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MARCH 14–16 **2023** BALI INDONESIA

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University of Nairobi

The molecular epidemiology of human rotavirus and strain diversity in Kenya pre and post rotavirus vaccine introduction: A review

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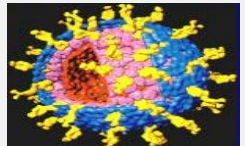
Background

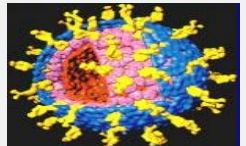
- Acute gastroenteritis caused by RV: => A global public health problem.
- In 2016, approximately 4.48 billion diarrhea episodes and 1.66 million diarrhoea-related deaths were recorded worldwide across all age groups (Troeger et al. 2016).
- A major contributor of childhood morbidity and mortality with >151,000 deaths in children below 5 year of age in 2019 (Kraay et al. 2022).
- Rotavirus vaccination have substantially reduced the burden of RV disease.



Background (2)

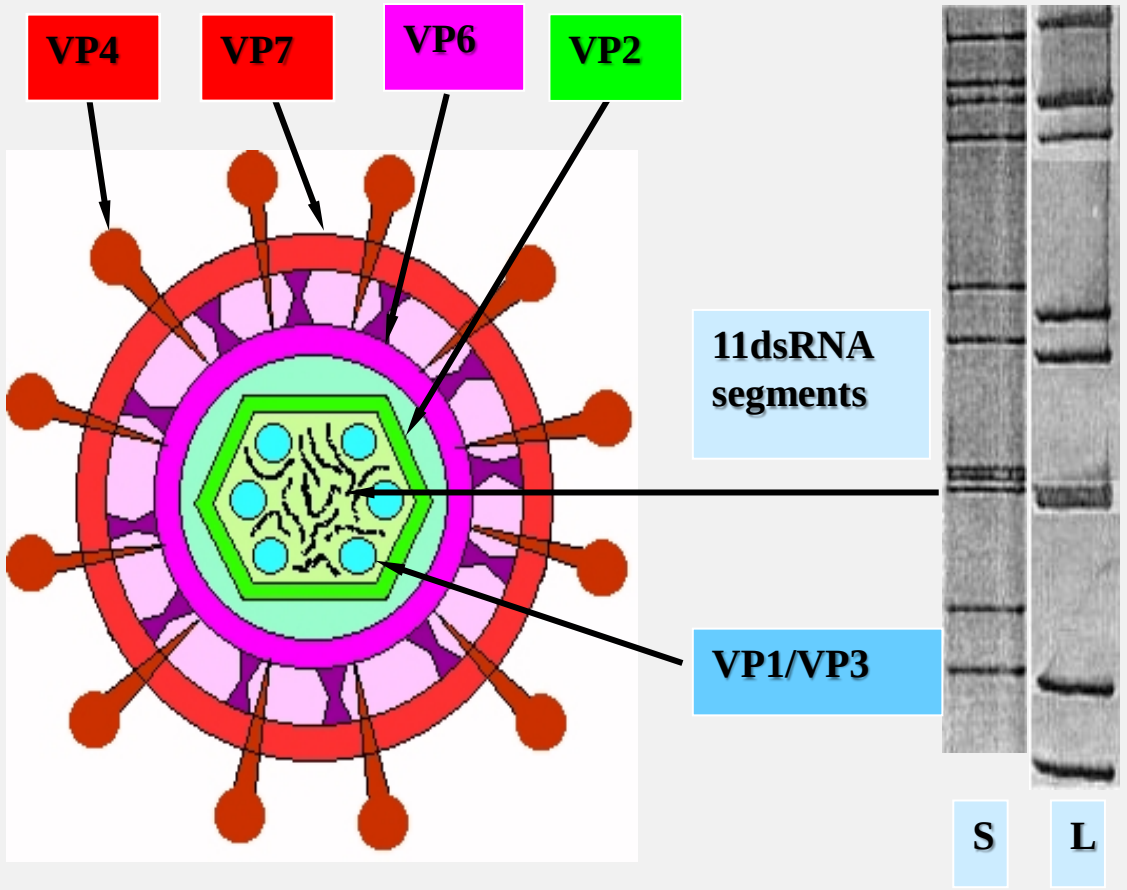
- Kenya introduced the monovalent RV vaccine (Rotarix®) in its expanded program for immunization in **July 2014. KDHS 2022 RV1 = 96%, RV2 = 92%**
- Kenya switched to ROTAVAC® (frozen formulation – Storage at -20ºC) this year due to the global shortage of Rotarix®.
- Discussion ongoing to switch to ROTAVAC-5D® rather than ROTAVAC® to save storage space.
  (ROTAVAC 5D® liquid formulation – Storage at 2 – 8ºC)

Need to continue monitoring for genotype shift after the vaccine switch.



Rotavirus Structure

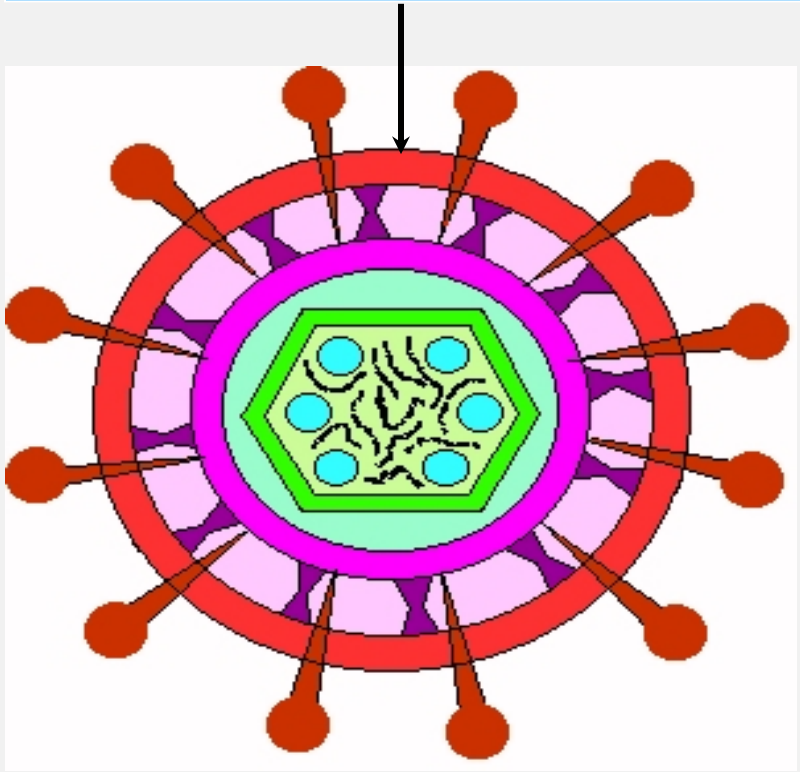
- Virion consists of an inner capsid surrounding the RNA segments.
- A middle VP6 protein capsid.
- An outer layer containing **VP4** protein spikes imbedded in a **VP7** capsid.
- Antibodies to VP7 and VP4 define G and P serotypes respectively.
- VP7 & VP4 Genotyping done by RT-PCR and whole genome sequencing.



VP7 or G genotypes

VP7 Outer Capsid Protein – G serotype

Major neutralization protein.

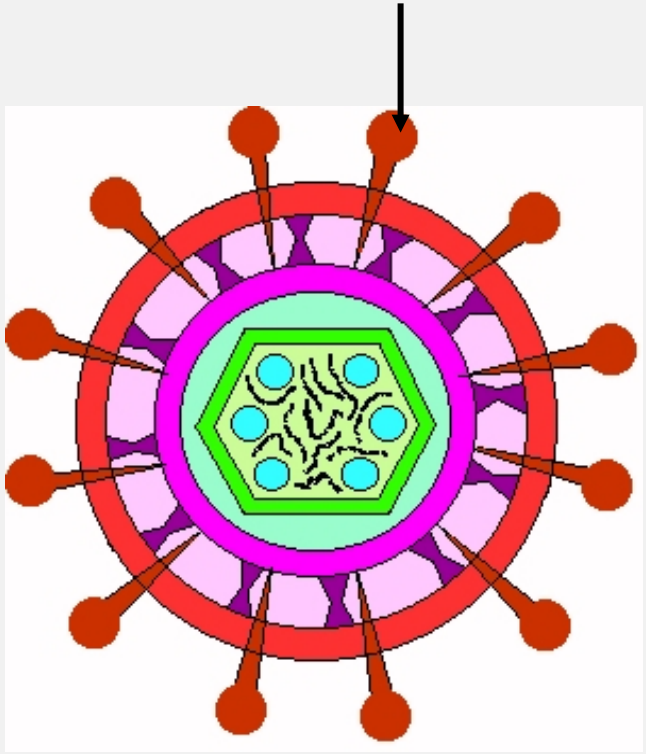


- To date 41 G genotypes are defined in human, animals and bird species.
- Genotype G1-G4 thought to be most important globally
- New serotypes emerged globally i.e., G8, G9, G10 and G12.

VP4 or P genotypes

VP4 Outer Spike Protein – P genotypes

Neutralization protein, cell attachment and protease-enhanced infectivity, virulence, haemagglutination.



- To date 57 P genotypes are defined in human, animals and bird species.
- P types P[8] and P[4] thought to be globally important.
- P[6] originally associated with neonatal infections.

Rotavirus Surveillance in Kenya 1980s

1980

- Rotavirus surveillance in Kenya started in 1980s.
- But mostly research based by individual scientists [through individual investigators grants).

- Continued to the early 2000s before the formation of the **African Rotavirus Surveillance Network.**
- These earlier studies built the initial foundation for epidemiological studies in Kenya.

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2006

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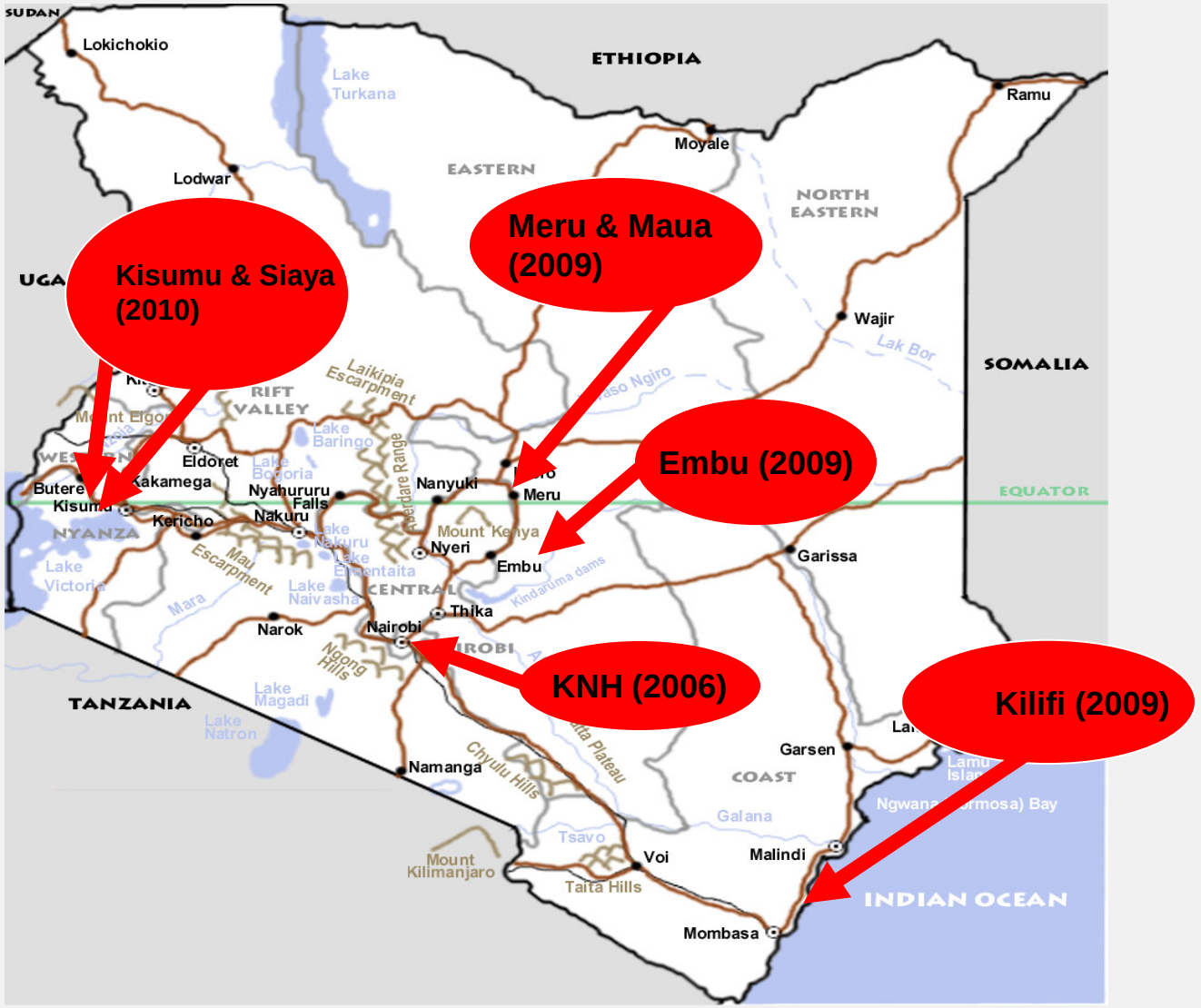
- In 2006, WHO introduced the "**WHO's Generic Protocol for Hospital based Surveillance of Rotavirus Gastroenteritis.**
- Kenya was among the first countries in Africa to implement these protocol.

Rotavirus surveillance sites in Kenya



Methodology

Objectives

- To determine prevalence of Rotavirus infection in Kenya from 1975 to 2018
- To determine the distribution of RV genotypes pre and post-vaccine introduction

Procedures

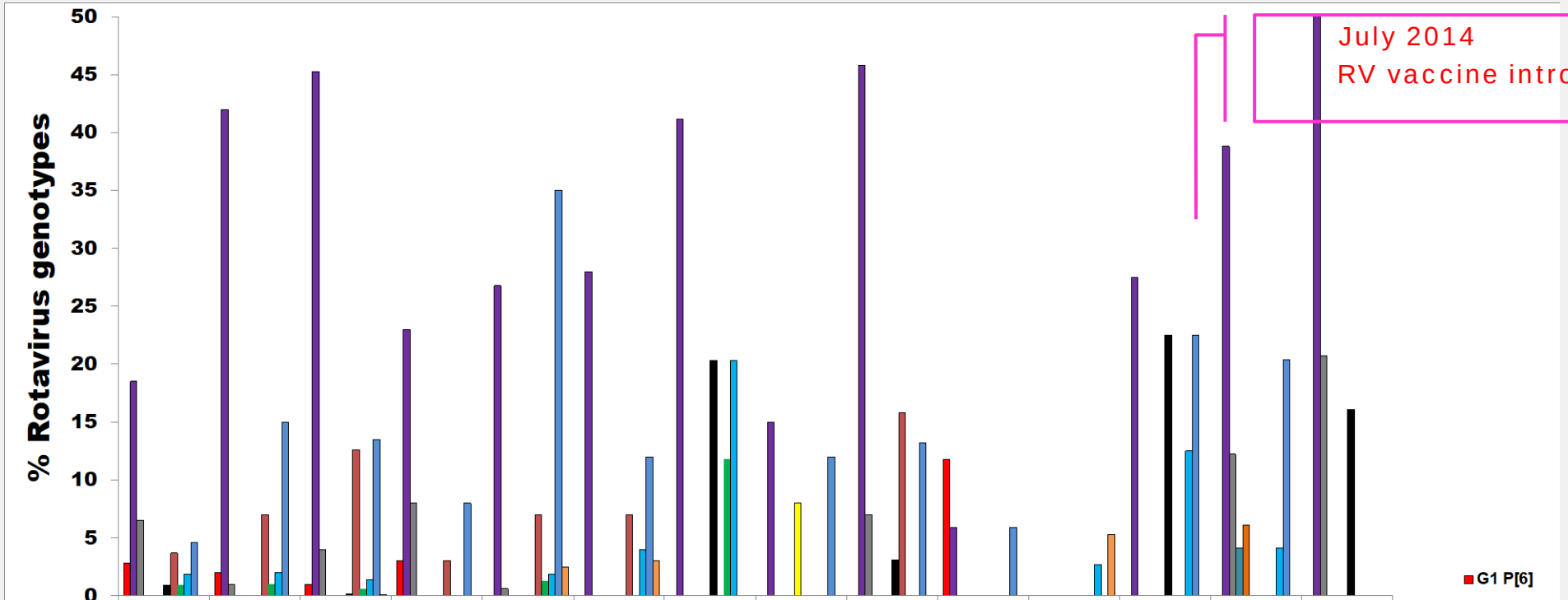
- Literature search: Google Scholar, PubMed Central, PubMed databases for studies published between 2005* to 2019 and their references
- Key terms

Prevalence of Rotavirus infection in Kenya for the period 1975 to 2018

Area of Study	Year of study	Detection assay	No. tested	Age (Yrs)	% RV+
KNH, Nairobi	1975-1976	Culture	160	<6	41
KNH, Nairobi	1994	ELISA	153	<5	22
KNH, Nairobi	1981-1983	ELISA / PAGE	36	<5	39
KNH, Nairobi	1987-1991	ELISA/PAGE	376	<1	27
IDH, Nanyuki, Kitui	1991-1994	ELISA	1431	<6	28,23,14
KNH, Nairobi	1996-1999	ELISA	538	<5	17.3
KNH, Nairobi	2000	Dako, IDEIA	382	<5	56.2*
Karen, Nairobi	1999-2000	Dako, IDEIA	207	<5	14
Karen, Nairobi	2001-2002	Dako, IDEIA	119	<5	11*
Maua, Meru	2004-2005	Dako, IDEIA	135	<5	18
KNH, Nairobi	2006-2008	Dako, IDEIA	1702	<5	40
Mama Lucy, Nairobi	2015-2017	ProspecT™	155	<5	46.9
Mbagathi, Nairobi	2015-2017	ProspecT™	168	<5	53.1
Kilifi, Nairobi, Siaya	2010-2018	ProspecT™	6562	<5	20

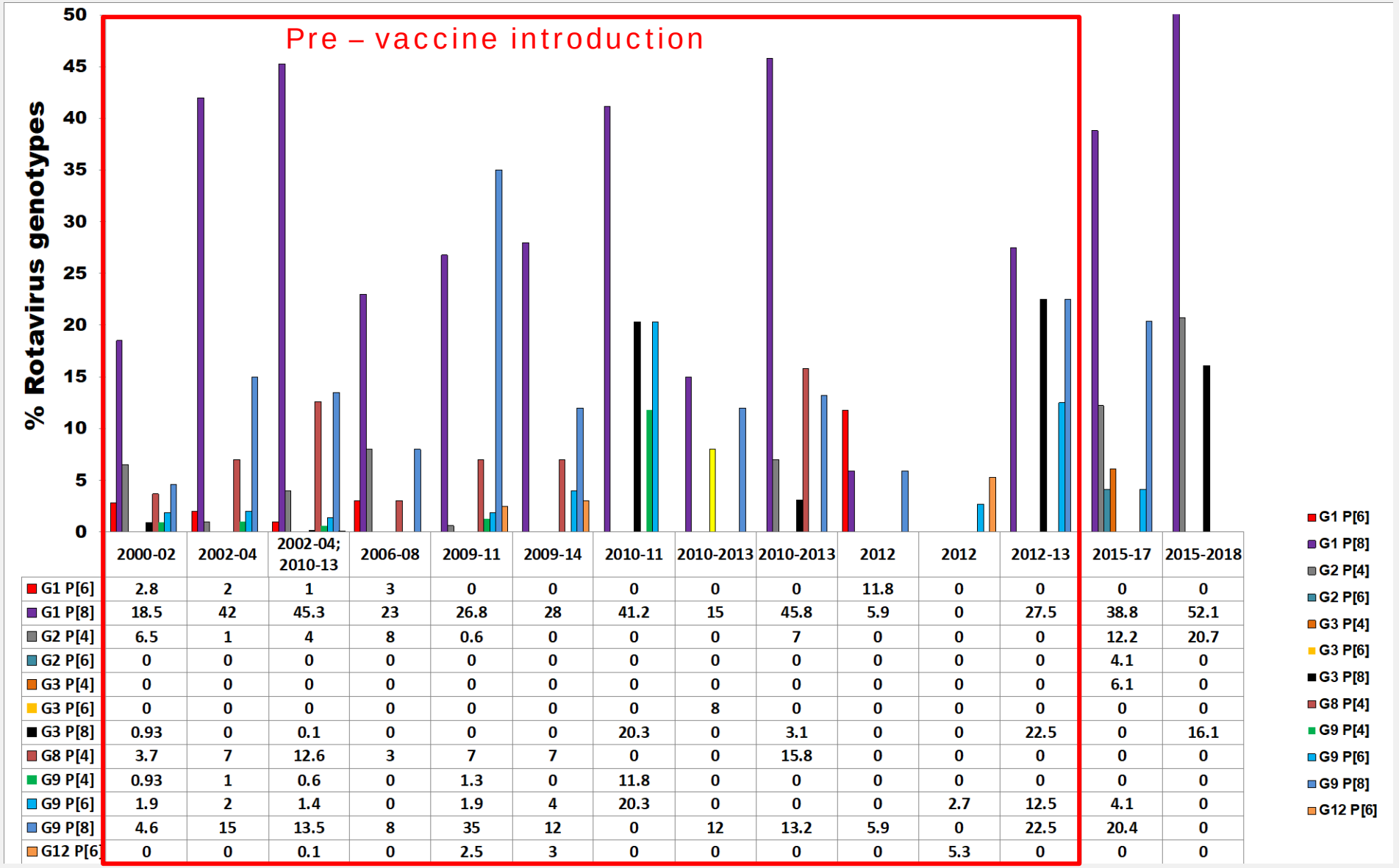
Implementation of WHO's Generic Protocol for Hospital based Surveillance of Rotavirus Gastroenteritis

Distribution of RV genotypes pre and post vaccine introduction (N=2721)



	2000-02	2002-04	2002-04; 2010-13	2006-08	2009-11	2009-14	2010-11	2010-2013	2010-2013	2012	2012	2012-13	2015-17	2015-2018
G1 P[6]	2.8	2	1	3	0	0	0	0	0	11.8	0	0	0	0
G1 P[8]	18.5	42	45.3	23	26.8	28	41.2	15	45.8	5.9	0	27.5	38.8	52.1
G2 P[4]	6.5	1	4	8	0.6	0	0	0	7	0	0	0	12.2	20.7
G2 P[6]	0	0	0	0	0	0	0	0	0	0	0	0	4.1	0
G3 P[4]	0	0	0	0	0	0	0	0	0	0	0	0	6.1	0
G3 P[6]	0	0	0	0	0	0	0	8	0	0	0	0	0	0
G3 P[8]	0.93	0	0.1	0	0	0	20.3	0	3.1	0	0	22.5	0	16.1
G8 P[4]	3.7	7	12.6	3	7	7	0	0	15.8	0	0	0	0	0
G9 P[4]	0.93	1	0.6	0	1.3	0	11.8	0	0	0	0	0	0	0
G9 P[6]	1.9	2	1.4	0	1.9	4	20.3	0	0	0	2.7	12.5	4.1	0
G9 P[8]	4.6	15	13.5	8	35	12	0	12	13.2	5.9	0	22.5	20.4	0
G12 P[6]	0	0	0.1	0	2.5	3	0	0	0	0	5.3	0	0	0

Distribution of RV genotypes pre and post vaccine introduction



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G2 P[4]	6.5	1	4	8	0.6	0	0	0	7	0	0	0	12.2	20.7
G2 P[6]	0	0	0	0	0	0	0	0	0	0	0	0	4.1	0
G3 P[4]	0	0	0	0	0	0	0	0	0	0	0	0	6.1	0
G3 P[6]	0	0	0	0	0	0	0	8	0	0	0	0	0	0
G3 P[8]	0.93	0	0.1	0	0	0	20.3	0	3.1	0	0	22.5	0	16.1
G8 P[4]	3.7	7	12.6	3	7	7	0	0	15.8	0	0	0	0	0
G9 P[4]	0.93	1	0.6	0	1.3	0	11.8	0	0	0	0	0	0	0
G9 P[6]	1.9	2	1.4	0	1.9	4	20.3	0	0	0	2.7	12.5	4.1	0
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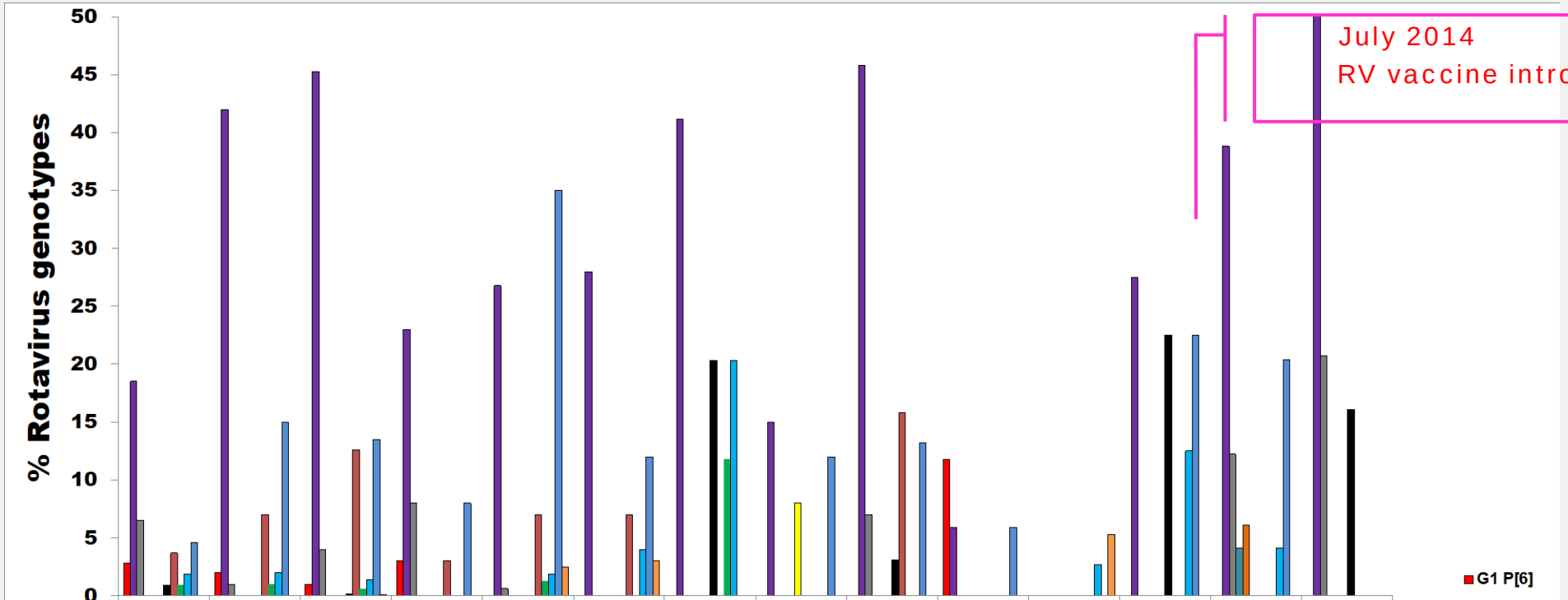
Distribution of RV genotypes pre and post vaccine introduction



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G2 P[4]	6.5	1	4	8	0.6	0	0	0	7	0	0	0	12.2	20.7
G2 P[6]	0	0	0	0	0	0	0	0	0	0	0	0	4.1	0
G3 P[4]	0	0	0	0	0	0	0	0	0	0	0	0	6.1	0
G3 P[6]	0	0	0	0	0	0	0	8	0	0	0	0	0	0
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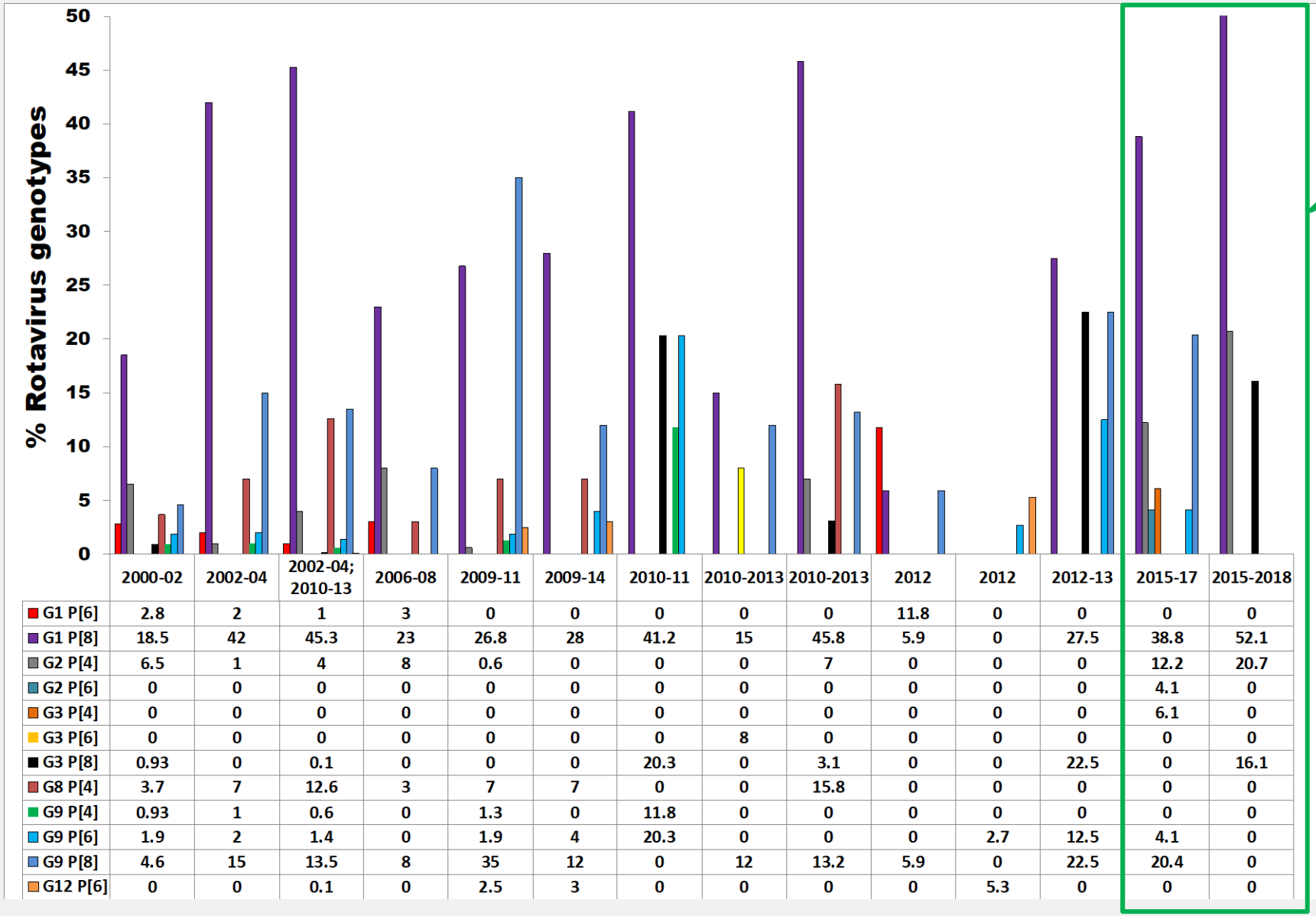
Distribution of RV genotypes pre and post vaccine introduction



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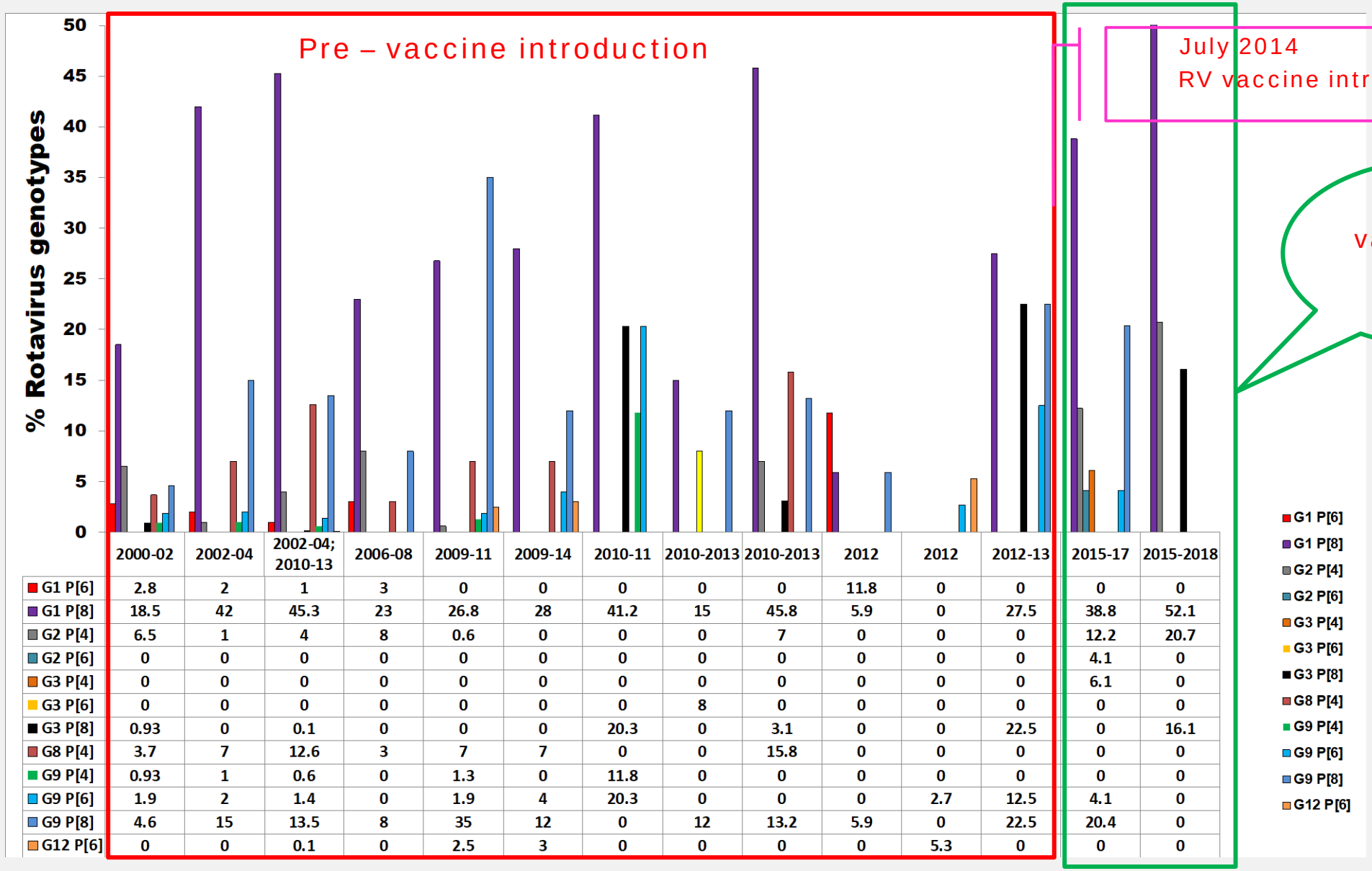
Distribution of RV genotypes pre and post vaccine introduction (N=2721)



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G12 P[6]	0	0	0.1	0	2.5	3	0	0	0	0	5.3	0	0	0

Conclusions

- Rotavirus prevalence in Kenya over the last 40 years ranges between **11-56%.**
- Genotype **G1 P[8]** is still the predominate genotype pre and post-vaccine
- Variation of RV strains with evidence of uncommon genotypes pre and post-vaccination. => e.g., genotypes G8, G9 and G12 are still being detected
- Limited genotyping data is available post-vaccine introduction.
- Continued surveillance is needed to monitor genetic diversity of rotavirus strains post-vaccine switch.

Future work

Re-activate rotavirus sentinel surveillance	Seek funding from WHO and partners to re-activate rotavirus sentinel surveillance at KNH and Eastern region of Kenya.
Post-vaccine switch surveillance	❑ Continue monitoring cases of intussusception. ❑ Monitor vaccine effectives of the ROTAVAC 5D®. ❑ Continue surveillance to monitor genetic. diversity of rotavirus strains. ❑ Monitor prevalence of other enteric pathogens.

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THANKS FOR YOUR ATTENTION

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