer all secondary school pupils who have not received two doses of MMR catch up MMR alongside existing planned immunisation sessions in schools.
4. Identify vulnerable groups locally and target with additional interventions.
5. Support these activities with a national awareness campaign using press coverage, advertising and social media targeting parents of young children, school pupils and those aged 16-24 years.

A national grant fund could be established for local interventions, with health boards sharing the results of funded work. Planning should take into account that some health boards have recently undertaken catch up activities covering some of these areas. It is estimated that these catch up activities would cost £400,000 to £500,000.

Other high-level actions which would significantly support service interventions include undertaking a review of the GP contract for vaccination and immunisation services, rolling out the digital Red Book in mobile format to help parents access their child's immunisation history and ensuring vaccination programmes and their impact on preventable childhood diseases is part of the school curriculum.

Discussions are underway into how a catch up can be achieved in the most effective and efficient manner possible.

Conclusions

Measles is a serious illness that was once a common childhood infection in Wales, and before vaccination began in the UK in 1968 almost every child caught measles and some died. Similarly, rubella was once an endemic infectious cause of congenital malformations.

Remarkable progress has been achieved in Wales, the UK and globally towards the elimination of the threat of measles and rubella since vaccines against the disease began being used just over 50 years ago. The UK was certified by the WHO to have eliminated rubella and measles in 2016 and 2017 respectively, a status that was maintained for two years. However UK measles elimination certification was lost in 2019 due to re-established circulation of measles in England.

Achieving 95% uptake of two doses of MMR vaccine in the routine programme before school entry is a challenging target but one which is achievable and necessary to maintain if circulation of measles is to remain eliminated. In addition

periodic supplementary catch up activities are needed to maintain high levels of uptake in older children and young adults.

The recommendations in this report and supporting actions set out what needs to be done in Wales to maintain elimination of measles and rubella, minimise the impact of mumps, and protect the population from the threat of future outbreaks.

Acknowledgements

This report is based on a series of Measles and Rubella Elimination Task Group (METG) and sub-group meetings that had a broad membership consisting of key individuals with expertise from health boards, NHS Wales Informatics Service and other organisations (Appendix 2).

We are grateful to all those who participated in this process, especially the sub-group leads.

The recommendations and supporting actions in this report are based on the work of the expert sub-groups. The report was written by the Vaccine Preventable Disease Programme team in Public Health Wales.

Appendix 1. Actions to support the recommendations

Primary care

1. Strengthen collaborative working between Health Visitors (HV) and practices to provide timely intervention for children who have missed MMR, with an identified HV for each practice following up outstanding MMR lists.
2. Ensure practices with queues put in place an action plan to offer scheduled infant vaccines at the correct time and develop national guidance on the management of immunisation queues and cancelled clinics.
3. Promote the use of 'early-warning' outcome uptake data for practices, training Practice Managers and cluster leads on the use of this data.
4. Strengthen the role of HV managers in supporting HV actions, monitoring trends in follow-up caseload, management of non-attendance and outstanding lists as KPIs.
5. Ensure MMR uptake is checked as routine part of antenatal care and offer post-natal MMR to women who have never received two doses of MMR.
6. All health boards should be required to ratify domiciliary immunisation policies, ensuring maintenance of competency of key staff.
7. Consideration should be given to the use of NHS digital technology, including texting, to issue reminders as some GPs are already doing for children's flu vaccinations.
8. Map dedicated resources to support hard to reach groups across Wales (e.g. travellers' provision, Health Access Teams (HATs), asylum seekers services) to allow the identification and sharing of best practice and to shape policy on HAT services offering vaccines at point of first contact to avoid delay pending GP registration.
9. Consider expanding the role of Healthcare Support Workers in MMR vaccine administration.
10. Ensure Make Every Contact Count (MECC) training includes MMR immunisation for staff coming into contact with parents of young children and young people.
11. Continue to opportunistically identify individuals outstanding MMR and immunise.

School immunisation services

12. Outstanding MMR immunisation should be offered alongside scheduled teenage HPV, MenACWY and Td/IPV vaccinations in all schools in all health boards.
13. All health professionals in regular contact with school age children should complete MMR e-learning even if they do not immunise.

14. An immunisation status check should be incorporated where appropriate into routine contacts with school healthcare professionals.
15. Closer working with the Welsh Network of Healthy Schools Schemes to strengthen existing links with Healthy Schools coordinators at local and national level and ensure up to date relevant information is included in new national indicators on coverage in schools.
16. Encourage head teachers to include the importance of being up to date with immunisations in letters to new pupils starting in primary and secondary schools.
17. Consider greater utilisation of school communication channels to maintain consistent immunisation messages, including on social media such as school Facebook pages.
18. Improve the exchange of data between the local Child Health Office and education services to improve timeliness and quality of data, utilising informatics solutions where possible.
19. Electively home educated and children missing from health databases should be addressed with national data sharing agreements between local authorities and health boards.
20. Ensure promotional resources are used to highlight the importance of immunisations to older adolescents across all settings including education, health and community.

Universities

21. Engage with Healthy Universities and Colleges Network to strengthening the immunisation component in the Framework, including at events associated with the network.
22. Strengthen students unions' role in awareness raising.

NHS Occupational Health Services

23. Develop a standard statement on Welsh Government and health boards' expectation of MMR vaccination uptake for use during the employment cycle, for example as part of Train, Work, Learn information, and issue annual CMO and CNO reminders.
24. Ensure MMR vaccination information is part of corporate and local induction.
25. Add a question about MMR vaccinations to Personal Appraisal Development Review and return to work interviews.
26. Once the ESR/Cohort bi-directional interface programme has been implemented across NHS Wales, establish current level of uptake in high-risk areas in order to calculate the level of resources required and the costs involved.

27. Produce information materials (posters, leaflets, social media packs) for health care workers.
28. Agree evidence based MMR immunity targets for NHS Wales healthcare workers.
29. Promote e-learning modules for both vaccinators and non-vaccinators.
30. Undertake a risk assessment for implementation of MMR peer vaccinators in high-risk areas.
31. Consider the use of text reminders to reduce likelihood of missed appointments for MMR vaccinations.
32. Consider requesting NHS Occupational Health services have access to existing childhood immunisation information systems.

NHS Wales Informatics Service

33. Implement the electronic exchange of data between the Child Health Information System (CHIS) and General Practice systems to improve data quality, timeliness and efficiency (this was a recommendation of the Health & Social Care Committee review of the national measles outbreak in 2013).
34. Ensure that national school codes are available and used by all health boards in the Children and Young Persons Integrated System (CYPrIS).
35. Develop a 'Vaccine Passport' to issue at 16 years of age to improve awareness of vaccination status and advise to catch up on missing doses.
36. Ensure clear guidance is available on CYPrIS, including the interface between CYPrIS and new Community IT system, to permit national reporting on timeliness of uptake of the first and second MMR doses at GP and cluster level.
37. Ensure that all health boards within Wales have routine child health data sharing arrangements in place, facilitated by electronic data sharing through CYPrIS wherever possible.
38. Make invitations for children to attend MMR vaccination more user friendly.

Public Health Wales

Surveillance

39. Ensure that WHO measles and rubella elimination surveillance quality criteria are met using an 'enhanced surveillance' approach.
40. Implement a plan to meet WHO criteria for discarded case rates for measles and rubella.
41. Develop data recording procedures in the TARIAN health protection case management system to facilitate measles and rubella surveillance and compliance with WHO measles and rubella elimination requirements.
42. Improve data transfer from Public Health England reference laboratories and subsequent updating of TARIAN.

43. Develop a protocol for more timely feedback of surveillance data relating to progress towards measles and rubella elimination goals.
44. Publish quarterly surveillance reports on confirmed cases of infection by health board.
45. Ensure surveillance teams can access relevant CYPrIS data on vaccinations status.
46. Ensure surveillance teams can access relevant information on TARIAN to ensure high quality data are returned to the WHO.

Health Protection Teams

47. Ensure data collected in TARIAN includes enhanced details of immunisation history and where possible complete information on epidemiological links.
48. Ensure AWARE teams have routine access to CYPrIS immunisation data for cases and contacts.

Microbiology

49. Ensure that adequate samples are available for UK level measles surveillance and virus genotyping to facilitate both surveillance and outbreak management.
50. Develop a resource to help patients understand the importance of providing two samples for testing.

Immunisation uptake monitoring

51. Update the Child Health Information Process Standards (CHIPS) to reflect the move to CYPrIS.
52. Ensure that adequate training is in place for health board Child Health departments to support immunisation data quality and local use of data.
53. Explore the potential for updating and data cleansing CYPrIS vaccination data using electronic data extracts from general practices until routine data exchange is established.
54. Survey immunisation data sharing arrangements between Wales and England border Child Health Departments and establish cross-border arrangements for sharing appropriate data.
55. Support the development of updated CYPrIS generated reports with improved usefulness for queue management, MMR catch-up and outbreak management.
56. Develop school level MMR coverage tools for School Nurses, Immunisation Coordinators and Health Protection Teams, to assist in highlighting schools with low coverage or large numbers of susceptible children.
57. Enhance quality assurance procedures for national COVER data with comparison of national data to local CYPrIS data extracts.
58. Monitor rates of those who decline to consent.
59. Assess coverage of MMR in vulnerable population groups and monitor equity of vaccination uptake.

Public Information

60. Ensure high quality evidence based information is provided to parents and young people through printed materials and the Public Health Wales website.
61. Public Health Wales should make full use of its social media channels to support parents' immunisation decisions.
62. Use all channels to prompt MMR catch up for travel, young people and among students.
63. Ensure provision of easy read and multi-language public information.

Training

64. All professionals immunising or advising parents on immunisation should receive evidence-based training on how to address vaccine hesitancy.
65. Specific communication techniques such as those advocated by the WHO should form part of core e-learning immunisation resources, including supporting documentation such as forms to decline vaccination.

Research and Development

66. Research reasons for vaccine hesitancy among parents and young people in Wales.
67. Develop a method for identifying school populations where there are likely to be issues of unknown vaccination or registration status.
68. Investigate with health boards service-side causes of failure to vaccinate or delayed vaccinations to inform appropriate national service guidance.
69. Assess vaccination status ascertainment in migrant children.
70. Scope and develop a protocol for ascertainment of MMR status for younger adults using general practice data.

Appendix 2. Task Group Members

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