Vaccines
Meet the management

26 September 2019

Roger Connor

President, GSK Vaccines

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A number of adjusted measures are used to report the performance of our business, which are non-IFRS measures. These measures are defined and reconciliations to the nearest IFRS measure are available in our second quarter 2019 earnings release and Annual Report on Form 20-F for FY 2018.

All expectations and targets regarding future performance and the dividend should be read together with "Assumptions related to 2019 guidance and 2016-2020 outlook" on page 61 of our second quarter 2019 earnings release.

Agenda

GSK Vaccines priorities	Roger Connor President, GSK Vaccines	
Vaccines R&D approach	Dr. Emmanuel Hanon Senior VP, Vaccines R&D	
Manufacturing expertise	Russell Thirsk VP Site Operations	
Summary	Roger Connor President, GSK Vaccines	

Q&A:
Jay Green, Senior VP, Finance
Patrick Desbiens, Senior VP, Commercial
Thomas Breuer, Chief Medical Officer

Attractive market dynamics

Expanding and durable market

Attractive demographics	Growing and ageing population Increasing vaccination rates
Long product lifecycles	No ‘patent cliffs’

Barriers to entry

Large initial capital investment	Limited number of global players
Long development lead times	Could take up to 10-20 years to bring to market; Returns on investments take time
Complex manufacturing	>100 quality checks for each vaccine

Steady forecast growth with potential for pharma-like operating margins and cash conversion

Market evolving: expanding disease areas and target groups across the life course

Early 2000s
Mainly paediatric
Minimal clinical differentiation

Vaccines today
New vaccines for adults / adolescents
Increased clinical differentiation

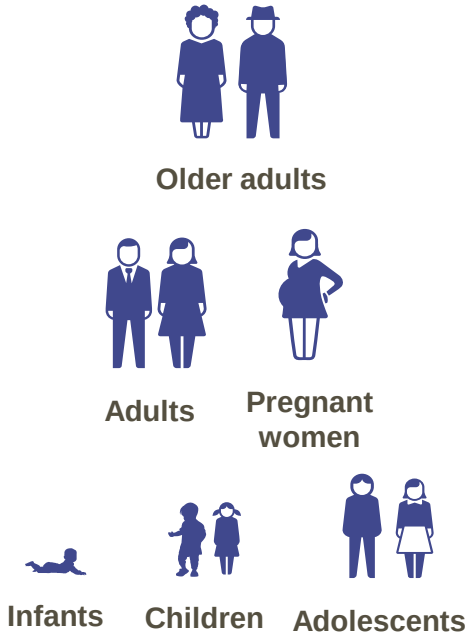
Vaccines tomorrow
Potential for advances in technologies and therapeutic approaches

~£2.8bn
market size in 2000

~£23bn
market size in 2018

+7%
projected market growth to 2024

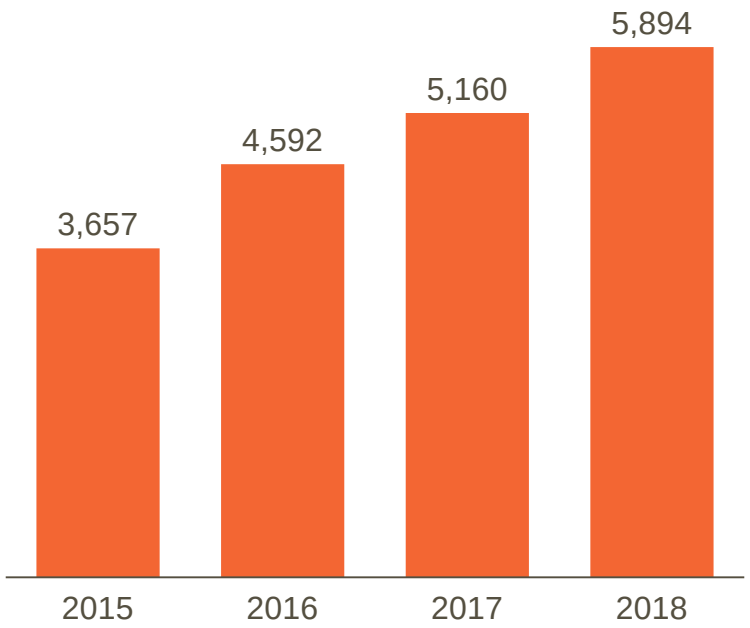
vaccinate for life



Source for market data: Evaluate Pharma.

GSK Vaccines: strong track record of performance

Global vaccines turnover
(£m)



12% CER CAGR from 2015 – 2018

Strong margin progression
25% to 33%[1]

Novartis integration ~£400m cost savings over 3 years

US market share from 14% to 24%[2]

Recent high value launches: Shingrix, Bexsero

27% of Rx/Vx turnover in H1 2019

1. Change from pro forma core operating margin of vaccines business for FY 2015 to adjusted operating margin for FY 2018.
2. Market share in 2015 and 2018 of the four largest vaccines manufacturers based on company reported US sales at a comparable currency.

Focus on delivering Vaccines priorities

Innovation

- Design and deliver ground-breaking vaccines
- Leverage disruptive technologies
- Foster partnerships

Performance

- Focus on priority assets
- Target key markets
- Drive growth, operating performance and cash conversion

Trust

- Deliver on-time supply
- Ensure quality standards
- Serve as Global Health partner

Culture

Innovation

GSK Vaccines pipeline

	Phase 1 / 2	Phase 2	Phase 3
	RSV older adults *	COPD *	Shingrix immuno-compromised *
	RSV maternal *	RSV paediatric	Bexsero paediatric (US)
	Therapeutic chronic hepatitis B	MenABCWY	MMR (US)
Recent start	Clostridium difficile	Menveo liquid [1]	Rotarix liquid (PCV free [2])
Recent start	SAM (rabies model)	Shigella *	
		Tuberculosis *	
		Malaria (next generation) *	
		HIV *	

* In-license or other alliance relationship with third party.
1. Menveo booster also in development.
2. Porcine circovirus free formulation.

Innovation

Shingrix: a new standard of prevention in shingles

Risk of shingles increases as immune system function declines

99.5%

of adults ≥50 years old in US infected with VZV[1,2]

Key risk factors:

Increasing age

Immuno-suppression

1 in 3

estimated lifetime risk of shingles

Potential complication:

Postherpetic neuralgia

Unprecedented clinical profile with upside opportunities

>90% efficacy across identified age groups
Sustained efficacy

Landmark ACIP preferential recommendation in US
included individuals previously vaccinated and 50-59 age cohort

Approvals in US, Canada, Europe, Australia, Japan and China

Launched in US, Canada and Germany

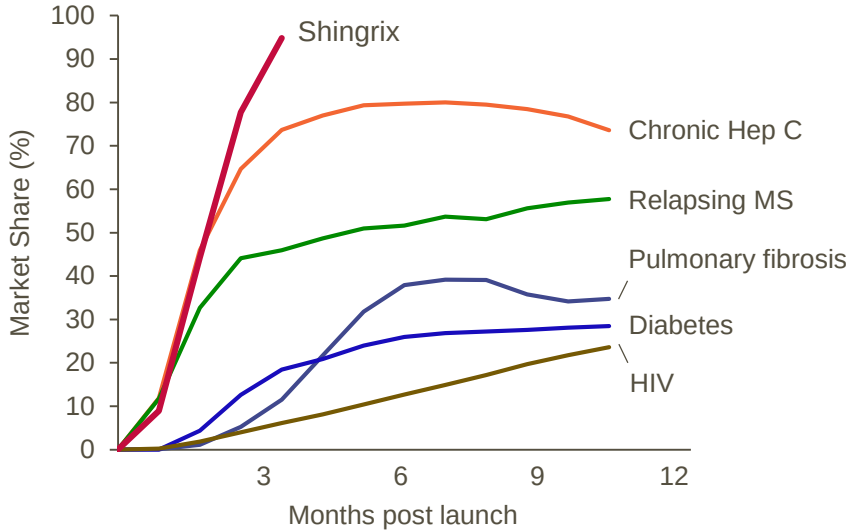
VZV = varicella zoster virus.

1. Harpaz R, et al. MMWR Recomm Rep. 2008.
2. Kimberlin DW, et al. N Engl J Med. 2007.

Innovation

Shingrix: US launch driving market expansion

Share uptake superior to recent benchmarked biopharma launches



Source: Internal calculations by GSK using IQVIA database.

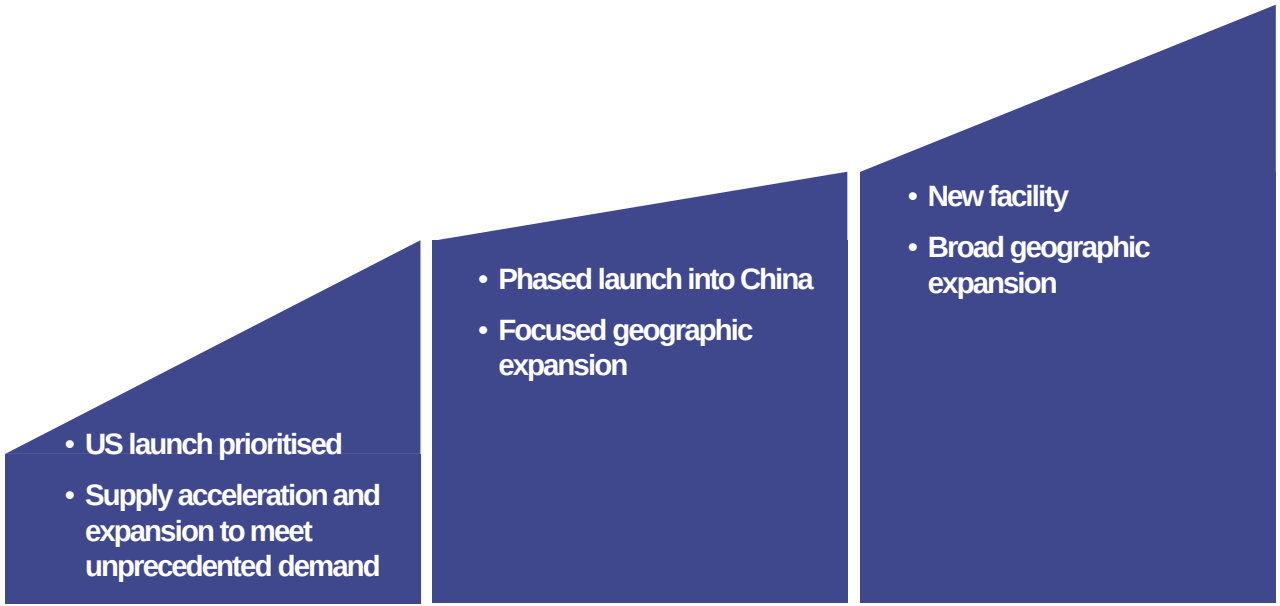
Significant US opportunity remains

Received at least first dose of Shingrix	~9m[1]
Potential revaccination population	~23m[2]
Adults 50+ that receive vaccinations	~67m[3]
Population 50+	~115m[4]

1. Estimated based on IQVIA TRxs launch through end of June 2019.
2. US Census & CDC reported immunisation rate.
3. US Census & IQVIA Patient Data Analysis (Estimated % of adults who have received vaccinations when 50+).
4. US Census.

Innovation

Shingrix: global opportunity to expand the market as capacity increases over time



Large global opportunity

>1% of eligible 50+ population estimated to have received Shingrix

Lifecycle management

In immuno-compromised individuals

Note: graph not to scale.

Performance

Bexsero: leading the market in Meningitis B

Invasive Meningococcal B disease

Incidence and serotype distribution varies by region; most common serogroup is Men B

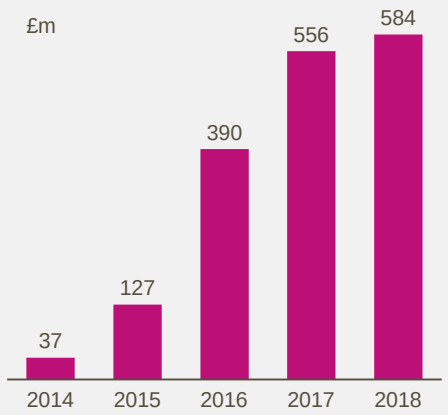
Affects healthy infants, children and teens

Invasive Men B mortality rate: ~10%

Dramatic health impact: rapid disease progression, up to 20% of those who survive may suffer major physical or neurological disability

Strong sales growth

Growing global sales[1]



Launched in 34 markets

EU: Strong competitive differentiation with infant indication: incidence in infants >10x that in adolescents (competing product indicated for adolescent use only)

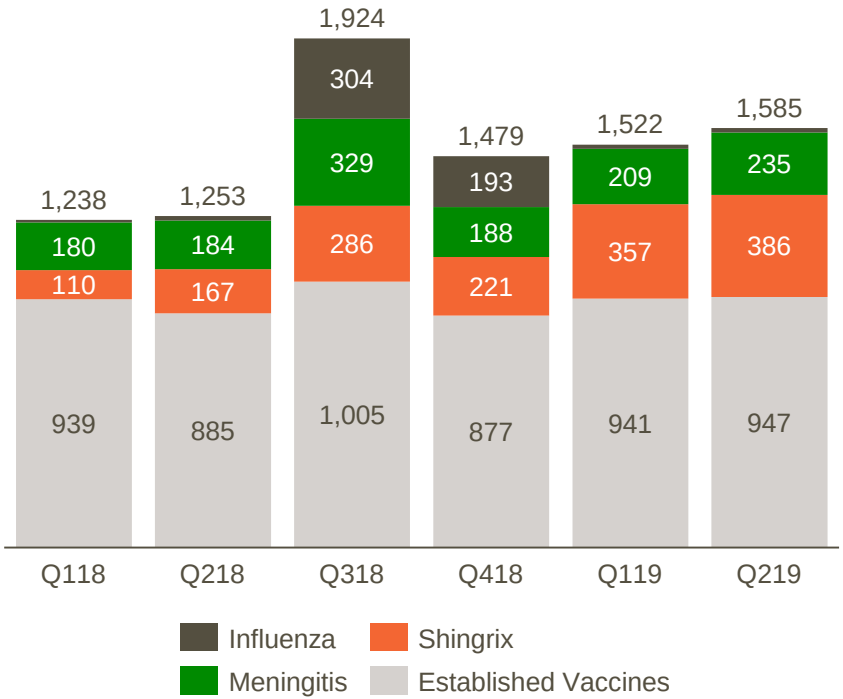
US: 69% market share of fast growing MenB market[2]; infant indication studies ongoing

1. 2014 and 2015 figures represent 12 month pro forma sales (unaudited).
2. US Men B market grew +34% in H1 2019.

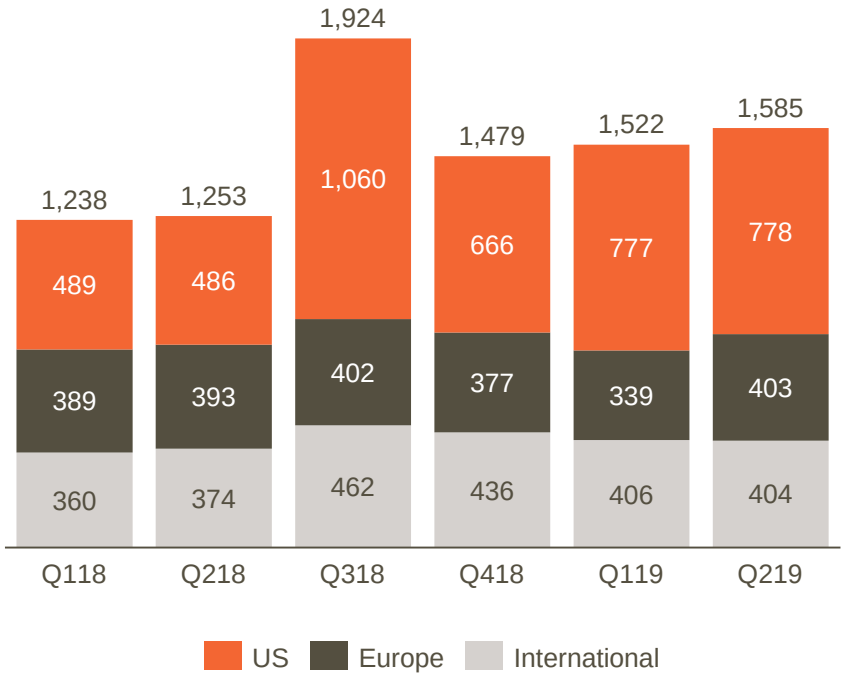
Performance

Broad portfolio with quarterly sales fluctuations

Products



Regions



Performance

Established vaccines and flu: durable assets provide portfolio backbone

Strategic lifecycle management enables a durable, cash generative portfolio

Hepatitis franchise

£808m in 2018

- Supply agility created opportunities
- Engerix-B approved in US in 1989

Havrix™ Hepatitis A Vaccine

Engerix-B

DTP franchise[1]

£1,197m in 2018

- Hexa competition in Europe; expected in US
- Boostrix 65+ age expansion approved in US in 2011

Pediarix

Boostrix

Flu franchise

£523m in 2018

- First approval in US in 2005
- Highly seasonal
- GSK: 40-45m US doses in 2019/20

Fluarix Quadrivalent Influenza Vaccine

FluLaval® Quadrivalent Influenza Virus Vaccine

Rotavirus

£521m in 2018

- Available in 115 markets
- 2 dose differentiation
- Pursuing PCV-free[2] liquid formulation for the US

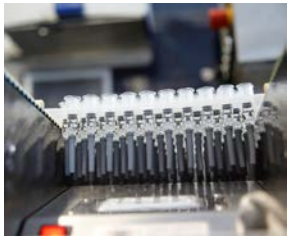
Rotarix

1. Diphtheria, tetanus, pertussis.
2. Porcine circovirus free formulation.

Trust

Our supply reliability, safety and quality

Strong history, experience, capabilities



World class manufacturing capabilities

Strong regulatory track record

Technical competence

Supply stability and reliability

Trust

Value of vaccines for public health

Vaccines offer tremendous impact

2-3m

Deaths prevented every year by vaccination[1]

$150bn

Benefit of vaccines to low and middle income countries over next decade[2]

x44

Estimated return on investment of the cost of immunisation[3]

Our vaccines make meaningful contributions

~40%

Of the world's children receive at least one GSK vaccine

>2m

Doses distributed every day

~160

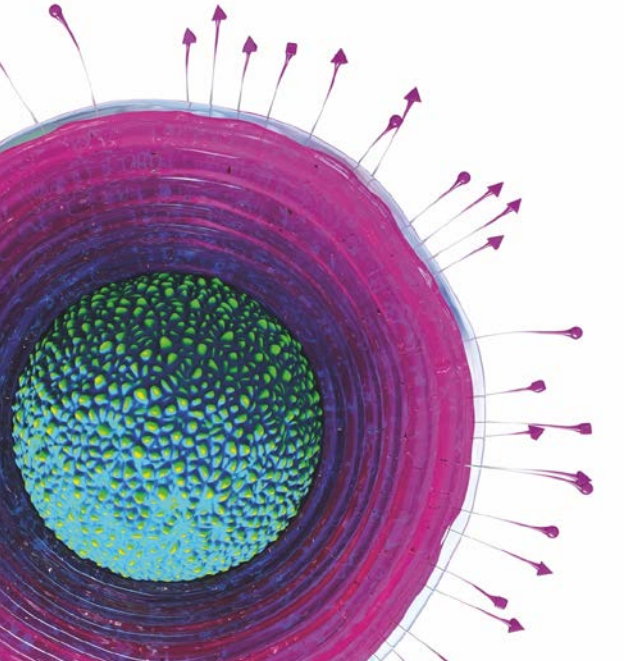
Countries where GSK supplies vaccines

270m

Doses of oral polio vaccine delivered to UNICEF

Sources: 1. Ehreth J, "The global value of vaccination" in Vaccine 2003 Jan 30; 21 (7-8):596-600. 2. Stack et al, 'Estimated Economic Benefits During The 'Decade of Vaccines' Include Treatment Savings, Gains in Labor Productivity', Health Affairs, 30, 6 (2011): 1021-1028 3. Ozawa S. et al, "Return on investment from childhood immunisation in low- and Middle-Income countries, 2011-20", in Health Affairs, 35, 2 (2016): 199-207.

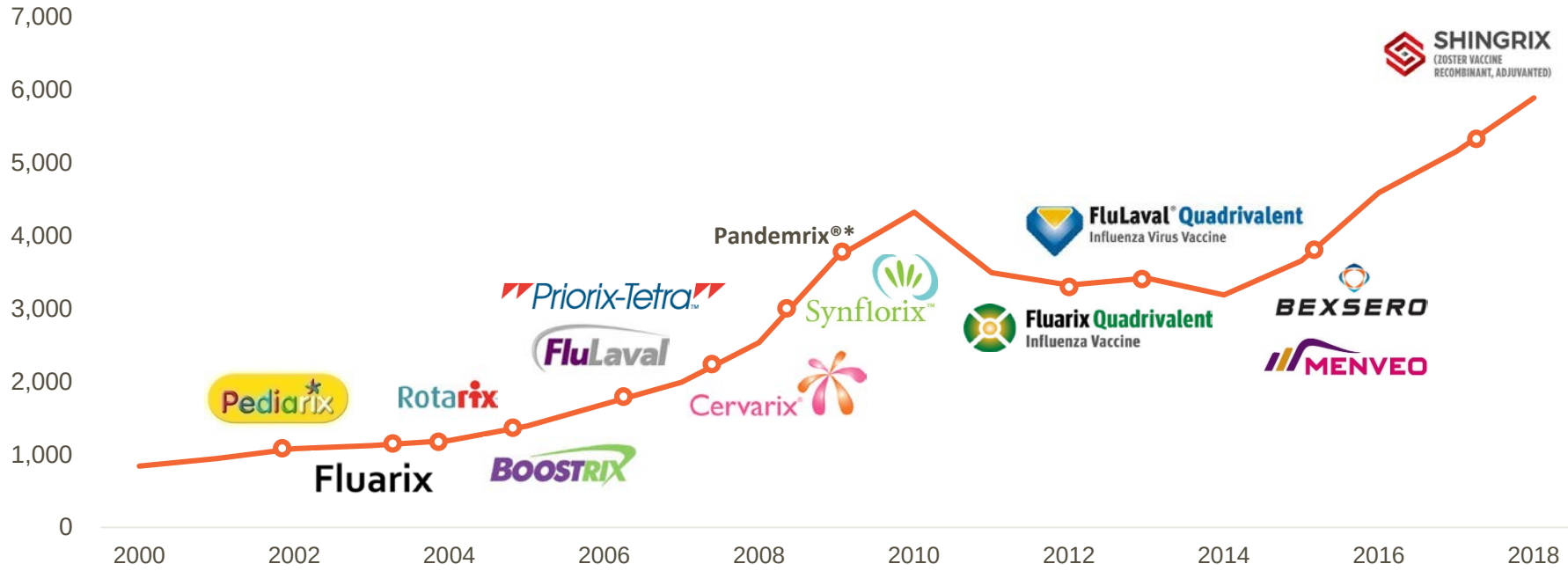
GSK: The market leader in vaccines



- Strong history and expertise
- Pipeline with un-rivalled technology platforms
- Broad portfolio
- Strong topline growth and margin progression
- Geographic spread
- Manufacturing expertise

Innovation is key

Vaccines turnover (£m)



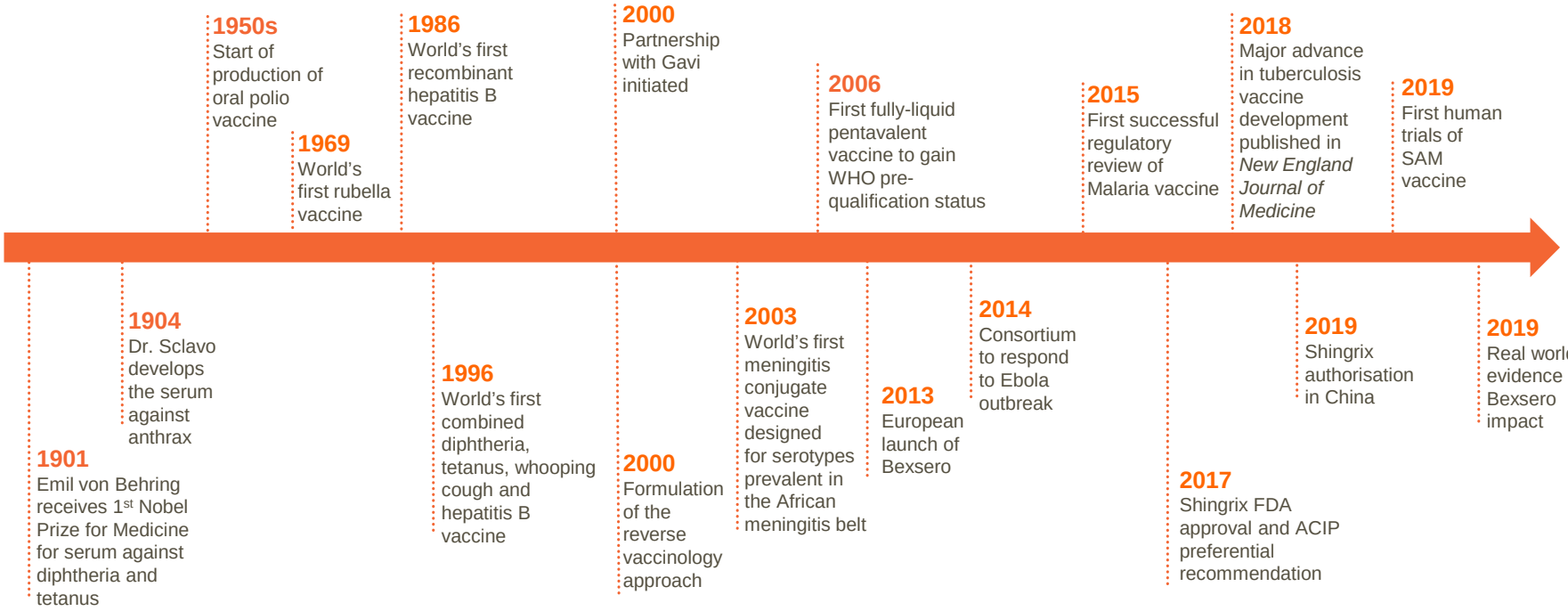
Note: New product launches have contributed to the growth shown, but there may also be additional factors to take into account.
* 2008 – 2010 trendline impacted by pandemic vaccine stockpile purchases.

Dr. Emmanuel Hanon

Head of R&D, GSK Vaccines

Innovation

GSK history of vaccines leadership and innovation



Innovation

Vaccines innovation trends

Innovation

Our vaccines R&D approach

Science
x
Technology
x
Culture

Design and deliver ground-breaking vaccines

- Shingrix and meningitis portfolio (Lifecycle management)
- Key development assets: RSV, COPD
- Therapeutic vaccines, antimicrobial resistance

Leverage disruptive technologies

- Improve vaccine efficacy
- Make manufacturing simpler and faster
- Speed up product development timelines

Evolve vaccines R&D

- Focus on science and resourcing to accelerate development
- Attract and retain leading scentists and best talent
- Smart risk-taking and single point of accountability

Innovation

Classification of pipeline assets in clinical testing

Innovative assets

Commercial assets

Addressing commercially-relevant disease areas

Global Health assets

Science-based, sustainable, focused on impact

Marketed assets

Lifecycle management

New presentations, indications, or geographic expansion (or combination)

Innovation

GSK Vaccines pipeline

Commercial assets | Global Health assets | Lifecycle management

	Phase 1 / 2	Phase 2	Phase 3
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		HIV *	

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[1] Menveo booster also in development.
[2] Porcine circovirus free formulation.

Innovation

RSV vaccine opportunity: high unmet need

Target protection against RSV across all ages with high burden

Disease burden

- Burden highest in young children and older adults
- 177,000 hospitalisations and 14,000 deaths in older adults
- Around half of hospitalisation occur during first three months of life
- 50% of infants are infected before 1 year of age, and virtually everyone gets an RSV infection by 2 years of age

Vaccine candidates

Maternal

Maternal antibodies to confer protection for first 6 months

Paediatric

Immunological priming to confer protection from 4 months to 2 years

Older Adults

Adjuvant to confer protection beyond 60 years

RSV-associated hospitalisation burden in the USA, 1997–2009[1]

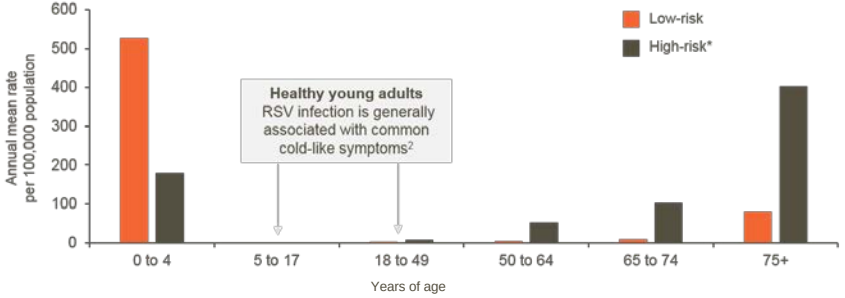


Figure adapted from Matias G *et al. BMC Public Health* 2017;17:271 under Creative Commons Attribution 4.0 International License (http://creativecommons.org/licenses/by/4.0/).

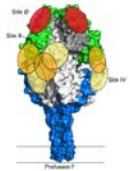
*Persons were considered at high risk if they had any of the following: chronic obstructive pulmonary disease, cardiovascular disorders, kidney disorders, diabetes, immunosuppression, liver disorders, stroke or central nervous system disorders.

1. Matias G *et al. BMC Public Health* 2017;17:271; 2. Centers for Disease Control and Prevention (CDC), 2018. RSV in older adults and adults with chronic medical conditions. https://www.cdc.gov/rsv/high-risk/older-adults.html (accessed July 2019).

Innovation

Three RSV vaccine candidates

All with FDA fast track designation and key data in 2020



maternal

passive immunisation

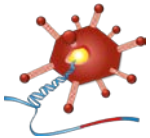
US market potential (individuals)

~4m

annual birth cohort*

FDA fast track

	Status	Design	Read out
Phase 1/2	Ongoing	Safety, reactogenicity and immunogenicity of 1 dose IM injection in healthy non-pregnant women, n=500	H2 2019
Phase 2	Planned	Safety, reactogenicity and immunogenicity of 1 dose IM injection in healthy pregnant women, n=150	H2 2020



paediatric

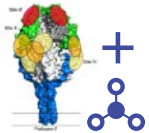
active immunisation

~4m

annual birth cohort*

FDA fast track

Phase 1/2	Completed	Safety, reactogenicity and immunogenicity of two doses IM injection at 0, 1-month schedule in RSV-seropositive infants, n=82	Completed
Phase 2	Ongoing	Safety, reactogenicity and immunogenicity of two doses IM injection at 0, 1-month schedule in RSV-sero-naive infants, n=150	H2 2020



AS01

older adults

supraseasonal profile

~70m

age 60+**

FDA fast track

Phase 1/2	Ongoing	Safety, reactogenicity and immune responses of two doses IM injection at 0, 2 month schedule, n=1048	H2 2020***

* US birth cohort: https://www.cdc.gov/nchs/fastats/births.htm.
** US Census: https://www.census.gov/data/tables/2018/demo/age-and-sex/2018-older-population.html.
*** Full POC data expected to read out in 2021.

Innovation

COPD: therapeutic vaccine candidate designed to reduce exacerbations

Disease burden

- COPD affects 10% of the world's population aged over 40
- 3rd largest cause of mortality worldwide (3.1 million deaths in 2015)
- US: ~16 million affected by COPD[1]; about 2/3 of COPD costs are linked to exacerbations that require hospitalisation[2]; 2020 projected medical costs of $49 billion in the US[1]

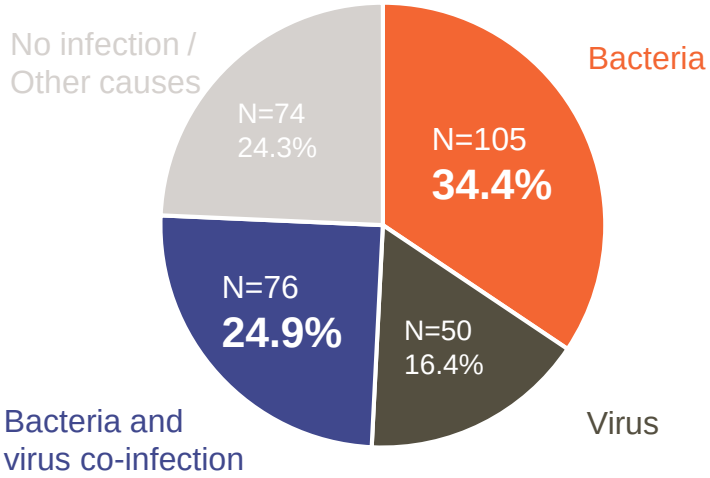
Vaccine candidate

- Therapeutic vaccine – aimed at reducing acute exacerbations
- 75% of exacerbations are linked to infections[3]: 30-45% are associated with NTHi and Mcat (GSK AERIS study[4])
- Technology: NTHi and Mcat antigens and AS01e adjuvant system
- Two dose schedule, 8 weeks apart

Status

- Phase 2 POC study ongoing in adults age 40-80 with COPD
- Data expected H2 2020

Causes of COPD exacerbations



Microbe	Role in exacerbations
Haemophilus influenzae	20–30%
Moraxella catarrhalis	10–15%

AECOPD: Acute exacerbations of chronic obstructive pulmonary disease; NTHi: non-typeable *Haemophilus influenzae*; Mcat: *Moraxella catarrhalis.*
1. CDC 2018 2. Anzueto Eur Respir Rev 2010; 3. Sethi & Murphy 2008 and Sethi S & Murphy N Engl J Med 2008; 4. Wilkinson et al Thorax 2017.

Innovation

Scientific expertise opens new fields in vaccines R&D

Therapeutics

	Global disease burden	Technology approach	Goal	Status
Chronic hepatitis B	**>250m patients** **887,000 annual deaths**	Viral vector & recombinant adjuvanted proteins	Functional cure (HBsAg and HBV DNA elimination)	FTIH H2 2019

Antimicrobial resistance

	US disease burden	Technology approach	Goal	Status
Clostridium difficile	**500,000 patients** **30,000 annual deaths**	Recombinant adjuvanted proteins	Protection against infection, reduced use of anti-biotics	FTIH H2 2019

FTIH: First time in humans

Innovation

Advances in platform technologies are the foundation for breakthrough vaccines innovation

- **Adjuvant systems**
- **Reverse vaccinology**
- **Adenoviral vectors**
- **Bioconjugation**
- **SAM (self-amplifying mRNA)**

Improve efficacy

Faster, simpler and more efficient development & manufacturing

Innovation

Adjuvant systems – a technology evolution

Enhance immune responses to antigens for increased efficacy

Adjuvant

Substance **to enhance and modulate the immune response** to vaccine antigen(s)

Antigen

Molecular structure that can be **recognised by the immune system**

Innovation

GSK leadership in adjuvant systems

Shingrix is a prime example of the power of our adjuvant systems

Adjuvant base	Immuno-enhancers	Adjuvant systems	
Aluminium salts	MPL	AS04	Fendrix Cervarix
Oil/water emulsions	Vitamin E (tocopherol)	AS03	Pandemrix
Liposome	QS-21 MPL	AS01	Shingrix malaria

The above examples represent only licensed vaccines.

Innovation

GSK Vaccines pipeline

AS01 key to future priorities

Commercial assets | Global Health assets | Lifecycle management

	Phase 1 / 2	Phase 2	Phase 3
	RSV older adults * AS01	COPD * AS01	Shingrix immuno-compromised * AS01
	RSV maternal *	RSV paediatric	Bexsero paediatric (US)
	Therapeutic chronic hepatitis B AS01	MenABCWY	MMR (US)
Recent start	Clostridium difficile AS01	Menveo liquid [1]	Rotarix liquid (PCV free [2])
Recent start	SAM (rabies model)	Shigella *	
		Tuberculosis * AS01	
		Malaria (next generation) * AS01	
		HIV *	

Note: Candidates using AS01 are designated.

* In-license or other alliance relationship with third party.
[1] Menveo booster also in development.
[2] Porcine circovirus free formulation.

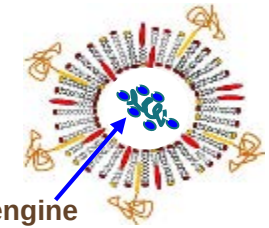
Innovation

SAM Technology (self-amplifying mRNA)

Antigen production inside the body, by the body

Manufacture SAM
in a cell-free system

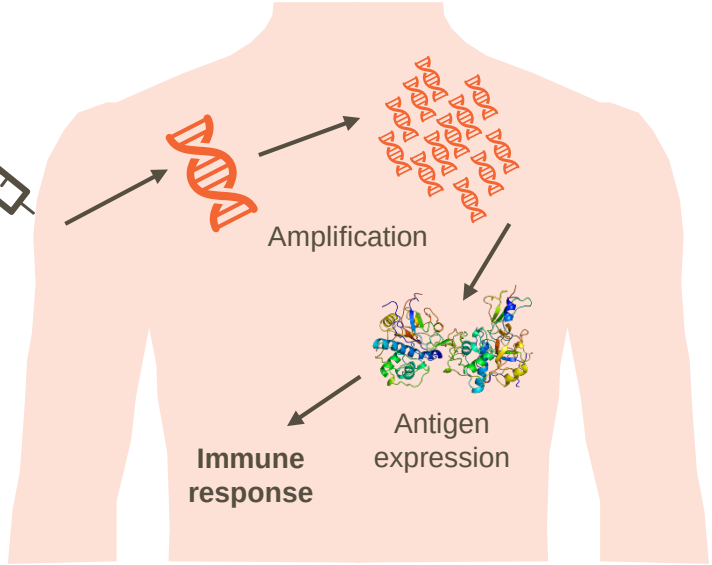
Lipid nanoparticle



mRNA engine

- Native antigen
- Non-replicating Subunit
- Antigen sequence

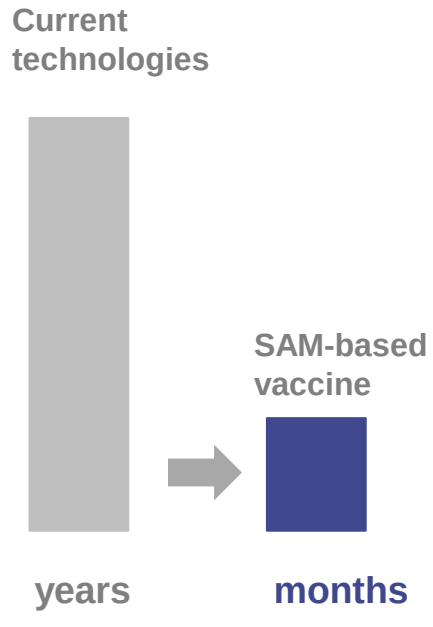
Inject SAM



Innovation

SAM Platform – a technology revolution

Faster discovery	• Shorter lead times for each candidate • High throughput screening of many candidates
Simpler manufacturing	• Faster transfer and scale up • Independent from biological manufacturing processes – compatible with continuous manufacturing • Suitable for rapid response approach
Improved vaccine potency	• Less antigen needed as platform delivers high potency • Has effect of an adjuvant



Innovation

Vaccines R&D priorities

Priorities

Accelerate key pipeline assets	– COPD – RSV
Strategic lifecycle management	– Shingrix immuno-compromised – Meningitis
Focus early pipeline on high potential areas	– Therapeutic vaccines – Antimicrobial resistance
Advance disruptive technologies	– Adjuvant systems – SAM technology
Leverage partnerships	– VBI – Innovax and Xiamen University
Evolve R&D culture	– Science-led – Smart, accountable risk-taking

Pipeline progress

Start of clinical studies

First trials in humans

– Therapeutic hepatitis B vaccine candidate: H1 2019

– Clostridium difficile vaccine candidate: H2 2019

– SAM technology (rabies model): H2 2019

Key data readouts

– COPD: H2 2020

– RSV older adults: H2 2020*

– RSV maternal: H2 2020

– RSV paediatric: H2 2020

* Full POC data expected to read out in 2021.

Russell Thirsk

Head of Belgium Operations, GSK Vaccines

Trust

Vaccines differ from small molecule drugs

	Vaccines	Non-biological drugs	Implications
Composition	Complex with various core components[1]	Typically a single active chemical component[1,5]	More sophisticated manufacturing and testing required
Regulatory framework & trials	Low risk tolerance Large community-based trials in healthy subjects[2]	Higher risk tolerance Typically smaller clinical trials in patients with disease or conditions	Cost and time requirements, Changes to regulatory requirements can impact manufacturing
Supply	Cold chain required[3]	Cold chain less common	Shipping and storage
Lead time	Long lead time[1]	Typically shorter lead time	Challenges to manage demand and inventory
Administration	Multiple injections with extended periods between doses (months or years)[4]	Regular intervals, often with daily schedules	Requires health care practitioner for administration

1. International Federation of Pharmaceutical Manufacturers and Associations. The complex journey of a vaccine. 2014. Available at: http://www.ifpma.org/resource-centre/the-complex-journey-of-a-vaccine-2/. Accessed May 2016; 2. World Health Organisation. Clinical evaluation of vaccines. Last updated, 26 November 2015. Available at: http://www.who.int/biologicals/vaccines/clinical_evaluation/en/. Accessed May 2016; 3. Public Health England. Immunisation against infectious disease: the green book. 2013. Available at: https://www.gov.uk/government/publications/storage-distribution-and-disposal-of-vaccines-the-green-book-chapter-3. Accessed May 2016; 4. Centers for Disease Control and Prevention. Recommended immunisation schedule for persons aged 0 through 18 years – United States, 2016. Available at: www.cdc.gov/vaccines/schedules/downloads/child/0-18yrs-schedule.pdf. Accessed May 2016; 5. Morrow T & Felcone LH. Biotechnology Healthcare 2004; 1: 24-29;

Trust

Vaccines manufacturing journey

Quality control: 70% of total production time

Manufacturing infrastructure
- preparation
- construction
- validation

5+ years

Raw material reception	Bulk antigen manufacturing	Coupling, formulation, filling	Lot release, packaging and shipment	Regulator batch release	Distribution
2 weeks	1 – 10 weeks	6 – 18 weeks	3 – 4 months	1 – 3 months	

Patient safety and pharmacovigilance – ongoing

Quality control and assurance

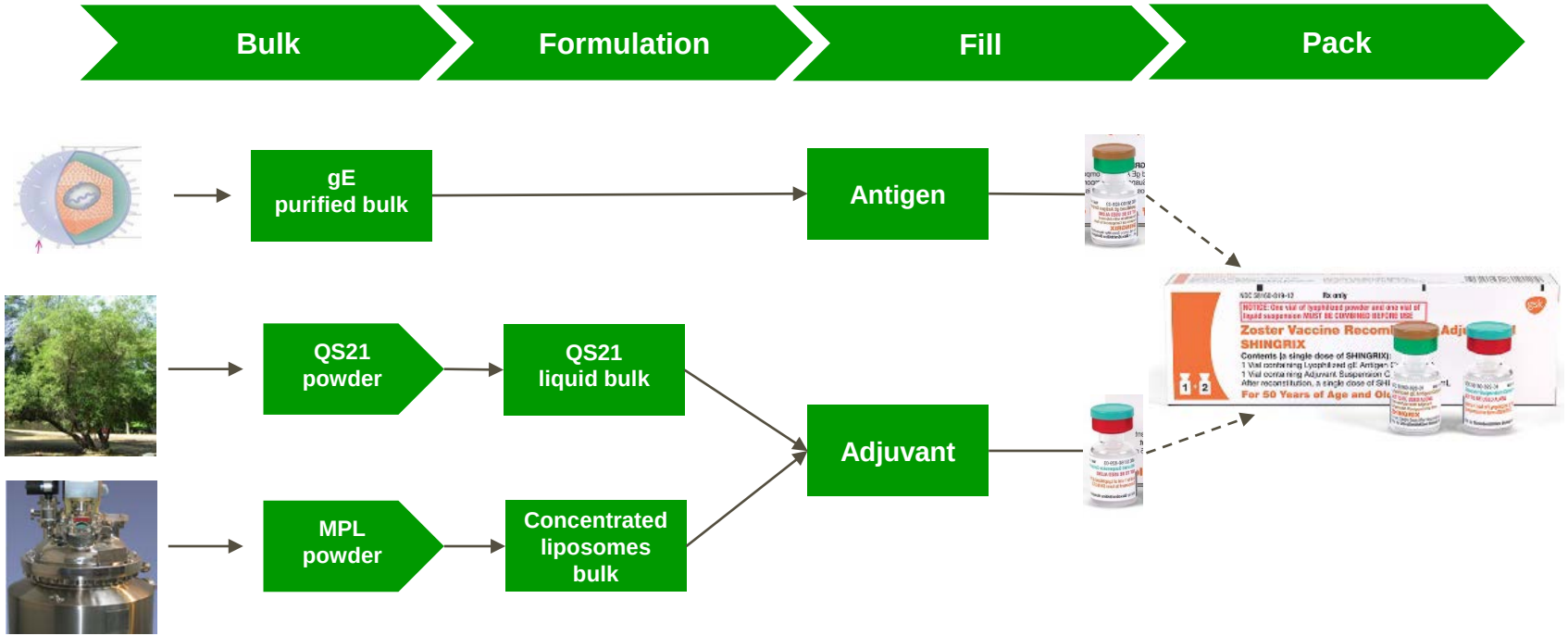
Cold chain – continuous

Note: This scenario is fictionalised, based upon industry experience of managing complex manufacturing processes, but it does not represent an actual example.

Trust

Example: Shingrix production process

Lead time: 8 – 12 months



Trust

Sites and batches - stringent quality testing

Manufacturing sites are approved and regularly inspected

- US FDA
- EMA Europe
- WHO pre-qualification
- National Regulatory Authorities
- Internal audits by Quality Assurance

20-25 site inspections/year

Each batch undergoes repeated, rigorous quality testing

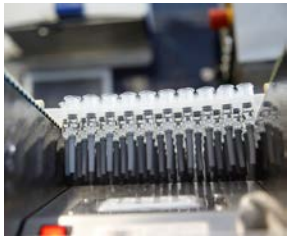
- Manufacturer's release
- Reference country review, test, release
- Recipient country national regulatory authority review, test, release

>100 quality checks for each vaccine

Trust

GSK Vaccines manufacturing capability

Strong history, experience, capabilities



World class manufacturing capabilities

Strong regulatory track record

Technical competence

Supply stability and reliability

Roger Connor

President, GSK Vaccines

GSK Vaccines are positioned for success, growth and differentiation for a very long time

Attractive growing market

Durable with limited global competitors

Barriers to entry

Innovation
Design and deliver ground-breaking vaccines
Leverage disruptive technologies
Foster partnerships

Performance
Focus on priority assets
Target key markets
Drive growth, operating performance and cash conversion

Trust
Deliver on time supply
Ensure quality standards
Serve as Global Health partner

Culture

Topline growth

Strong margins

Durable cash flow

Q&A

Roger Connor
President, GSK Vaccines

Jay Green
Senior VP, Finance

Dr. Emmanuel Hanon
Senior VP, Vaccines R&D

Patrick Desbiens
Senior VP, Commercial

Russell Thirsk
VP Site Operations

Thomas Breuer
Chief Medical Officer