Enhanced International R&D Cooperation 20th DCVMN Annual General Meeting

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International Vaccine Institute

Presentation Content

- Introduction
- IVI Organization
- Examples of IVI International R&D Cooperation
- Conclusion



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DCVMN Goals

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- DCVMN has built a successful track record of producing innovative, high-quality, and affordable vaccines
- DCVMN members' will is to contribute to improving the health and well being of people in all regions, especially in developing countries
- 70% of global vaccines are now produced by large multinationals based in North America and Europe, with the remaining 30% being produced by the vaccine industry in emerging and developing countries
 - The vaccine industry in these countries is **growing rapidly,** in volume, innovation, technology sharing, and effective partnerships
 - When it comes to the supply of children's vaccines, the figures are actually reversed, with **70% of** vaccines being produced by developing-country manufacturers
- As developing-country manufacturers continue to cooperate, increasing numbers of technology transfer agreements are being sought and negotiated to speed up access to new vaccines
- In the Decade of Vaccines, DCVMN members should be able to supply **most of the childhood vaccines**
- Further, vaccines against **neglected diseases** are in the pipeline to better protect low-income countries

• DCVMN Manufacturers as of 2012

DCVMN: 37 manufacturers from 14 countries





Pagliusi et al. Developing Countries Vaccine Manufacturers Network: Doing good by making high-quality vaccines affordable for all. Vaccine 31S (2013) B176–B183

BRICS's Impacts on the Global Vaccine Market

- Brazil, the Russian Federation, India, China and South Africa (BRICS) have made considerable progress in vaccine production, regulation and development over the past 20 years
- By **2014**, all five countries had **strong initiatives** for the development of vaccine technology and had greatly **improved** their **national regulatory capacity**
- Through collaborations with universities, donors, international partners and multinational corporations, vaccine manufacturers in BRICS have not only provided
- increased production capacity for important underutilized vaccines but also developed novel vaccines for specific use in LMICs
- Vaccines from the BRICS countries are currently competitively priced because the manufacturing costs in BRICS are relatively low
- More cooperation between academia, biotechnology firms and public health institutions should also be **encouraged**

•	Vaccines	produced i	in BRICS,	2013
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Country and references	No. of manufacturers	Vaccine types
Brazil ^{11,12}	3	BCG, BMP, DT, DTP, DTP–Hib, Hep B, Hib, influenza, IPV, ^a OPV 1–3, ^a MMR, ^a MMR–varicella, ^a pneumococcal conjugate, ^a rabies, rotavirus, ^a Td, YF
Russian Federation ^{13,14}	4	BCG, brucellosis, diphtheria, DT, DTP, DTP–Hep B, encephalitis vaccine (EnceVir), <i>Gonococcus</i> , hepatitis (child and adult), influenza (live and inactivated), M, meningococcal A, MM, mumps, OPV, rabies, rubella, tetanus, rabies, tularaemia, varicella, YF
India ^{8,11}	10	BCG, C (inactivated oral), DT, DTP, DTP–Hep B, DTP– Hib, Hep B, Hib, influenza H1N1, JE (inactivated), meningococcal A conjugate, M, MR, MMR, OPV 1+3, ^a OPV 1, ^a OPV 1–3, ^a pandemic influenza (live), Pent., rabies, rubella, seasonal influenza, Td, TT, typhoid conjugate, typhoid VI polysaccharide
China ¹¹	46	Anthrax, BCG, BMP, brucellosis, DT, DTP, DTP–Hib, haemorrhagic fever with renal syndrome, Hep A, Hep A (live), Hep A–Hep B, Hep B, Hep E, Hib, influenza (split), influenza H1N1, influenza H5N1, JE (live and inactivated), <i>Leptospira</i> , M, meningococcal ACYW-135, MM, MMR, MR, OPV 1–3, rabies, rubella, TT, typhoid Vi, varicella, tick-borne encephalitis, tracheitis, TT, YF
South Africa ^{11,15}	1	Hep B ^a



Kaddar et al. Impact of BRICS' investment in vaccine development on the global vaccine market. Bull World Health Organ 2014;92:436-446

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The International Vaccine Institute

is dedicated to enabling the world's most vulnerable people to have full, productive lives

Accelerating vaccine R&D for global health

by accelerating R&D for critical vaccines

with partners in Korea, across Asia and around the globe





IVI is an International Organization dedicated to Global Health



Global Vaccine Research Institute

- HQ and labs at Seoul National University in Seoul, South Korea
- Field programs in 29 countries: Asia, Africa, Latin America
- 12 Nationalities in workforce of ~ 130 staffs

OECD-recognized International Organization (not for profit)

- UNDP initiative
- UN Treaty-based
- First international organization in Korea (1997)
- 36 countries and WHO as State parties





An Extensive Global Network

36 Signatory Countries, 160 Partners, Multiple Programs in 44



IVI has 160 partners worldwide ranging from Government, Industry, Academia and Civil Society to Intergovernmental Organizations



Global Health

Conduct public health research and immunization campaigns in collaboration with WHO, GAVI, UNICEF, CEPI, and health ministries

World Health unicef C E P I

Philanthropy

- Bill & Melinda Gates Foundation, a key supporter since 2000
- Samsung Foundation supports our MERS vaccine development program

BILL&MELINDA GATES foundation SAMSUNG LIFE PUBLIC WELFARE FOUNDATION





Partnerships with Global Networks





IVI Develops and Delivers Vaccines against Infectious Diseases with Limited Commercial Potential - yet High Public Health Importance





IVI Capacity: Laboratory Science

Clinical Research Laboratory (CRL)

Molecular, clinical, and translational immunology.

Qualifies and validates immunogenicity assays in support of clinical trials.



Vaccine Process Development (VPD)

Vaccine conjugation, bacterial/viral process development, Analytics and formulation.

Identifies and assists vaccine manufacturers with tech transfer



IVI Lab Infrastructure

Animal testing facilities. (mice/rats)

BSL 1-3 rated laboratories.





IVI Capacity: Field Programs

Epidemiology & Public Health Research

Infectious disease surveillance and epidemiologic studies





Policy & Economic Research (PER)

Disease burden, cost-of-illness, and vaccine cost-effectiveness field studies



Develops vaccine investment cases for governments, GAVI, and WHO



RESEARCH ARTICLE

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Girecit for

A multi-country study of the economic burden of dengue fever based on patient-specific field surveys in Burkina Faso, Kenya, and Cambodia

Jung-Seok Lee ⁽ⁿ⁾ *, Vittal Mogasale^{1e}, Jacqueline K. Lim^{1e}, Sowath Ly^{3e}, Kang Sung Lee^{1e}, Sopheak Sorn^{2e}, Esther Andia^{3e}, Mabel Carabali ⁽ⁿ⁾ ^{4e}, Suk Namkung^{1e}, Si-Ki Lim^{1e}, Valéry Ridde^{5,8e}, Sammy M. Njenga ^{3e}, Seydou Yaro^{7e}, In-Kyu Yoon^{1e}

1 International Vaccine Institute, Sacul, South Korea, 2 Institute Pasteur, Phroom Penh, Cambodia, 3 Kenya Medical Research Institute (KEMRI), Nairobi, Kenya, 4 McGill University, Morttreal, Quebec, Canada, 5 French Institute for Research on Sustainable Development (IRD), University Fants Sorborne Otte's, Paris, France, 6 University of Montreal Public Health Research Institute (IRSPUB), Montreal, Canada, 7 Centre MURA2, Bob-Obiclass, Buthing Face



INTERNATIONAL VACCINE INSTITUTE





IVI Capacity: Clinical Trials and Regulatory Affairs

Development & Delivery (D&D)

- Plans and conducts regulated clinical trials, vaccine effectiveness studies, and vaccination campaigns

- Facilitates NRA product registration & WHO prequalification

- Engages governments and international bodies on policies related to vaccines and vaccination







VABIOTECH

Biostatistics & Data Management (BDM)

- Data management, statistical analysis,

mathematical modelling of infectious diseases.

- Vaccine Adverse Events Information Monitoring System (VAEIMS)

- Centralized Dengue Vaccine Safety Data Monitoring (cVDMS)

El casas hu advarsa avent (Tan 10)				
ricases by adverse event (10p 10)		AEFI cases by genc	ler	
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. cerm	<i>m</i>			
ay fever	9			
omiting	6			
enign neoplasm of long bones of upper nb and scapula	5			
zziness	5			
cky mountain spotted fever	5	M	ale Female	
d spots	4			
reaming	4	Gender	#	%
irple violet skin	3	Male	8	40
engue fever virus infection	3	Female	12	60
ausea	3	Missing	0	C
hers	9	Total	20	100
tal	56			

Clinical Development and Regulatory (CD&R)

- Develops clinical strategy and clinical development plan from phase I-IV including designing studies, executing the clinical studies, and communicating the results to scientific community

- Provides technical and regulatory support to partners





Vaccine Pipeline: Several Vaccine Candidates under Development by IVI

	PRECLINICAL	CLINICAL	LICENSURE / WHO PQ
Oral cholera vaccine (Shantha, Eubiologics)			
Vi-DT typhoid conjugate Vaccine (SK, Biofarma)			•
MERS vaccine (GeneOne)			
Schistosomiasis vaccine			
Chikungunya vaccine			
Non-typhoidal Salmonella vaccine (NTS)			
Shigella vaccine			
Hepatitis A vaccine			
TB vaccine			

• Vaccines under different stages of development.

Bivalent inactivated oral cholera vaccine is first product licensed and approved by WHO.







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IVI Typhoid Programs 2000 - 2019





Enteric Fever Vaccine Program

Past

Current

- Diseases of The Most Impoverished (DOMI): Typhoid, Cholera, and Shigella (~\$50M)
- Vi-based Vaccines for Asia Initiatives (VIVA) (\$14M)
- Bivalent (Typhoid-paratyphoid A) vaccine development (\$2.1M)

- Vi-DT SK preclinical (\$5M)
- Vi-DT SK clinical phase I and II (\$7.2M)
- Vi-DT SK CMC (\$7M)
- Vi-DT Biofarma (\$1.7M)
- Vi-DT SK phase III (~\$15.7M)
- Vi-DT SK phase I and II LTFU (~\$1M)

Total projected programmatic funding for Vi-DT: \$41.6 million (includes \$3.5M from ViVA)



Vi-DT Typhoid Conjugate Vaccine enters Phase III End of 2019



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IVI Cholera Vaccine Programs 2000 - 2019





IVI Cholera Program Activities Overview





OCV: Virtuous Cycle of Demand – Supply (eventually)



Gavi, Cholera Supply and Procurement Roadmap, 2018 (in millions of doses) **Historical and projected demand for OCV 2013-2028**

- 2016: New source of supply (EuBiologics)
- 2018: WHO/UNICEF announce Ending Cholera 2030 Roadmap to reduce cholera deaths by 90% by 2030
- Increased demand, increased supply, decreased disease = "virtuous cycle" 96M doses requested in 2019!
- New manufacturers entering market due to increased demand





Oral cholera vaccination in Nepal Rotary, Kim & Chang, Exim Bank, etc, 38,000 people in 2 campaigns KOICA GDEF – IVI cholera vaccination in Mozambique, 190,000, 2018 Korean vaccine 'Euvichol-Plus' used



IVI Vaccines Bring Affordable Innovation to Global Health

VACCINE	COST	MANUFACTURER	
VACCINE #1 ORAL CHOLERA	Cost thru PQ: \$28M	9 Sind Sinder (10) Character Character Sinder Sinder (10) Character Sinder Sinder (10) Sinder (10) Sinder Sinder (10) Sinder (10	
VACCINE	BILL&MELINDA GATES foundation	SHANCHOL PQ 2011	EUVICHOL, EUVICHOL PLUS PQ 2016, 2018
VACCINE #2 Vi-DT TCV (Typhoid)	Estimated Cost thru PQ: \$28M BILL& MELINDA GATES foundation	Phase III to begin 2019-2020 in Nepal&Philippines	biococo Phase III to begin 2020 in Indonesia
VACCINE #3 •Non-typhoidal Salmonella •Shigella	IVI internal investment preclinical POC; Wellcome Trust \$3.2M	No partner identified	



CNBG and IVI exchange MOU to provide high-quality vaccines to developing countries



Dr. Yuntao Zhang (right), Vice President of the CNBG, shakes hands with Dr. Jerome Kim (left), Director-General of IVI, as they exchange an MOU

IVI website (2019). Link: <u>https://www.ivi.int/the-cnbg-and-ivi-exchange-mou/</u> (accessed in Sep



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Conclusion - The Global Value of IVI

- Accelerating the development and introduction of a new-generation Typhoid Conjugate Vaccine and other diseases vaccines through a public-private partnership model
- A proven development model: 36 million IVI Oral Cholera Vaccine doses deployed in 22 countries since 2013
- A dedicated partner of WHO Global Task Force on Cholera Control for Ending Cholera : A Global Roadmap to 2030
- Implementing WASH programs into cholera vaccination campaigns
- Increasing access to the HPV vaccine for young girls and women in developing countries
- Provided training and technical assistance to 18 vaccine manufacturers in 14 countries
- Transferred vaccine licenses to manufacturers in 6 countries
- Over 1,300 medical professionals from 72 countries trained in IVI Vaccinology Courses
- Integrated partner of CEPI, Gavi, WHO, and national development agencies







