WEEKLY EPIDEMIOLOGICAL REPORT

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Immune Amnesia: Unveiling the Long-Term Impact of Measles on the Body's Defense System

Measles is a highly contagious disease, most commonly affecting children, has shown to have effects that extend beyond its initial symptoms. Recent research has revealed a profound, long-lasting impact of measles on the immune system, a phenomenon known as "immune amnesia." This hidden consequence of the disease results in extended immunosuppression, leaving individuals susceptible to a variety of infections. Understanding the mechanism behind immune amnesia highlights the critical importance of widespread measles vaccination—not just to prevent measles itself, but to safeguard the body's broader immune defenses.

What is Immune Amnesia?

Immune amnesia describes a condition where the immune system "forgets" previously acquired immunity following a measles infection. Measles is known for its ability to wipe out significant portions of the immune system's memory.

Memory cells, including B cells and T cells, are crucial for recognizing and responding to pathogens previously encountered by the body. The measles virus targets and destroys these memory cells, reducing the immune system's ability to effectively respond to pathogens, it has encountered before. This destruction leads to increased vulnerability to infections for which individuals previously had immunity. It includes infections they had been vaccinated against or had been exposed to earlier.

A study led by Stephen Elledge of Harvard Medical School and Brigham and Women's Hospital has revealed that measles can eliminate between 11 to 73 per cent of a person's antibodies, leading to immune amnesia. The research, supported by both human and macaque studies (non-human primate studies), demonstrates that measles destroys immune memory, leaving individuals exposed to previously encountered pathogens for months to years after infection. This discovery highlights the crucial importance of the MMR vaccine in preventing not only measles but also the long-term immune damage it can inflict.

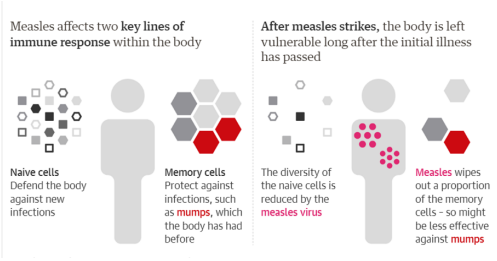

Figure 1: How measles leaves a body vulnerable to infection

Source: *Science Immunology*

The image (Figure 1) visually illustrates how measles leaves the body vulnerable to infections. It shows how the virus affects two key lines of immune response—naive cells and memory cells. Naive cells defend the body against new infections, while memory cells protect against previously encountered infections. After a measles infection, the diversity of naive cells decreases and the virus wipes out a portion of the memory cells, leaving the body vulnerable long after recovery.

Mechanism of Immune Amnesia

The mechanism behind immune amnesia involves the measles virus's interaction with immune cells. The measles virus primarily targets alveolar macrophages in the lungs, which possess a receptor known as Signaling Lymphocytic Activation Molecule (SLAM). This receptor facilitates the virus's entry into the cells, bypassing phagocytosis and releasing viral genetic material directly into the cell's cytoplasm. Infected macrophages then transport the virus to lymph nodes, where the Measles virus infects and destroys memory T-cells and B-cells. This process not only erases pre-existing immune memories but also leads to the production of new lymphocytes with memory solely for measles.

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Duration and Scale of Immune Damage

Research indicates that measles-induced immune amnesia can last approximately 2-3 years. Michael Mina and colleagues at Emory University analyzed child mortality rates in the U.S., U.K., and Denmark before and after the introduction of the measles vaccine. Their findings revealed that nearly half of all childhood deaths from infectious diseases during periods of measles prevalence could be attributed to the disease. The restoration of immune memory to pre-measles levels can take up to five years, during which individuals remain at an increased risk for secondary infections. In some cases, the immune damage from measles may be permanent, necessitating re-exposure to diseases or revaccination to rebuild immune defenses.

Long-Term Immunosuppression

Beyond the immediate destruction of memory cells, measles also exerts a broader suppressive effect on the immune system. T-cell immunity, which is responsible for recognizing and attacking infected cells, may also be diminished. This extended immunosuppression can lead to reduced responses to other infections and may contribute to the lasting remission of autoimmune diseases. The full extent of measles' impact on immune function illustrates the significant and enduring effect the disease can have on overall health. For example, measles virus infection not only heightens susceptibility to other infections, which contribute significantly to the acute mortality associated with measles but can also trigger autoimmune encephalomyelitis.

The Need for Revaccination

Given the significant loss of immune memory following measles infection, revaccination is crucial. Individuals who have recovered from measles should be revaccinated with routine childhood vaccines to mitigate the effects of immune amnesia and protect against infections to which they had previously developed immunity. This preventive measure can help restore immune defenses and reduce susceptibility to other diseases.

Measles and Population Mortality

The effects of measles-induced immune amnesia extend beyond individual health, impacting population mortality. Historical evidence suggests that measles epidemics are associated with increased mortality in the population for up to 2-3 years following an outbreak. This increased mortality is likely due to the weakened collective immune defenses resulting from immune amnesia. In contrast, the measles-mumps-rubella (MMR) vaccine does not induce such debilitative effects. On the contrary, widespread measles vaccination has been linked to significant reductions in overall morbidity and mortality.

The Global Health Impact of Measles Vaccination

The introduction of measles vaccination has had a transformative effect on global public health. According to the World Health Organization (WHO), measles vaccines prevented over 21 million deaths between 2000 and 2017. The benefits of vaccination extend beyond the direct prevention of measles-related deaths. By preserving immune memory and preventing immune amnesia, measles vaccines have likely prevented hundreds of thousands of additional deaths that could result from the immune system's inability to protect against other pathogens.

The Road Ahead: Vaccination as a Lifesaver

The evidence is clear: widespread vaccination is essential not only to prevent measles but also to maintain immunity against a broad spectrum of infections. The restoration of immune memory after measles infection is a lengthy process, and during this rebuilding phase, individuals are at higher risk for other infectious diseases. Continued efforts to vaccinate against measles are crucial in mitigating these risks and preventing future outbreaks. With millions of people estimated to have been infected with measles in recent years, the need for comprehensive global vaccine coverage remains urgent. By preventing immune amnesia and preserving overall immunity, measles vaccination stands as one of the most effective tools in protecting global health.

Conclusion

The public health value of the measles vaccine is undeniable. Not only does it prevent the immediate dangers of measles infection, but it also protects individuals from long-term immune damage caused by the disease. As the evidence around immune amnesia continues to accumulate, it becomes increasingly clear that vaccination is vital for preserving immunity and reducing the burden of infectious diseases worldwide. The fight against measles is not merely a battle against a single disease; it is a fight to maintain the integrity of our immune systems and, by extension, the health of future generations.

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https://doi.org/10.1126/science.aaa3662

Table 1: Selected notifiable diseases reported by Medical Officers of Health 27th – 02nd Aug 2024 (31st Week)

RDHS	Dengue Fever		Dysentery		Encephalitis		En. Fever		F. Poisoning		Leptospirosis		Typhus F.		Viral Hep.		H. Rabiies		Chickenpox		Meningitis		Leishmania-		Tuberculosis		WRCD	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	T*	C**
Colombo	308	7390	0	21	0	7	0	45	0	16	11	316	0	8	0	7	0	0	14	336	2	25	0	0	58	1350	**95**	100
Gampaha	148	3324	1	29	1	15	0	12	0	70	12	451	1	6	0	7	0	0	15	270	2	85	0	14	79	757	**62**	92
Kalutara	27	1939	0	19	0	2	0	29	2	34	17	493	2	7	0	8	0	1	6	414	0	39	0	1	28	389	**100**	96
Kandy	107	3006	0	29	0	2	1	9	0	54	6	176	0	22	0	8	0	1	4	293	0	13	1	30	38	385	**96**	100
Matale	16	506	0	9	0	0	0	4	1	19	5	75	0	2	0	4	0	0	7	111	1	10	3	177	0	83	**100**	100
Nuwara Eliya	9	253	3	102	0	5	0	9	3	198	6	131	0	30	0	5	0	0	10	165	3	14	0	1	6	173	**100**	92
Galle	32	1428	0	33	0	20	0	8	0	72	10	496	7	75	0	7	0	1	18	478	5	57	0	3	15	277	**80**	100
Hambantota	11	632	0	25	0	3	0	5	0	44	5	336	3	37	0	5	0	1	15	234	0	22	15	333	7	88	**92**	82
Matara	31	639	1	8	1	5	0	2	0	26	11	319	0	17	0	3	0	0	4	236	0	60	2	83	7	98	**100**	100
Jaffna	13	5160	0	47	0	2	0	22	0	31	0	17	4	430	0	5	0	1	0	150	0	13	0	1	0	180	**100**	100
Kilinochchi	1	273	0	9	0	0	0	2	0	2	0	17	0	10	0	0	0	1	0	6	0	5	0	0	0	16	**100**	100
Mannar	8	215	0	5	0	0	0	1	0	0	0	21	0	10	0	1	0	0	0	5	0	3	0	1	0	41	**100**	100
Vavuniya	1	154	0	10	0	1	0	1	0	21	0	71	0	4	0	4	0	0	1	31	1	14	0	8	3	26	**100**	100
Mullaitivu	1	190	0	7	0	0	0	0	0	16	2	64	0	11	0	0	0	0	0	4	1	4	0	8	0	23	**100**	83
Batticaloa	25	1274	2	91	1	10	0	6	0	47	0	56	0	2	0	17	0	1	1	85	2	32	0	3	6	103	**93**	93
Ampara	2	201	0	26	0	3	0	0	0	17	2	148	0	1	0	5	0	0	3	82	1	29	2	15	0	90	**71**	100
Trincomalee	12	584	0	13	0	1	0	3	1	5	1	126	0	12	0	3	0	0	7	50	0	11	0	13	2	76	**100**	100
Kurunegala	61	1756	2	36	1	25	0	3	0	345	15	446	0	17	0	4	0	2	15	345	12	196	10	400	10	333	**93**	100
Puttalam	19	834	0	5	0	3	0	3	0	3	3	166	0	14	0	1	0	1	3	95	1	46	0	24	6	142	**85**	92
Anuradhapura	5	582	0	13	0	6	0	2	12	38	3	309	0	27	0	8	0	1	2	184	0	35	11	566	5	187	**100**	100
Polonnaruwa	11	281	0	16	0	0	0	1	0	6	6	205	0	2	10	31	0	0	2	91	2	24	5	339	2	76	**100**	100
Badulla	15	639	2	24	0	5	0	4	1	31	7	377	0	23	1	20	0	0	5	244	0	22	1	27	8	152	**100**	100
Monaragala	12	568	0	14	0	3	1	3	0	78	4	556	0	23	2	23	0	1	3	80	0	67	6	164	0	72	**100**	73
Ratnapura	72	1955	2	75	1	5	0	8	0	15	42	1201	1	17	0	19	0	2	7	220	1	93	1	123	10	207	**80**	95
Kegalle	39	1512	0	11	0	6	0	8	1	11	21	473	0	21	3	9	0	1	24	596	2	44	0	19	11	228	**82**	100
Kalmunai	18	619	0	15	0	0	1	1	3	8	1	56	1	5	0	4	0	0	5	157	0	11	0	0	1	85	**77**	83
SRILANKA	1004	35914	13	692	5	129	3	191	24	1207	190	7102	19	833	16	208	0	15	171	4962	36	974	57	2353	**302**	**5571**	**93**	95

Source: Weekly Returns of Communicable Diseases (esurvillance.epid.gov.lk). T=Timeliness refers to returns received on or before 02nd Aug, 2024 Total number of reporting units 358 Number of reporting units data provided for the current week: 358**C****-Completeness *

A = Cases reported during the current week. B = Cumulative cases for the year.

Table 2: Vaccine-Preventable Diseases & AFP

27th – 02nd Aug 2024 (31st Week)

Disease	No. of Cases by Province									Number of cases during current week in 2024	Number of cases during same week in 2023	Total number of cases to date in 2024	Total number of cases to date in 2023	Difference between the number of cases to date in 2024 & 2023
	W	C	S	N	E	NW	NC	U	Sab					
AFP*	00	01	00	00	00	00	01	00	01	01	04	42	54	-22.2 %
Diphtheria	00	00	00	00	00	00	00	00	00	00	00	00	00	0 %
Mumps	00	01	06	00	00	00	01	00	00	08	04	174	131	32.8 %
Measles	01	00	00	00	00	00	00	00	00	01	39	233	179	30.2 %
Rubella	00	00	00	00	00	00	00	00	00	00	00	02	01	100 %
CRS**	00	00	00	00	00	00	00	00	00	00	00	00	00	0 %
Tetanus	00	00	00	00	00	00	00	00	00	00	00	04	06	-33.3 %
Neonatal Tetanus	00	00	00	00	00	00	00	00	00	00	00	00	00	0 %
Japanese Enceph-alitis	00	00	00	00	00	00	00	00	00	00	00	06	02	200 %
Whooping Cough	00	00	00	00	00	00	01	00	00	01	00	37	05	640 %

Key to Table 1 & 2

Provinces: **W**: Western, **C**: Central, **S**: Southern, **N**: North, **E**: East, **NC**: North Central, **NW**: North Western, **U**: Uva, **Sab**: Sabaragamuwa.

RDHS Divisions: **CB**: Colombo, **GM**: Gampaha, **KL**: Kalutara, **KD**: Kandy, **ML**: Matale, **NE**: Nuwara Eliya, **GL**: Galle, **HB**: Hambantota, **MT**: Matara, **JF**: Jaffna, **KN**: Killinochchi, **MN**: Mannar, **VA**: Vavuniya, **MU**: Mullaitivu, **BT**: Batticaloa, **AM**: Ampara, **TR**: Trincomalee, **KM**: Kalmunai, **KR**: Kurunegala, **PU**: Puttalam, **AP**: Anuradhapura, **PO**: Polonnaruwa, **BD**: Badulla, **MO**: Moneragala, **RP**: Ratnapura, **KG**: Kegalle.

Data Sources:

Weekly Return of Communicable Diseases: Diphtheria, Measles, Tetanus, Neonatal Tetanus, Whooping Cough, Chickenpox, Meningitis, Mumps., Rubella, CRS,

Special Surveillance: AFP* (Acute Flaccid Paralysis), Japanese Encephalitis

CRS =**Congenital Rubella Syndrome

NA = Not Available

Take prophylaxis medications for leptospirosis during the paddy cultivation and harvesting seasons.

It is provided free by the MOH office / Public Health Inspectors.

Comments and contributions for publication in the WER Sri Lanka are welcome. However, the editor reserves the right to accept or reject items for publication. All correspondence should be mailed to The Editor, WER Sri Lanka, Epidemiological Unit, P.O. Box 1567, Colombo or sent by E-mail to **chepid@sltnet.lk. Prior approval should be obtained from the Epidemiology Unit before publishing data in this publication**

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