GSK Vaccines meet the management

29 November 2016
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Investor Relations
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Agenda

Luc Debruyne
President
GSK Vaccines

Thomas Breuer
Chief Medical Officer
GSK Vaccines

Emmanuel Hanon
Head of R&D
GSK Vaccines

John McGrath
Head of Global Industrial Operations
GSK Vaccines

Q&A
Luc Debruyne
President, GSK Vaccines

Luc was appointed President, Global Vaccines in 2013. Following the successful integration of the Novartis vaccines business acquired in early 2015, GSK Vaccines delivers today a broad portfolio of more than 30 paediatric, adolescent, adult/travellers and elderly vaccines to 90% of the world’s countries. Luc’s ambition for the business is to lead the industry in improving health globally, continuously delivering better vaccines and protecting more people while running our business sustainably. He is a member of the Corporate Executive Team.

Luc joined GSK in 1991. He spent two years in the UK as a commercial strategy director in R&D, before becoming head of GSK’s European Commercial Centre of Excellence in 2005. In 2006, Luc became the General Manager for GSK in the Netherlands and then in 2010 Senior Vice President and General Manager in Italy, while also managing the European Established Products Business Unit. In 2012, he was appointed Senior Vice President, Pharma Europe, prior to assuming his current role.

Luc is a member of the Vaccines CEO Roundtable convened by the International Federation of Pharmaceutical Manufacturers Associations (IFPMA) and a member of the Management Committee of the Belgian Federation of Enterprises. He has previously co-chaired the Executive Committee of the European Federation of Pharmaceutical Industries and Associations (EFPIA) and has been a member of the Board of Italy’s Farmindustria and its equivalent in The Netherlands, NEFARMA. He also served on the Committee for international investment of CONINDUSTRIA, Italy and was a member of ASPEN.
Thomas Breuer

Chief Medical Officer, GSK Vaccines

Thomas Breuer is GSK Vaccines Chief Medical Officer. He leads the global medical affairs organisation, safety and pharmacovigilance, and patient access functions such as health economics. He is a member of the management team of GSK Vaccines.

From 2007 to 2015 Thomas ran the Vaccines Development Organisation and has been instrumental in the development and licensure of many of GSK’s vaccines. Before joining the company in 2001, Thomas had a career in internal medicine and public health. After six years in patient care he worked at the US Centers for Disease Control (CDC) in Atlanta, GA, before joining the German Public Health Institute as Head of Infectious Disease Epidemiology in Berlin.

Thomas has a doctorate in medicine from the University of Cologne, Germany. He is board certified in internal medicine and has a Master of Science degree in epidemiology from the University of Texas.
Emmanuel Hanon

Head of Research & Development, GSK Vaccines

Emmanuel leads our vaccines research and development organisation, covering discovery, early and late-stage development, regulatory and medical affairs activities. He is based in Rixensart, Belgium.

Emmanuel joined GSK Vaccines in 2001 taking roles of increasing responsibility in Immunology and Human Cell mediated immunity before leading the viral vaccines programme in R&D.

After heading the Elderly vaccines franchise, playing a critical role in the development of our flu pre-pandemic and pandemic strategy, he was appointed Senior Vice President - Vaccine Discovery and Development in August 2011.

Prior to joining GSK, Emmanuel obtained a PhD at University of Liège in the field of Immunology and herpes virology and occupied a post-doctorate position in the field of retrovirology at Imperial College in the UK.
John McGrath has been involved with the biologics industry for over twenty five years since graduating from Dublin City University in Ireland.

In that time he has held various technical and management positions in Ireland, the UK, the US, Switzerland and Belgium.

His experience spans manufacturing, process engineering, validation, quality assurance, general management and operations.

John holds a BSc from Dublin City University and an MBA from Babson College in the United States.
Strategic overview

Luc Debruyne
President, GSK Vaccines
Cautionary statement regarding forward-looking statements

This presentation contains statements that are, or may be deemed to be, “forward-looking statements”. Forward-looking statements give the Group’s current expectations or forecasts of future events. An investor can identify these statements by the fact that they do not relate strictly to historical or current facts. They use words such as ‘anticipate’, ‘estimate’, ‘expect’, ‘intend’, ‘will’, ‘project’, ‘plan’, ‘believe’, ‘target’ and other words and terms of similar meaning in connection with any discussion of future operating or financial performance. In particular, these include statements relating to future actions, prospective products or product approvals, future performance or results of current and anticipated products, sales efforts, expenses, the outcome of contingencies such as legal proceedings and financial results.

Other than in accordance with its legal or regulatory obligations (including under the UK Listing Rules and the EU Market Abuse Regulation), the Group undertakes no obligation to update any forward-looking statements, whether as a result of new information, future events or otherwise. Investors should, however, consult any additional disclosures that the Group may make in any documents which it publishes and/or files with the US Securities and Exchange Commission (SEC). All investors, wherever located, should take note of these disclosures. Accordingly, no assurance can be given that any particular expectation will be met, and investors are cautioned not to place undue reliance on the forward-looking statements.

All expectations and targets regarding future performance should be read together with the “Assumptions related to 2016-2020 outlook” on page 35 of the Group’s third quarter earnings release dated 26 October 2016. Forward-looking statements are subject to assumptions, inherent risks and uncertainties, many of which relate to factors that are beyond the Group’s control or precise estimate. The Group cautions investors that a number of important factors, including those in this document, could cause actual results to differ materially from those expressed or implied in any forward-looking statement. Such factors include, but are not limited to, those discussed under Item 3.D ‘Risk factors’ in the Group’s Annual Report on Form 20-F for 2015 and those discussed in Part 2 of the Circular to Shareholders and Notice of General Meeting furnished to the SEC on Form 6-K on 24 November 2014. Any forward-looking statements made by or on behalf of the Group speak only as of the date they are made and are based upon the knowledge and information available to the Group on the date of this presentation.

A number of adjusted measures are used to report the performance of our business. These measures are defined in our third quarter earnings release dated 26 October 2016 and Annual Report on Form 20-F for 2015. The earnings release also contains reconciliations to the equivalent IFRS numbers.
The value of vaccination

*Widely recognised as one of the best investments in healthcare*

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**Tremendous progress for global health...**

- ~3m deaths prevented annually:
  - ~5 per minute

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**...but still underserved populations**

- ~22m infants still missing basic vaccines

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**Target populations are growing...**

- ~1bn 60+ year olds by 2020

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**...and major diseases remain without vaccines**

- RSV
- Group B Strep
- TB
- HIV
- & many more...

Source: UN, WHO, CDC.
Vaccines benefit all phases of life
Multiple drivers of the need for vaccines

Examples of industry wide focus areas, including vaccines under development

Poverty
• Cholera
• Malaria
• Parasitic infections

Emerging infections
• Ebola
• West Nile
• Zika

Travellers
• Hepatitis
• Rabies
• Yellow fever

Chronic diseases
• Flu
• RSV*
• Staph**

Therapeutic vaccines
• Autoimmune
• Cancer
• COPD***

*RSV: Respiratory Syncytial Virus
** Staph: Staphylococcus infection
***COPD: Chronic Obstructive Pulmonary Disease
Vaccines is an attractive business, with barriers to entry

Growing market: ~£18bn in 2015
grow at 5%

Pharma-like operating margins

Long product lifecycles, no patent cliff

Few global players

Large capital investment

Complex manufacturing & quality control

Depth of expertise across value chain

1 Market data from Evaluate Pharma: $27bn, assuming FX rate of $1.53 per GBP
2 Expected CAGR from Evaluate Pharma: 2015-2022
Value and volume based business model

Two distinct markets

‘Quarterly’ volatility the norm

Tenders
• Wins
• Timing
• Funding
• Pricing

Government stockpiles
• Replenishments
• Withdrawals

Seasonality
• Back to school
• Flu season
• Outbreaks

Supply
• GSK
• Competitors

Source: GSK internal data, using GSK 2015 full year sales. Excludes legacy Novartis brands
GSK Vaccines is an ambitious global leader

*Helping to improve health around the world*

**Broadest portfolio in the industry**

- 39 vaccines approved, covering every demographic

**Helping to protect more people**

- ~2 million doses per day

**Continuously delivering new and improved vaccines**

- 15 in development, including Shingrix™ candidate vaccine, Men ABCWY, RSV, GBS, COPD, as well as novel proprietary adjuvant systems

**Strategy to deliver sustainable financial performance**

- 2020 vision
  - Targeting strong sales growth and margin expansion*

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Shingrix is an investigational candidate vaccine for shingles that has been submitted for approval to the FDA and other authorities. The name 'Shingrix' has not yet been approved for use by any regulatory authority. * Growth expectations were communicated at the investor event in May 2015. This includes the expected CAGR to 2020, using 2015 as the base year. All expectations and targets regarding future performance should be read together with the “Assumptions related to 2016-2020 outlook” on page 35 of the Group’s third quarter earnings release dated 26 October 2016. All financial figures at CER.
The Novartis transaction complemented our strengths

**Acquired portfolio**
Including meningitis

**Innovation**
Pipeline assets and platform technologies

**Supply chain**
Ownership of diphtheria & tetanus antigens

**People**
Network of highly skilled experts in R&D, manufacturing & quality

**US**
Helping to unlock US potential (e.g. Rockville)
GSK is well positioned in US, Europe and International

2016 vaccines sales for top four companies: September YTD

Source: Company reports and GSK estimates
Strong growth for GSK in US, Europe and International

9 month sales to September 2016

- **US**: £1,245m, +13%
- **Europe**: £1,053m, +18%
- **International**: £1,157m, +17%

2016 YTD: £3.5bn, +16% CER pro-forma

All growth rates are at CER and pro-forma: i.e. adjusted for the Novartis transaction.
Strong growth across most franchises

9 month sales to September 2016

2016 YTD: £3.5bn +16% CER pro-forma

All growth rates are at CER and pro-forma: i.e. adjusted for the Novartis transaction.

"Other vaccines" includes Cervarix, Priorix, Priorix Tetra, Varilrix, Rabipur and others.
On track to deliver vaccines sales growth targets*

**Expected growth drivers**

- **~1/3 of growth from:** Marketed portfolio
- **~1/3 of growth from:** Meningitis portfolio
- **~1/3 of growth from:** Shingrix candidate vaccine

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Shingrix is an investigational candidate vaccine for shingles that has been submitted for approval to the FDA and other authorities. The name ‘Shingrix’ has not yet been approved for use by any regulatory authority. *Growth expectations were communicated at the investor event in May 2015. This includes the expected CAGR to 2020, using 2015 as the base year. All expectations and targets regarding future performance should be read together with the “Assumptions related to 2016-2020 outlook” on page 35 of the Group’s third quarter earnings release dated 26 October 2016. All sales growth rates at CER.*
On track to deliver improved margin expectations*

~22% Core operating margin 2014 pro-forma

Improved leverage from sales growth
(CoGS, SG&A and disciplined R&D investments)

Transaction cost savings ~£400m by 2017

Maintain CapEx investments

Overall vaccines margin 30%+ by 2020**

*Core results are defined in the third quarter results dated 26 October 2016. ** Growth expectations were communicated at the investor event in May 2015. This includes the expected CAGR to 2020, using 2015 as the base year. All expectations and targets regarding future performance should be read together with the with the “Assumptions related to 2016-2020 outlook” on page 35 of the Group’s third quarter earnings release dated 26 October 2016. All sales growth rates at CER.
Innovative R&D programmes aim to deliver sustainable growth to 2020 and beyond

GBS—Group B Streptococcus

Shingrix is an investigational candidate vaccine for shingles that has been submitted for approval to the FDA and other authorities. The name ‘Shingrix’ has not yet been approved for use by any regulatory authority.
Positioned to be global leader for a very long time

Strategic focus

- Reliable sustainable supply
- Focus on US approvals & success
- Bolster innovation pipeline
- Build broader talent pool
- Flawless execution
Portfolio strength & growth drivers

Thomas Breuer
Chief Medical Officer, GSK Vaccines
GSK’s strong vaccines portfolio

**Maternal**
- Diphtheria
- Influenza (flu)
- Pertussis
- Poliomyelitis
- Tetanus

**Paediatric**
- Diphtheria
- Haemophilus influenzae type b (Hib)
- Hepatitis A
- Hepatitis B
- Influenza (flu)
- Measles
- Meningococcal (A, B, C, W, Y)
- Mumps
- Pertussis
- Pneumococcal
- Poliomyelitis
- Rotavirus
- Rubella
- Tetanus
- Typhoid fever
- Varicella

**Adolescent, adult and travel**
- Cervical cancer (HPV)
- Diphtheria
- Haemophilus influenzae type b (Hib)
- Hepatitis A
- Hepatitis B
- Influenza (pre-pandemic flu)
- Influenza (seasonal flu)
- Measles
- Meningococcal (A, B, C, W, Y)
- Mumps
- Pertussis
- Poliomyelitis
- Rabies
- Rubella
- Tetanus
- Tick-borne encephalitis
- Typhoid fever
- Varicella

**Older adult**
- Diphtheria
- Hepatitis A
- Hepatitis B
- Influenza (pre-pandemic flu)
- Influenza (seasonal flu)
- Pertussis
- Tetanus
- Shingles*

**Maternal**
- GSK’s vaccines do not currently have approved indications for maternal immunisation. GSK recently received EMA approval for updated Boostrix and Boostrix Polio labels with human prospective safety data in pregnant women. Maternal immunization is recommended by WHO and implemented in many countries including US and Europe

**Under regulatory review**

* Under regulatory review
Vaccine product lifecycle is a lifelong endeavor

No patent cliff – no generics – each vaccine a unique entity

* schematic
**Trivalent (TIV)** licensed in 1998

<table>
<thead>
<tr>
<th>Strains</th>
<th>TIV</th>
</tr>
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<tbody>
<tr>
<td>A1 &amp; A2</td>
<td>**</td>
</tr>
<tr>
<td>A1 &amp; A2 &amp; B</td>
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</table>

**Quadrivalent (QIV)** licensed in 2012

<table>
<thead>
<tr>
<th>Strains</th>
<th>QIV</th>
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<tbody>
<tr>
<td>A1 &amp; A2 &amp; B1 &amp; B2</td>
<td>**</td>
</tr>
</tbody>
</table>

* e.g. A/H1N1, A/H3N2 - ** e.g. B/Victoria, B/Yamagata
Flu vaccines: from trivalent to quadrivalent

**Trivalent (TIV) licensed in 1998**

- 3 strains

**Quadriivalent (QIV) licensed in 2012**

- 4 strains

* e.g. A/H1N1, A/H3N2  -  ** e.g. B/Victoria, B/ Yamagata
Flu vaccines: from trivalent to quadrivalent

<table>
<thead>
<tr>
<th>Trivalent (TIV) licensed in 1998</th>
<th>Quadrivalent (QIV) licensed in 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 strains</td>
<td>4 strains</td>
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<tr>
<td></td>
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<tr>
<td>TIV</td>
<td>QIV</td>
</tr>
<tr>
<td><img src="image1" alt="TIV" /></td>
<td><img src="image2" alt="QIV" /></td>
</tr>
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<td>*</td>
<td>*</td>
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<td>**</td>
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</table>

Competitive differentiation $\rightarrow$ total revenue increase 2012-2015: 46%***

* e.g. A/H1N1, A/H3N2 - ** e.g. B/Victoria, B/ Yamagata - *** at constant exchange rates -
Rotarix: continuous label & technical improvements since initial licensure (2004)

- Impact data*
- Thermostability data
- Rotarix co-administration
- Lowering cost of goods**

Rotarix growth since 2009: CAGR ~ 15%***

* Morbidity/Mortality, Health budget  
** e.g. fully liquid presentation, "blow fill" tube  
*** at constant exchange rates
Rotarix: impact on the number of diarrhoea-related deaths in Mexico

Countrywide vaccines introduction in May 2007

Mexico: Decline in overall diarrhoeal death between 45-55% (versus baseline)

1 Among children aged <5 years in Mexico according to age group

UK: 80% reduction in rotavirus gastroenteritis hospitalisations in infants²

Infanrix (DTPa) franchise: expanded combinations and indications (from 3-in-1 to 6-in-1)

- **Infanrix™ 4-in-1 combos**
- **Infanrix™ 5-in-1 combos**
- **Pediarix™ for the US (DTPa-HBV-IPV)**
- **Kinrix™ for the US (DTPa-IPV)**

*Infanrix™ Hib, Infanrix™ IPV, Infanrix™ HBV  -  ** Infanrix™ IPV-Hib, Infanrix™ –HBV-IPV*
Infanrix (DTPa) franchise: expanded combinations and indications (adding vaccines aimed for boosting)

**Infanrix™ (DTPa)**
- 1994: Infanrix™ (DTPa)
- 1996: Infanrix™ (DTPa)
- 1997: Infanrix™ hexa (DTPa, IPV, HBV/Hib)
- 2000: Pediarix™ for the US (DTPa-HBV-IPV)
- 2008: Kinrix™ for the US (DTPa-IPV)

**Infanrix™ 4-in-1 combos**
- 1994: Infanrix™ 4-in-1 combos
- 1996: Infanrix™ 5-in-1 combos

**Pediarix™ for the US**
- 2000: Pediarix™ for the US (DTPa-HBV-IPV)

**Kinrix™ for the US**
- 2008: Kinrix™ for the US (DTPa-IPV)

**Ditanrix™ (dT)**
- 1999: Ditanrix™ (dT)

**Boostrix™ (Tdap)**
- 1999: Boostrix™ (Tdap)

**Boostrix™ IPV (Tdap-IPV)**
- 2003: Boostrix™ IPV (Tdap-IPV)

**Boostrix™ (Tdap) US formulation***
- 2004: Boostrix™ (Tdap) US formulation***

**Maternal immunisation Boostrix / Boostrix IPV (EU label expanded)****
- 2016: Maternal immunisation Boostrix / Boostrix IPV (EU label expanded)****

DTPa franchise (including Infanrix™ & Boostrix™ family) 10 year CAGR: ~9%*****

*Infanrix™ Hib, Infanrix™ IPV, Infanrix™ HBV -  ** Infanrix™ IPV-Hib, Infanrix™ –HBV-IPV - ***Different alum content  **** GSK’s vaccines do not currently have approved indications for maternal immunisation. GSK recently received EMA approval for updated Boostrix and Boostrix Polio labels with human prospective safety data in pregnant women. Maternal immunization is recommended by WHO and implemented in many countries including US and Europe - *****at constant exchange rates
Shingrix is an investigational candidate vaccine for shingles that has been submitted for approval to the FDA and other authorities. The name ‘Shingrix’ has not yet been approved for use by any regulatory authority. Growth expectations were communicated at the investor event in May 2015. This includes the expected CAGR to 2020, using 2015 as the base year. All expectations and targets regarding future performance should be read together with the “Assumptions related to 2016-2020 outlook” on page 35 of the Group’s third quarter earnings release dated 26 October 2016. All sales growth rates at CER.
Meningococcal meningitis
Meningococcal disease: uncommon, however progresses rapidly with unpredictable outcome

Incidence and diagnosis

Meningococcal disease incidence peaks in infants and adolescents
Early signs and symptoms often resemble those of common viral illnesses¹

Significant morbidity and mortality

Despite appropriate medical treatment:
- ~5–10% of cases are fatal²
- Up to 20% of survivors of invasive meningococcal disease (all serogroups) have sequelae², including limb amputations, seizures and hearing loss³

*Case-control study (246 cases recruited) in UK (May 2008 to September 2010). Subjects aged 1 month to 13 years at disease
Broad meningitis vaccines portfolio*, including candidate pentavalent

**MenACWY**
- MenACWY tetravalent vaccine
  - Approved in 64 countries
    - US & EU (2010)
- Lifecycle management
  - Fully liquid formulation
  - Booster indication in US

**MenB**
- MenB vaccine
  - Approved in 38 countries
    - EU from > 2 months onwards (2013)
- Lifecycle management
  - Infant indication in US
  - Impact on meningococcal carriage (> 40,000 subjects)

**MenABCWY**
- Candidate pentavalent combination vaccine
  - Currently in phase II, data expected ~2017

* Meningitis portfolio: Menjugate (MenC vaccine), Bexsero (MenB vaccine), Menveo (MenACWY vaccine) ** Candidate vaccine
UK infant effectiveness data major milestone for Bexsero

First country to start a public UMV program

83% effectiveness, cases halved, >600k infants vaccinated

PRESS RELEASE

Issued: 5 September 2016

‘Real world’ data shows 83 percent effectiveness for Bexsero® in infants in first year of UK national meningitis B immunisation programme

- Cases of meningitis B halved after ten months

Preliminary data from the world’s first national meningitis B immunisation programme with Bexsero®, launched one year ago in the UK, shows the estimated effectiveness of the vaccine at 83 percent against any meningitis B strain and 84 percent against vaccine preventable strains, for all children receiving the first two of three recommended doses. Reported cases of the disease have dropped 50 percent in the vaccine-eligible population in the first ten months of the programme, compared to the average number of cases over the last four years. These data were presented today by Public Health England (PHE) at the International Pathogenic Neisseria Conference (IPNC) in Manchester, UK.

Uptake of the vaccine in the UK national immunisation programme is high. In more than 600,000 infants aged 0-1 year old, eligible for the vaccine, more than 90 percent received two doses.
Excellent execution of Bexsero’s launch

Strong performance globally

Doses sold since launch cumulative (millions)

Cumulative volume >10 million in 2 years
Investing to expand capacity to capture market growth over time

Source: GSK internal data
GSK shingles candidate vaccine

In regulatory approval process

Efficacy of the Herpes Zoster Subunit Vaccine in Adults 70 Years of Age or Older

Efficacy of an Adjuvanted Herpes Zoster Subunit Vaccine in Older Adults
Epidemiology of shingles/herpes zoster (HZ) in the US

~1 m cases in the US annually\(^1\)

32% estimated lifetime risk of zoster\(^1\)

50% of persons living over age 85 years are likely to develop zoster\(^1\)

The most important risk factors
- Increasing age
- Immunosuppression

Feared complication
- Postherpetic neuralgia

1. CDC. *Epidemiology and Prevention of Vaccine-Preventable Diseases*. 13th ed. 2015
Shingrix candidate vaccine developed to differentiate

Ambition at the outset:

• Sub-unit vaccine (non-live)
• High efficacy in 50+, including older subgroups
• Sustained efficacy over time
• Applicable to immunocompromised individuals
• Refrigerator stable

Shingrix is an investigational candidate vaccine for shingles that has been submitted for approval to the FDA and other authorities. The name ‘Shingrix’ has not yet been approved for use by any regulatory authority.
### Two dose vaccine: strong efficacy across different age groups

**ZOE-50 / pooled ZOE-50 / ZOE-70 results**

<table>
<thead>
<tr>
<th>Age range (years)</th>
<th>Cases VACCINE GROUP</th>
<th>Cases PLACEBO GROUP</th>
<th>VE (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥50</td>
<td>6</td>
<td>210</td>
<td><strong>97.2 (93.7-99.0)</strong></td>
</tr>
<tr>
<td>≥70</td>
<td>25</td>
<td>284</td>
<td><strong>91.3 (86.8-94.5)</strong></td>
</tr>
<tr>
<td>≥70</td>
<td>4</td>
<td>36</td>
<td><strong>88.8 (68.7-97.1)</strong></td>
</tr>
</tbody>
</table>

#### Efficacy against HZ (ZOE 50)*

#### Efficacy against HZ (pooled ZOE 50/ZOE 70) **

#### Efficacy against postherpetic neuralgia (pooled ZOE 50/ZOE 70)**


** Cunningham AL, Lal H, Kovac M, et al. Efficacy of the herpes zoster subunit vaccine in adults ≥70 years of age. NEJM 2016;375:1019-1032
High and sustained efficacy over 4 years

Pooled ZOE-50 and ZOE-70 results

<table>
<thead>
<tr>
<th>Time post-vaccination*</th>
<th>HZ/Vaccine group n=8,250</th>
<th>Placebo group n=8,346</th>
<th>VE (95% CI)†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>2</td>
<td>83</td>
<td>97.6 (90.9-99.8)</td>
</tr>
<tr>
<td>Year 2</td>
<td>7</td>
<td>87</td>
<td>92.0 (82.8-96.9)</td>
</tr>
<tr>
<td>Year 3</td>
<td>9</td>
<td>58</td>
<td>84.7 (69.0-93.4)</td>
</tr>
<tr>
<td>Year 4</td>
<td>7</td>
<td>56</td>
<td>87.9 (73.3-95.4)</td>
</tr>
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*Year 1: from 30 days to 395 days after the second vaccination. Year 2: from >395 days to 760 days after the second vaccination. Year 3: from >760 days to 1,125 days after the second vaccination. Year 4: from >1,125 days after the second vaccination to the last contact date.
Safety and reactogenicity profile

ZOE-50/70 results*

Safety:
No imbalance between vaccine and placebo group for:
- Serious Adverse Events
- Potentially Immune mediated Diseases
- Deaths

Reactogenicity:
- Local and systemic reactions were common, however majority were of
  - mild to moderate intensity
  - of short duration

Second-dose compliance:
High: ~95%

* Herpes zoster subunit vaccine – GSKs shingles candidate vaccine
Key milestones on track

Filing completed in US, Canada and Europe

2016

US, Canada, EU filings

2017

Japan filing

Additional co-administration data

Revaccination of people previously vaccinated with Zostavax*

Phase III efficacy study in immuno-compromised

2018

* Zostavax is a trademark of Merck & Co
Shingrix candidate vaccine: the opportunity…

Globally only a small proportion of the older adult population has received a shingles vaccine

<table>
<thead>
<tr>
<th>Redefine and expand the market</th>
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<tbody>
<tr>
<td>New standard of prevention</td>
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<tr>
<td>Potential revaccination</td>
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<tr>
<td>Increase immunisation rates</td>
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<tr>
<td>Geographic expansion</td>
</tr>
<tr>
<td>New cohorts</td>
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<tr>
<td>91%-97% efficacy</td>
</tr>
<tr>
<td>opportunity*</td>
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<tr>
<td>Data in 2017</td>
</tr>
<tr>
<td>~30% in US (current)</td>
</tr>
<tr>
<td>US, Canada, EU filed</td>
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<tr>
<td>Immuno-compromised</td>
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<tr>
<td>Sustained efficacy</td>
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<tr>
<td>expand the market</td>
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<tr>
<td>Expand age recommendations</td>
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</tbody>
</table>

* of Zostavax recipients. Zostavax is a trademark of Merck & Co.
Shingrix is an investigational candidate vaccine for shingles that has been submitted for approval to the FDA and other authorities. The name ‘Shingrix’ has not yet been approved for use by any regulatory authority.
Research & Development

Emmanuel (Manu) Hanon
Head of R&D, GSK Vaccines
R&D organisation

Rixensart, Belgium

Siena, Italy

Rockville, MD, US
# Vaccines R&D timelines (illustrative)

<table>
<thead>
<tr>
<th>Identify antigens</th>
<th>Produce antigens</th>
<th>Pre-clinical testing</th>
<th>Phase I</th>
<th>Phase II</th>
<th>Proof of concept</th>
<th>Phase III</th>
<th>File</th>
<th>Registration/post-marketing surveillance</th>
</tr>
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<tbody>
<tr>
<td><strong>Research</strong> (including immunology)</td>
<td></td>
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<tr>
<td><strong>Pre-clinical development</strong> (including formulation science)</td>
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<tr>
<td><strong>Clinical development</strong> (including post-marketing surveillance)</td>
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<tr>
<td><strong>Transfer process to manufacturing</strong></td>
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<tr>
<td><strong>Start building facility</strong></td>
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</tbody>
</table>

### Timeline:
- **1–10 years**: Research and pre-clinical development
- **2–3 years**: Phase I and phase II trials
- **2–4 years**: Phase III trials and proof of concept
- **≥ 1 year**: Transfer process to manufacturing and start building facility

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Innovative R&D programmes aim to deliver sustainable growth to 2020 and beyond

Near/mid term key R&D focus
- Lifecycle management
- Meningitis
- Shingrix candidate vaccine

Longer term R&D focus
- Lifecycle management
- RSV
- GBS

New vaccines
- COPD
  - Technology platforms

Shingrix is an investigational candidate vaccine for shingles that has been submitted for approval to the FDA and other authorities. The name ‘Shingrix’ has not yet been approved for use by any regulatory authority.
Respiratory Syncytial Virus (RSV)
RSV-associated hospitalisation burden significantly impacts infants and the elderly.

Respiratory syncytial virus-associated hospitalisation burden in the Netherlands.  
■: versus summer baseline period;  □: versus peri-seasonal baseline period.
The inclusion of RSV F (fusion) protein in the composition of an RSV vaccine is critical.

Graham B et al., Current Opinion in Immunology 35; 30-38, 2015
Novel RSV candidate vaccine approaches

The inclusion of RSV F (fusion) protein in the composition of an RSV vaccine is critical.

GSK Pre-F approach differs from competitor Post-F which recently did not meet end points.

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GSK Pre-F approach differs from competitor Post-F which recently did not meet end points.

Graham B et al., Current Opinion in Immunology 35; 30-38, 2015

Absorption with Pre-F but not Post-F depletes neutralising IgG from convalescent serum

LOD = Limit of detection

IgG = Immunoglobulin G
Novel RSV candidate vaccine for the elderly

The inclusion of RSV F (fusion) protein in the composition of an RSV vaccine is critical.

GSK Pre-F approach differs from competitor Post-F which recently did not meet end points.

AS01 adjuvant system has been shown to be highly efficient in the elderly.
Novel RSV candidate vaccine for the elderly

The inclusion of RSV F (fusion) protein in the composition of an RSV vaccine is critical.

GSK Pre-F approach differs from competitor Post-F which recently did not meet end points.

AS01 adjuvant system has been shown to be highly efficient in the elderly.

Elderly candidate with AS01
Expected to enter late stage development in 2020.
Period of most severe RSV cases for young infants occurs from birth to 12 months

Paramore, Pharmacoeconomics 22:274-285, 2004
Period of most severe RSV cases for young infants occurs from birth to 12 months

Two-pronged approach for infants

Maternal vaccine

Paediatric vaccine

Week of pregnancy

Age in months

0 2 3 4 5 6 7 8 9 10 11 12 13 14 15

0 5,000 10,000 15,000 20,000 25,000 30,000 35,000

Maternal IgG

Infant’s immune response

Period of greatest risk for severe RSV disease

Paramore, Pharmacoeconomics 22:274-285, 2004
Maternal immunisation strategy to help prevent diseases that afflict very young infants

Infants protected by maternal flu vaccination

Proportion with confirmed influenza

VE = 50.5%

p = 0.01

GSK's flu vaccines do not have approved indications for maternal immunization

VE = Vaccine efficacy

Novel RSV candidate vaccine approaches

The inclusion of RSV F (fusion) protein in the composition of an RSV vaccine is critical.

GSK Pre-F approach differs from competitor Post-F which recently did not meet end points.

Absorption with Pre-F but not Post-F depletes neutralising IgG from convalescent serum.

Maternal Expect Phase III start: 2019

GSK preclinical data, unpublished
A different novel approach for paediatric

Genetically engineered recombinant CHAd155
Same vector used in Ebola vaccine (Okairos transaction)
Non-alum composition

Paediatric
Expect Phase III start: post 2020
Group B Streptococcus (GBS)
Maternal immunisation for GBS

The leading cause of pneumonia, meningitis and sepsis in neonates

1 in 2,500 of babies develop GBS disease despite antibiotic prophylaxis of colonised mothers

No vaccine is available

Gibbs, Obstet Gynecol, 104;1062-1075, 2004
**GBS maternal immunisation expanded programme**

**Phase II trivalent vaccine antibody data shows response at period of greatest risk**

Based on capsular polysaccharide (CPS) from 5 dominant GBS serotypes conjugated to a protein carrier

**Decision to expand composition to pentavalent, to help protect against >95% of prevalent serotypes**

Development of internationally standardised assay

Validate the correlate of protection and agree clinical development plan with FDA

Expect phase I start of pentavalent ~2020

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Le Doare, Vaccine 31(4) D7, 2013 ; GSK clinical data, unpublished
A new vaccine concept for COPD
### Role of microbes in acute exacerbations of COPD

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>Prevalence in acute exacerbations of COPD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Haemophilus influenzae</strong></td>
<td>20-30%</td>
</tr>
<tr>
<td><strong>Moraxella catarrhalis</strong></td>
<td>10-15%</td>
</tr>
<tr>
<td><strong>Streptococcus pneumoniae</strong></td>
<td>10-15%</td>
</tr>
<tr>
<td><strong>Pseudomonas aeruginosa</strong></td>
<td>5-10% mostly in advanced disease</td>
</tr>
</tbody>
</table>

Adapted from Sethi S & Murphy TS N Engl J Med. 2008;359:2355-65
Testing hypothesis for a COPD vaccine

**Non-typeable Haemophilus influenzae (NTHi)**
- **PiLA**
  - motility and biofilm formation
- **PE**
  - serum resistance, adhesion, invasion
- **PD**
  - serum resistance, adhesion

**Moraxella catarrhalis (Mcat)**
- **UspA2**
  - adhesion, serum resistance

Proof of concept in humans expected to be completed by 2019
Unique expertise in platform technologies

Supports current and future pipeline

Adjuvants
Unique expertise in platform technologies

Supports current and future pipeline

- Adenovirus vector and Self-Amplifying RNA (SAM)
- Novel glyco-conjugation
Vaccines Global Manufacturing Network

John McGrath
Head of Global Industrial Operations, GSK Vaccines
How long does it take to manufacture a single dose of vaccine?

Options:
A. Between 3 and 8 months
B. Between 6 and 12 months
C. Between 6 and 18 months
D. Between 10 and 26 months
How long does it take to manufacture a single dose of vaccine?

Options:

A. Between 3 and 8 months
B. Between 6 and 12 months
C. Between 6 and 18 months
D. Between 10 and 26 months
What percentage of the world’s children receive at least one GSK vaccine?

Options:

A. 10%
B. 20%
C. 40%
D. 50%
What percentage of the world’s children receive at least one GSK vaccine?

Options:

A. 10%
B. 20%
C. 40%
D. 50%
What percentage of the world’s countries receive our vaccines?

Options:

A. 50%
B. 70%
C. 80%
D. 90%
What percentage of the world’s countries receive our vaccines?

Options:

A. 50%
B. 70%
C. 80%
D. 90%
Our strong manufacturing network is a competitive advantage: our people, buildings & processes

- Ability to navigate a complex regulatory environment
- Extensive capacity (~1bn doses/year) and investing to expand
- Able to respond to variability in short term demand
- Expertise in balancing supply and demand over the long term
Vaccines differ from medicines in many aspects, from composition to development and administration.

<table>
<thead>
<tr>
<th></th>
<th>Vaccines</th>
<th>Non-biological drugs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Composition</strong></td>
<td>Complex with various core components&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Typically a single active chemical component&lt;sup&gt;1,5&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Trials</strong></td>
<td>Large community-based trials in healthy subjects&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Typically smaller clinical trials in patients with a disease or conditions</td>
</tr>
<tr>
<td><strong>Regulatory approval</strong></td>
<td>Complex and time consuming&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Usually less complex</td>
</tr>
<tr>
<td><strong>Supply</strong></td>
<td>Cold chain required&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Cold chain less common</td>
</tr>
<tr>
<td><strong>Time to market from production to supply</strong></td>
<td>Long lead time&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Typically shorter lead time</td>
</tr>
<tr>
<td><strong>Administration</strong></td>
<td>Multiple injections with extended periods between doses (months or years)&lt;sup&gt;4&lt;/sup&gt;</td>
<td>Regular intervals, often with daily schedules&lt;sup&gt;6&lt;/sup&gt;</td>
</tr>
</tbody>
</table>
A complex manufacturing journey

Note: This scenario is fictionalised, based upon industry experience of managing complex manufacturing processes, but it does not represent an actual example.
Our global manufacturing network
Shelf life management is critical
What does it mean from a supply perspective?

Example: vaccine with a 36 month shelf life

Shelf life is 36 months from filling syringe or vial however, up to 1/3 of shelf life is used up before shipping

+/- 18–26 months

1/3 of shelf life spent between filling & shipment

Remaining 2/3 of shelf life between shipment and vaccine use

Accurate forecasting of vaccine demand is critical to optimising the shelf life available to the customer
For a vaccine available in 2019: When would manufacturing be initiated?*

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
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<tbody>
<tr>
<td><strong>…</strong></td>
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<tr>
<td><strong>H1</strong></td>
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<tr>
<td><strong>H2</strong></td>
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<tr>
<td><strong>2016</strong></td>
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<td><strong>H1</strong></td>
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<tr>
<td><strong>H2</strong></td>
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<tr>
<td><strong>2017</strong></td>
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<tr>
<td><strong>H1</strong></td>
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<td><strong>H2</strong></td>
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<tr>
<td><strong>2018</strong></td>
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<tr>
<td><strong>H1</strong></td>
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<tr>
<td><strong>H2</strong></td>
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<tr>
<td><strong>2019</strong></td>
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<tr>
<td><strong>H1</strong></td>
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<tr>
<td><strong>H2</strong></td>
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</tbody>
</table>

- **Customer**: Vaccines delivered to customers from Q1 2019
- **Distribution**: Logistic chains filled from Q4 2018 (depending on the country)
- **Packaging**: Specific leaflets and labels in 2018
- **Filling**: Secondary operations in 2018
- **Formulation**: Secondary operations in 2018
- **Bulk**: Antigens produced and purified in 2017

Production plan largely based on assumed demand

*This scenario is illustrative based upon industry experience of managing complex manufacturing processes
Manufacturing sites for vaccines are first approved and then regularly inspected by regulatory authorities.

Each vaccines batch undergoes repeated, rigorous quality testing\textsuperscript{1,2}

<table>
<thead>
<tr>
<th>QC</th>
<th>GSK quality process</th>
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<tbody>
<tr>
<td></td>
<td>Manufacturer's release\textsuperscript{2}</td>
</tr>
<tr>
<td></td>
<td>GMP compliance\textsuperscript{1}</td>
</tr>
<tr>
<td></td>
<td>Batch records\textsuperscript{1}</td>
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<tr>
<td></td>
<td>Lab tests\textsuperscript{1}</td>
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<tr>
<td></td>
<td>Certificate of analysis</td>
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<table>
<thead>
<tr>
<th>QA</th>
<th>GSK quality process</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Vaccine lot</td>
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<table>
<thead>
<tr>
<th>GSK quality process</th>
<th>Country quality process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer's release\textsuperscript{2}</td>
<td>Distribution to vaccine-recipient country</td>
</tr>
<tr>
<td>GMP compliance\textsuperscript{1}</td>
<td>Vaccine-recipient country test\textsuperscript{2}</td>
</tr>
<tr>
<td>Batch records\textsuperscript{1}</td>
<td>Vaccine-recipient country laboratory tests and document review\textsuperscript{2}</td>
</tr>
<tr>
<td>Lab tests\textsuperscript{1}</td>
<td>Vaccine-recipient country regulatory authority release\textsuperscript{2}</td>
</tr>
<tr>
<td>Certificate of analysis</td>
<td>Local operating companies’ national regulatory authority release, where required\textsuperscript{2}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>QC</th>
<th>GSK quality process</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Manufacturing country review, test\textsuperscript{1}, release\textsuperscript{2}</td>
</tr>
</tbody>
</table>

\*Specific to vaccines/biologics. † In the European economic area the official batch release performed by one country will be mutually recognized by all.

We are investing in capacity expansion

Proactive upgrading of supply network

- Designed to meet and exceed regulatory requirements: quality and current GMP
- Ensure sustainability for the long term
- Tackling recent supply constraints impacting HepA and Pa containing vaccines
Our strong manufacturing network is a competitive advantage: our people, buildings & processes

- Ability to navigate a complex regulatory environment
- Extensive capacity (~1bn doses/year) and investing to expand
- Able to respond to variability in short term demand
- Expertise in balancing supply and demand over the long term

“Vaccines is a business where experience really counts”
Question & Answer session