## \*\*\*\*Published February 2013\*\*\*

# MarketVIEW: Hepatitis E Virus (HEV) vaccines (CAT: VAMV040)

Product Name	:	MarketVIEW: Hepatitis E Virus (HEV) vaccines
Description	:	Global vaccine commercial opportunity assessment
Contents	:	Executive presentation + 1 forecast model
Therapeutic Area	:	Hepatitis vaccines
Publication date	:	February 2013
Catalogue No	:	VAMV040

# Background

Hepatitis E Virus (HEV) is most common in developing countries with inadequate water supply and environmental sanitation. The virus is enterically transmitted via the faecal-oral route and has been responsible for many large outbreaks. Every year it is estimated to infect about 20 million people, cause 3.3 million incident cases and claim 70,000 lives. Although HEV usually causes a self-limited acute illness in humans the virus disproportionately affects pregnant women with a probability of death estimated at ~20%.

In December 2011 the first HEV vaccine "Hecolin" was approved by China's State Food and Drug Administration (SFDA). The product is marketed by the subsidary company Innovax formed by Yangshengtang Group and Xiamen University in Fujian province. Hecolin is pending the WHO prequalification program so could be used outside of China in the future.

This **MarketVIEW** product contains an executive presentation with an MS Excel-based model which forecasts the potential commercial value of Hepatitis E Virus (HEV) vaccines across the private sector of highly endemic and endemic markets until 2030. The model contains value (\$ m) and volume (mio doses) predictions along with timeframe, pricing and penetration estimates for all adult risk groups (>16 yrs) including immunocompromised, women of child bearing-age and military personnel.

Bringing life to vaccine strategy...

### www.vacZine-analytics.com

# Methodology

**VacZine Analytics** has closely monitored all significant source material pertaining Hepatitis E Virus (HEV) epidemiology, disease indications and target groups. Source materials used are literature articles, government websites, medical bodies and associations, conference proceedings etc. Previously published research by **VacZine Analytics** in the field of viral pathogens has also been utilised.

## PRODUCT CONTENTS: Published February 2013 (CAT No: VAMV040)

\*\*\*\*This product is composed of one forecast model and a summary presentation

Contents **Executive Summary** Author's Note Key model outputs Hepatitis E vaccine: global revenues (\$ 000s) - per scenario Hepatitis E vaccine: global volumes (Doses 000s) - per scenario Hepatitis E vaccine: global revenues (\$ 000s) - region Hepatitis E vaccine: global volumes (Doses 000s)\* - per region Hepatitis E virus - Disease background and epidemiology Endemnicity of Hepatitis E Virus (HEV) Endemnicity of Hepatitis E Virus (HEV): list of countries Selected Large Reported Outbreaks of Hepatitis E Virus (HEV) Hepatitis E infection: morbidity & mortality Hepatitis E virus: genetic diversity Geographical distribution of HEV disease pattern Characteristics of HEV infections according to genotype Hepatitis E virus: transmission Routes of Hepatitis E virus infection Time course of Hepatitis E virus infection Hepatitis E virus: risk groups Hepatitis E infection: diagnosis/clinical description Clinical findings in Hepatitis E outbreaks Hepatitis E: age distribution of cases (Hong Kong 2001-2010) Comparison of major characteristics between HAV and HEV Hepatitis E virus: focus on pregnant women Hepatitis E virus: focus on neonates Hepatitis E virus: chronic infection Hepatitis E virus: Solid-organ transplant recipients Hepatitis E infection: treatment/management Hepatitis E virus: summary of vaccine development Hepatitis E vaccines: biological rationale Hepatitis E vaccines: current status Hecolin (Innovax) - HEV239 HEV239: late stage clinical data Hepatitis E vaccine: GlaxoSmithKline/WRAIR GlaxoSmithKline/WRAIR: Phase II clinical data Hepatitis E vaccines: other programs Hepatitis E vaccine: modelling commercial potential Hepatitis E vaccines: modelling methodology

# Bringing life to vaccine strategy...

## www.vacZine-analytics.com



#### Continued.....

Countries modelled (private sector) HEV vaccine: modelling scenarios (private sector) Commercial model assumptions: highly endemic countries Commercial model assumptions: endemic countries Hepatitis E vaccines: public sector use Hepatitis E vaccines: model caveats/limitations Bibliography About VacZine Analytics Disclaimer

#### PAGES: ~60 MS PowerPoint slides, fully referenced/sourced. Available in .pdf form

#### Contents - Vaccine demand model (MS Excel-based)

Title sheet CHARTS - TOTAL per scenario CHARTS - TOTAL per region Value/ Volume per scenario Val sum (highly endemic) Pricing highly endemic Val sum (endemic) Pricing endemic Vol sum (highly endemic) Vol sum (endemic) Highly endemic markets → LATAM (a) (>16 yrs at risk) AFRICA (a) (>16 yrs at risk) MENA (a) (>16 yrs at risk) ASIA (a) (>16 yrs at risk) INDIA (>16 yrs at risk) CHINA (>16 yrs at risk) Endemic markets -> LATAM (a) (>16 yrs at risk) M5EU (>16 yrs at risk) OTHER EU (a) (>16 yrs at risk) AFRICA (a) (>16 yrs at risk) MENA (a) (>16 yrs at risk) ASIA (a) (>16 yrs at risk) Population sources -> >16 yrs (highly endemic) >16 yrs (endemic) 20-44 yrs Females (highly endemic) 20-44 yrs Females (endemic) Military (highly endemic) Military (endemic) >16 yrs ALL COUNTRIES 20-44 yrs ALL COUNTRIES % PRIVATE SECTOR AT RISK POPULATIONS WORLD MILITARIES

Worksheets = 40 interconnected

# Bringing life to vaccine strategy...

#### www.vacZine-analytics.com



#### **PRODUCT COST:**

VacZine Analytics will grant a [enter region] license to [enter client name], for the price of:

#### USD \$8495.00/ GBP £5480.00<sup>#</sup> (Region license)\*

\*A region is North America, Europe or ROW For orders in the UK, VAT at 20% will be added to final invoice total # - indicative prevailing rate will be applied on date of transaction

#### HOW TO ORDER:

To order please contact your region account manager or order direct at <u>orders@vaczine-analytics.com</u> This report can also be purchased on-line. Please review the **TERMS and CONDITIONS** of purchase.



VacZine Analytics (R) is a trading division of Assay Advantage Ltd, UK Company Number: 5807728 VacZine Analytics (R) and the "spiral logo" are UK Registered Trademarks, 2009

Bringing life to vaccine strategy...

### www.vacZine-analytics.com

#### BIBLIOGRAPHY

- 1. Balayan MS, Andjaparidze AG, Savinskaya SS, et al Evidence for a virus in non-A non-B hepatitis transmitted via fecal-oral route. Intervirology 1983;20:23-31.
- 2. Viswanathan R. Infectious hepatitis in Delhi (1955–56) A critical study: epidemiology. Indian J Med Res 1957;45:49-58
- 3. Dalton HR, Bendall R, Ijaz S, Banks M. Hepatitis E: an emerging infection in developed countries. Lancet 2008; 8: 698-709
- Dalton HR, Bendall RP, Keane FE, Tedder RS, Ijaz S. Persistent carriage of hepatitis E virus in patients with HIV infection. N Engl J Med 2009;361:1025-7.
- 5. US Centers for Disease Control and Prevention. Hepatitis E Information for Health Professionals. Available at: http://www.cdc.gov/hepatitis/HEV/HEVfag.htm#section1. Accessed January 2013
- 6. Hughes J M et al. Clin Infect Dis. 2010;51:328-334
- 7. Rein DB, Stevens G, Theaker J, Wittenborn JS, Wiersma ST. The global burden of hepatitis E virus. Hepatology. 2012;55:988–97. DOIPubMed
- 8. Khuroo MS. Discovery of hepatitis E: The epidemic non-A, non-B hepatitis 30 years down the memory lane. Virus Research 161 (2011) 3-14
- 9. Hoofnagle JH et al. Hepatitis E. N Engl J Med 2012;367:1237-44
- 10. US Centers for Disease Control and Prevention. Hepatitis E Information for Health Professionals Transmission and exposure. Available at: http://www.cdc.gov/hepatitis/HEV/HEVfaq.htm#section2. Accessed January 2013
- 11. Kamar N et al. Hepatitis E. Lancet 2012; 379: 2477-88
- 12. World Health Organization (WHO). Global Alert and Response (GAR). Hepatitis E. Available at: http://www.who.int/csr/disease/hepatitis/whocdscsredc200112/en/index3.html. Accessed January 2013
- 13. UK Health Protection Agency. Public Health Operational Guidelines for Hepatitis E. Date of issue: May 2012
- 14. Aggarwal R. Clinical presentation of Hepatitis E. Virus Research 161 (2011) 15-22
- 15. Hong Kong Centre for Health Protection. Scientific Committee on Enteric Infections and Foodborne Diseases . Epidemiology and Prevention of Hepatitis E. Available at:
- http://www.chp.gov.hk/files/pdf/epidemiology\_and\_prevention\_of\_hepatitis\_e\_r.pdf. Accessed January 2013
- Khuroo, M.S., Deurmeyer, W., Zargar, S.A., Ahanger, M.A., Shah, M.A., 1983. Acute sporadic non-A, non-B, hepatitis in India. Am. J. Epidemiol. 118, 360–364
- 17. Patra, S. et al. 2007. Maternal and fetal outcomes in pregnant women with acute hepatitis E virus infection. Ann. Intern. Med. 147 (1), 28–33.
- 18. Khuroo, M.S., 2007. Association of severity of HEV infection in the mother and vertically transmitted infection in fetus. Ann. Intern. Med. (Published Online July 9, 2007).
- 19. Kamar, N et al., 2008. Hepatitis E virus and chronic hepatitis in organ-transplant recipients. N Engl. J. Med. 358 (8), 811– 817
- 20. le Coutre, P et al 2009. Reactivation of hepatitis E infection in a patient with acute lymphoblastic leukaemia after allogeneic stem cell transplantation. Gut 58 (5), 699–702
- 21. Ollier, L., et al 2009. Chronic hepatitis after hepatitis E virus infection in a patient with non-
- 22. Hodgkin lymphoma taking rituximab. Ann Intern Med 150 (6), 430-431.
- 23. Legrand-Abravanel F, Kamar N, Sandres-Saune K, et al. Hepatitis E virus infection without reactivation in solid-organ transplant recipients, France. Emerg Infect Dis 2011; 17: 30–37
- 24. Legrand-Abravanel F, et al. Characteristics of autochthonous hepatitis E virus infection in solid-organ transplant recipients in France. J Infect Dis 2010; 202: 835 44
- 25. Alric, L. et al. 2010. Chronic hepatitis E virus infection: successful virologic response to pegylated interferon-alpha therapy. Ann. Intern. Med. 153 (2), 135–136
- 26. Kamar, N et al. 2010a. Three-month pegylated interferon-alpha-2a therapy for chronic hepatitis E virus infection in a haemodialysis patient. Nephrol. Dial. Transplant 25 (8), 2792–2795
- 27. Tsarev SA, et al. Successful passive and active immunization of cynomolgus monkeys against hepatitis E. Proc Natl Acad Sci USA 1994;91:10198–202.
- 28. Bryan JP et al. Epidemic hepatitis E in Pakistan: patterns of serologic response and evidence that antibody to hepatitis E virus protects against disease. J Infect Dis 1994;170:517–21.
- 29. Tam A et al. In vitro infection and replication of hepatitis E virus in primary cynomolgus macaque hepatocytes. Virology 1997;238:94–102
- 30. Shrestha, M.P et al., 2007. Safety and efficacy of a recombinant hepatitis E vaccine. N. Engl. J. Med. 356, 895–903
- 31. Zhu, F.C et al 2010. Efficacy and safety of a recombinant hepatitis E vaccine in healthy adults: a large scale, randomised, double-blind placebo-controlled, phase 3 trial. Lancet 376, 895–902.
- 32. Hepatitis E vaccine debuts. Park SB. Nature News (October 2012) Vol 491: 7422

# Bringing life to vaccine strategy...

### www.vacZine-analytics.com

VacZine Analytics<sup>®</sup> Bringing life to vaccine strategy...

- Innovax Corporate Press Release. January 12th 2012. Available at: http://www.innovax.cn/en/news\_view.aspx?newsCateid=56&Cateid=56&NewsId=561. Accessed January 2013
- 34. Innovax Corporate Website. Available at:
- http://www.innovax.cn/en/pro1.aspx?ProductsCateID=52&CateID=52&CurrCateID=52. Accessed January 2013
  35. Zhang J, Liu CB, Li RC, et al. Randomized-controlled phase II clinical trial of a bacterially expressed recombinant hepatitis E vaccine. Vaccine 2009; 27: 1869–74
- Zhu FC, Zhang J, Zhang XF, Zhou C, Wang ZZ, Huang SJ, et al. Efficacy and safety of a recombinant hepatitis E vaccine in healthy adults: a large-scale, randomised, double-blind placebo-controlled, phase 3 trial. Lancet. 2010;376:895–902
- Safary A. Perspectives of vaccination against hepatitis E. Intervirology. 2001;44:162 http://dx.doi.org/10.1159/000050043
   Stevenson P. Nepal calls the shots in hepatitis E virus vaccine trial. Lancet. 2000;355:1623. http://dx.doi.org/10.1016/S0140-6736 (05)72531-9
- Lipoxen reports significant progress in the development of its DNA vaccine delivery patent portfolio. Feb 2008. Available at: http://www.lipoxen.co.uk/lipoxen-reports-significant-progress-in-the-development-of-its-dna-vaccine-delivery-patentportfolio.aspx. Accessed February 2013
- 40. Agarwal R et al. Hepatitis E vaccines. Hepatol Int (2008) 2:308-315
- 41. By calculation from US Census Bureau. International Database (IDB). Available at: http://www.census.gov/ipc/www/idb/index.php. Accessed October 2012
- 42. List of countries by number of military and paramilitary personnel. Available at: http://en.wikipedia.org/wiki/List\_of\_countries\_by\_number\_of\_military\_and\_paramilitary\_personnel. Accessed January 2013
- GAVI Vaccine Investment Strategy. Available at: http://www.gavialliance.org/about/strategy/vaccine-investment-strategy/. Accessed February 2013

Bringing life to vaccine strategy...

## www.vacZine-analytics.com

#### **TERMS and CONDITIONS:**

VacZine Analytics – a trading division of Assay Advantage Ltd UK Company Number: 5807728 (Herein referred to as "The Company"). (Herein [enter client name] to as "The Client").

1. This finished research product is provided is provided as a Service. Any additional Service required by the client will be subject to a new proposal being prepared.

2. The Service will commence after written (e-mail) or Fax confirmation stating the Client's acceptance of the Service according the description proposed by the Company.

**3. Cancellation policy**. The Company's cancellation policies are in accordance with the EU Consumer Protection (Distance Selling) Regulations 2000 (DSRs). Prior to acceptance of an order the Company will make available written information regarding Clients cancellation rights. This is posted on the Company website and is available for public review.

4. Cancellation rights: For finished documents - a Clients cancellation rights will last for seven working days counting from the day that the order was concluded. If the Services i.e. provision of the documents has taken place with the Clients agreement before this period the Client's cancellation rights have ended.

5. Invoicing will **100%** after submission of deliverables to the Client in a form reasonably acceptable to the Client.

6. If not purchased on line invoices are payable within thirty days of the invoice date.

7. All proposals are quoted in \$USD dollars or £GBP and invoices are to be settled in the same currency.

**8.** The Company agrees not to disclose to any third party confidential information acquired in the course of providing the services listed without the prior written consent of the Client. Exception occurs when the information is already in the public domain or when disclosure is necessary to help the Company's employees and agents with the performance of the Company's obligations to achieve satisfactory completion of the project and approved in writing by the Client.

**9.** Force Majeure: The Company will not be liable for any delay or failure to perform any obligation under this Agreement insofar as the performance of such obligation is prevented by an event beyond our reasonable control, included by not limited to, earthquake, fire, flood or any other natural disaster, labour dispute, riot, revolution, terrorism, acts of restraint of government or regulatory authorities, failure of computer equipment and failure or delay of sources from which data is obtained.

10. Please also refer to Master TERMS and CONDITIONS available upon request.

#### **VacZine Analytics**

Warren House Bells Hill Bishops Stortford Herts CM23 2NN United Kingdom Tel: +44 (0) 1279 654514 / +44 (0) 7952470582 / Fax: +44 (0) 1279 655926 E-mail: info@vacZine-analytics.com

Bringing life to vaccine strategy...

### www.vacZine-analytics.com



# **About VacZine Analytics:**

VacZine Analytics is an established strategic research agency based in the United Kingdom. Its aim is to provide disease and commercial analysis for the vaccine industry and help build the case for developing new vaccines and biologics.

For more information please visit our website www.vacZine-analytics.com

VacZine Analytics (R) is a trading division of Assay Advantage Ltd, UK Company Number: 5807728 VacZine Analytics (R) and "the spiral logo" are UK Registered Trademarks, 2009

Bringing life to vaccine strategy...

## www.vacZine-analytics.com