INFORMATION PAPER
on
Main eHealth activities outside of the EU

Annex 4
Main India eHealth policies and activities

LIST OF ABBREVIATIONS

ACCRONYM	DEFINITION
ANM	Auxiliary Nurse Midwife
ASHAs	Accredited Social Health Activists (first level agents)
BJP	Bharatiya Janata Party (People Party) Gov. since 2014
CF	Cancer Foundation
CIDR	Central Identity Data Repository
C-DAC	Centre for Development of Advanced Computing
CSC	Common Service Centre
CHC	Community Health Centre
CT	Computerized Tomography
DEA	Department of Atomic Energy
DOT	Department of Telecommunications
DICOM	Digital Image Communication
DVDMS	Drugs and Vaccines Distribution Management System
EHR	Electronic Health Record
EMR	Electronic Medical Record
EAG	Empowered Action Group (States)
FSSAI	Food Safety and Standards Authority of India
GP	General Practitioner
GOI	Government of India
HF	Health Facility
HIT	Health Information Technology Consultant
HMIS	Health Management Information System
HP	Health Professional
HcP	Healthcare Provider
HSSC	Healthcare Sector Skills Council
HIS	Hospital Information Systems

ISRO	Indian Space Research Organization
ICT	Information and Communication Technologies
MOU	Memorandum of Understanding
MoHFW	Ministry of Health and Family Welfare
MCTS	Mother and Child Tracking System
NDHA	National Digital Health Authority
NeHA	National eHealth Authority (initial name of NDHA)
NHM	National Health Mission
NHP	National Health Portal
NIN	National Identification Number
NIC	National Informatics Centre
NKN	National Knowledge Network
NMCN	National Medical College Network
NOTTO	National Organ and Tissue Transplant Organisation
NRCeS	National Resource Centre for EHR Standards
NRHM	National Rural Health Mission
NTN	National Telemedicine Network
NUHM	National Urban Health Mission
NCD	Non-communicable disease
Nbr	Number
PCC	Peripheral Cancer Centre
PHC	Primary Health Centre
RCC	Regional Cancer Centre
RCH	Reproductive Child Health
TCIL	Telecommunications Consultants India
TM	Telemedicine
TMIS	Training Management Information System
TB	Tuberculosis
UT	Union territories (including Dehli)
UHID	Unique Health Identification
UIDAI	Unique Identification Authority of India
VSAT	Very Small Aperture Terminal

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Preamble

Object

The present document is an Annex to Joint Action to support of the eHealth Network (JAseHN) Deliverable 8.1.4 in WP8 "Report on main eHealth activities outside of the EU". It has been prepared by Norbert Paquel (external, director of Canope cabinet – France) under the control of Michèle Thonnet (Work Package leader-FRNA), then corrected and approved by the sPSC.

The objective of D8.1.4 is to observe the situation in various countries in order to better understand the development factors and main trends in the worldwide movement towards a tighter integration of ICT tools in healthcare but also to be able to initiate cooperation when advisable and possible. To that end, concrete projects have been identified as potentially interesting for eHN Member States (MS) exchanges or cooperation. These opportunities would need deeper analysis, through direct contact with experts, notably local representatives of the concerned MS or participants in EU projects.

Methodology

As explained in the main D8.1.4 document, the research was based on a desk study carried out between 2017/02 and 2017/08. It is important to note that time runs often very fast in the eHealth and mHealth domains. Accordingly, contrary to healthcare organizations and fundamental policies trends, concrete programmes and projects can change rapidly. However, if they correspond to clear needs and sustainable methods, they should not disappear. Moreover, important developments that may have occurred since August 2017 have been taken into account when possible.

India: basic information on the country

These are the characteristics and events that should be kept in mind as they have a decisive influence on rhythm and policies for eHealth development.

Two main characteristics are always reminded in India' official papers. First, India is a continent from a geographic point of view – precisely the major part of the South Asia sub-continent, *"extending from the snow-covered Himalayan heights to the tropical rain forests of the south"*. Secondly, India is *"one of the oldest civilizations in the world with a kaleidoscopic variety and rich cultural heritage"*.

India is a union of 29 states and 7 union territories (including the National Capital Territory of Delhi) As of 2011, with an estimated population of 1.2 billion, India is the world's second most populous country. Diversity is impressive between states, from 207 M people in Uttar Pradesh to 607 000 in Sikkim (National Capital Territory of Delhi has 19M), whilst population densities varies from 828/km^2 to 86 in mountainous Sikkim. Although it is slowly evolving with growth of urban areas, proportion at 2010 census was of 37.7 urban and 68.8 rural. Poverty is much greater in socioeconomically backward states, which benefit of special attention and efforts: the Empowered Action Group (EAG) States[1], which together accounted in 2010 for 494,2M inhabitants (40.8% or the total population).

Albeit a long common history and strong common culture, there are also perennial oppositions and conflicts between the various ethnic groups – which explain some slow downs and difficulties. However, the main difference has been a consequence of India's rapid development, which has led to a bizarre state of ambivalence and the existence of "two Indias". On the one hand, India is a powerful emerging country which has entered with great success both the industrial and the information world; on the other hand, it remains under-developed, home to

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[1] Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, Rajasthan, Uttarakhand, Uttar Pradesh

some of the poorest populations on the planet. Half of all residents of rural areas live below the poverty line (a difficult estimation and varying methods, but this is the general figure). Acceptance of the situation originates in a centuries old system of differentiation and rigorous borders between castes religious groups, even if such differences have officially been suppressed. This duality is reflected in health, healthcare and eHealth.

- **Main dates to be reminded to understand present critical evolutions:**

1947 – Independence

2004-2014 After years of instability, the Congress Party (Indian National Congress – INC) leads a coalition. Prime minister Manmohan Singh launches programmes for employment guarantee and health improvement in rural areas, but economic crisis slowed down the country' growth.

2014 The other main party, the right wing/nationalist Bharatiya Janata Party (BJP – Indian People's Party), with its allies of the National Democratic Alliance winds a landslide election, governing the country as well as 19 states (on 29). Prime Minister Narendra Modi supports the promotion of foreign investments and invests in infrastructures while reducing social and health spending, liberalizing the labor market and loosening many non-technical standards (environment, privacy).

Remark: In this document, we use western numbering system. Indian documents and statistics use the Indian system: lakhs for 100 000 and crore for 10 000 000 (10M). 1 crore = 100 lakh

- I -
Health and Healthcare background

1. Elements on health situation

1.1 Central concern

The India of riches and middle class has the same problems that all developed countries with ageing population, chronic non-communicable diseases and lifestyle diseases. The India of the poor suffers from infectious diseases and consequences of malnutrition. The general situation is still unsatisfactory in many areas; many indicators reflect the situation of the majority of the population – maternal mortality, infant mortality are about ten times bigger than in EU (infants/100 000 live births: 40 vs 4, mothers: 174 vs 4-8 in the EU; life expectancy is 68 vs more than 75 in EU Member States). Neonatal mortality constitutes about 60% of the total infant mortality in India and is highest in the EAG states.

According to WHO Health Profile 2009 [2], the first concern is the high vulnerability of young children. Among children under five, 43.5% are underweight (the highest percentage in the world). The second major concern is poor sanitation. Only about 30% of the population uses improved sanitation facilities and this figure dips below 20% when focusing solely on the rural population.

1.2 Important national health policies

In an effort towards universal access, the Government created in 2005 the National Rural Health Mission which became a sub-mission of an overarching National Health Mission (NHM) in 2012; in 2013 another submission was launched, the National Urban Health Mission. The thrust of the mission is on establishing a fully functional, community owned, decentralized health delivery system with inter-sectorial convergence at all levels, to ensure simultaneous action on a wide range of determinants of health such as water, sanitation, education, nutrition, social and gender equality.

ASHAS and ANMs: building a first level of the health organization pyramid

An important strategy has been to reinforce first level resources in rural and poor areas. To that end, creation and training of Accredited Social Health Activists (ASHAS) as part of the NRHM is a key element. Local women trained to act as health educators and promoters in their communities, ASHAs create awareness on health and its social determinants and mobilize the community towards local health planning. Their tasks include motivating women to give birth in hospitals, bringing children to immunization clinics, encouraging family planning (e.g., surgical sterilization), treating basic illness and injury with first aid, keeping demographic records, and improving village sanitation. ASHAs are also meant to serve as a key communication mechanism between the healthcare system and rural populations.

ASHAs are in regular contact with the first level of the Healthcare system, rhe Auxiliary Nurse Midwife (ANM), a village-level female health worker.

Free-market orientation has stimulated another approach where the government cooperates with the numerous private organizations active in the country *(see above)* – for-profit or not-for-profit.

2. Healthcare system

2.1 General landscape

[11] Health is under states jurisdiction. The federal government can propose national measures respecting states constitutional domain; in the healthcare domain, such proposals concern fundamental rights of the citizen, national security against epidemics etc. Moreover, the government and the states have different means to influence public system and private one, which until recently was practically not regulated. The Federal Ministry in charge is the Ministry of Health and Family Welfare (MoHFW).

The healthcare system is a complex network of public and private care providers, ranging from a single doctor rural Primary Health Centres (PHCs) to specialty and super-specialty health care institutions like the medical college hospitals in the public sector and from a single doctor outpatient clinic to large trust or corporate hospitals and third-party providers in the private sector. According to National Family Health Survey, the private medical sector remains the primary source of health care for 70% of households in urban areas and 63% of households in rural areas.

The Healthcare system did not evolve along the economy and population. With only 1.5 hospital beds for 1000 inhabitants, India ranks very low compared to 3 – 4 in developing countries. The majority of hospitals are privately owned and located in cities due to the sector's awareness of the health-related issues and financial viability. While 75% of the country's healthcare infrastructure is concentrated in urban areas, more than 75% of the population lives in rural areas. Only two percent of qualified medical doctors are available in rural areas. Most of the public system, oriented towards rural and poor areas, lacks personnel and is operated by inexperienced and unmotivated interns who are mandated to spend time in public healthcare clinics as part of their curricular requirement. Furthermore, the disadvantaged urban population can't afford the private facilities in the cities.

The last 25 years have seen a steady increase in the usage of private healthcare facilities both for Out Patient and In Patient services, across rural and urban areas. *(The Ailing India: Colonel Y Udaya Chandar – 2016).* The Healthcare System, already one of the most privatized in the world, tends to grow in this same direction, and most ambulatory treatments happen in these structures. India spends around 4.1% of GDP on health, of which only about 1.1% is the contribution of the government. Out of pocket expenses are high at over 60%, much higher than in most countries.

Furthermore, since the private system is not regulated, the number of non-qualified and non-authorized medical doctors is growing.

Not to be neglected is the important non allopathic non Western traditional medical sector with in particular the Ayurveda and also Yoga, Naturopathy, Unani, Siddha, Homeopathy *[see https://www.nhp.gov.in/ayush_ms].* The Ministry of Health maintains a department for this domain, which concerns mainly the rural population.

2.2 Main actors: from isolated types to synergy, the Indian ways

Indian Healthcare landscape is the result of a complex system of relations between the diverse public and private, foreign and national, actors.

- **Government departments**

Main other departments concerned, aside with MoHFW, are Communications and Information Technology; Science & Technology; Human Resource Development; Consumer Affairs, Food and Public Distribution; Women and Child Development.

- **Public non-health institutions**

Another way for development of new techniques, especially ICT integration: building on huge budgets and interest of non-health national programmes with distinct budgets. Typical cases here: Department of Atomic Energy (DEA), Telecommunications Consultants India (TCIL), a consultancy company owned by Government under the control of the Department of Telecommunication, Indian Space Research Organization (ISRO). ISRO was a priority of all governments and has fulfilled its ambitious mission. India is a space power with competitive satellites and launchers. ISRO is a key player in eHealth.

- **Private sector: hospital groups - an impressive development**

The development of the private sector has been impressive. Origins are diverse but altogether this development is a testimony of the scientific, technical high level of the Indian upper class and of its financial power and dynamism. It has yet been stimulated by the economic development in the 2000' years. These groups operate hospitals and day care specialties facilities. They have an international vision and they extend rapidly their development abroad. Their high level techniques, their quality and their inferior cost have led to India becoming a medical tourism destination, attracting international patients from US, UK, Canada and Africa.

[https://en.wikipedia.org/wiki/List_of_hospitals_in_India] There are a great number of groups. Some examples:

The Apollo group, one of the four biggest, was created in 1983 by cardiologist Prathap Chandra Reddy. It was India's first corporate hospital, and it pioneered the private healthcare revolution in the country. In 2000, Apollo had 1500 beds, 25 pharmacy stores. In 2015 it had 9215 beds and 1822 pharmacy stores. The group operates in Bangladesh, Kuwait, Qatar, East Africa.

The biggest group, Fortis, was created in 2001 by the Sigh family, owners of Ranbaxy Laboratories, one of the biggest groups worldwide in the generic drug market. Fortis operates about 10 000 beds and 314 diagnostic centres. It is present in Singapore, Malaysia, United Arab Emirates, Vietnam, Australia, Hong-Kong. Similarly, Wockhardt Ltd, India's 5th largest Pharmaceutical and Healthcare company with a presence in 20 countries across the globe, has created Wockardt Hospitals, although much earlier – one of the first in 1989. Now, Wockards has partnered with Harvard Medical International to develop health education services.

- **Public hospitals and health centres – a collective research effort in Indian society**

The general public landscape has been outlined above. The following case is a typical example of the Indian cooperation between private wealth and public system for advanced medicine.

Sometimes, public education and research hospitals have been the result of transfer from philanthropic institutions to public ones. An example is the Tata Memorial Hospital created in 1941 in Mumbai[2] by the Tata family group, followed by the Cancer Research Institute in 1952. Both were taken over by the Ministry of Health in 1957, which transferred them to the Department of Atomic Energy. In 1966, they became the two arms of the Tata Memorial Centre. The hospital is the larger cancer treatment centre in Asia. In 1997, the Advanced Centre for Treatment, Research and Education in Cancer (ACTREC) was created to develop innovative research on cancer. The whole organization is still supported by the Tata group. Another example of industry role is in Uttar Pradesh: the Sanjay Gandhi Postgraduate Institute of Medical Sciences in Lucknow offers medial courses and specialty services in hematology, oncology, nuclear medicine and radiotherapy and a palliative care project. It is partially financed by the International Copper Association India.

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[2] Mumbaï was named Bombay until 1995

- **Foreign ICT providers**

This is where US and sometimes European companies are active – ICT hardware, medical devices, consulting firms. Notably, these companies have equipped hospital groups and care centres, determining the first generations of Information systems.

They have also participated in the development of non-profit foundations and education

- **Not-for-profit HcPs and Foundations**

They have been created in order to help India take into account the needs of the poor and of the emerging middle class as well as health education. Some foundations are active in specific domains, notably cancer. Example: Sri Shankara Cancer Foundation (SSCF) in Bangalore is a not-for-profit organization founded with the main purpose of providing state-of-the-art equitable treatment to all cancer patients at very affordable costs including free treatment to the poorest. Sri Shankara is supported by private donors and cooperates with national and regional government to finance hospital and research centre.

In many cases, foreign ICT providers participate. For example, the Cognizant Foundation, conducting the US IT Company Cognizant philanthropic and Corporate Social Responsibility initiatives. Cognizant has created the Indian Foundation with Indian personalities of the domain.

Two very big players have launched an impressive effort: *"GE Healthcare and Tata Trusts have joined hands to train 10,000 youth in various technical areas of healthcare over a three-year period"* *[http://health.economictimes.indiatimes.com/gehealthierindia/news/detail/1023]*

- **The new comers: mHealth start-ups**

New techniques and especially mHealth have triggered an impressive new wave or start-ups strongly supported by the government *(see II 5.3)*. They take advantage of the much bigger market of mobile information and services – for-profit and not-for-profit – and a growing number follows the same path than the hospital wave, expanding rapidly in foreign markets.

3. Motivations for selecting India for eHealth study

India is a great and diverse federal country (see Preamble). India has emerged in the last decade as one of the most powerful countries on the planet. A member of the BRICS3, it is home too many High level Science and Research laboratories and Universities and has a global presence in eHealth activities, starting from Teleradiology.

The EU and India already have close economic relations which open the door to many cooperation opportunities. Until recently (2013), India was a beneficiary of international aid programmes, notably from the USA and the EU. This situation has officially ended, for the EU, in 2013 and has been transformed in cooperation to confront scourges of the poor – malnutrition, infectious diseases and epidemics… "The EU and India share a number of interests across a range of policy areas, including energy and climate change; environment; research and innovation; pharmaceuticals, biotechnologies, migration and mobility; ICT; competition policy; macroeconomic issues, sustainable development; and education."4

Moreover, India is strongly engaged in international actions, in Africa and in South-East Asia zone, initiating and stimulating eHealth usage (see under 5.2).

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3 Brazil, Russia, India, China, South Africa

4 EU External Action Service

- II -
Telemedicine and eHealth development

4. Structural difficulties, stable principles and pillars

4.1 eHealth to participate in the reduction of the "two Indias" gap

The constant problem faced by India government is the considerable gap between "two Indias", India of the rich and India of the poor. More or less, public efforts tended to reduce it from the independence to present days. The gap is huge when it comes to health and to healthcare access *(see above in Preamble and I)*. However, fast evolution of economy and society gives India opportunities but also huge challenges. It provides notably financial resources - albeit in front of enormous needs -, and growth of a dynamic and educated middle class. It also allowed for building of strong private national healthcare providers groups *(see I)*. A critical aspect of the gap and, consequently of the whole country, is the lack of educated and trained workforce – doctors and other health professionals (HPs) and more generally educated workers amongst populations of the poorest zones (in the country and urban areas).

4.2 A fragmented eHealth landscape

In the health infrastructures of the India of the poor, there is not yet much use of ICT. In the private sector, pertaining to India of the rich and more and more to the fast-growing middle class, modern medical tools and ICT usage progress rapidly.

The fragmentation between owners, structures and states results in a fragmented and un-organized healthcare landscape, with little or no communication between structures. Hence, there are not much data exchanges development between actors and even penetration of Hospital Information Systems (HIS) is low. Existing systems in large units are in general built around proprietary foreign (US) systems that are not interoperable. Private GPs are not controlled, only officially authorized at national or State level. Even statistics for local GPs or Family practitioners cannot be built, as the majority of physicians in some rural areas do not have any degree.

4.3 Some constant India policies apply also to eHealth development

As outlined above, even with politically opposed governments, eHealth follows stable principles and even pillars of all Indian policies.

- Alliance and cooperation between public authorities and private actors. Governance and management may vary *(see above the Cancer)* but financing is shared for every social, education and research project.

- International vision, expressed in two different but somehow complementary actions.

  - Since independence, India follows a third world policy. It is today embodied in relations with Africa and especially the Pan-African e-Network Project.

  - Healthcare Providers (HP) enter rapidly in foreign countries while they grow in India – and for some healthcare services it is even their main base.

5. Multiple eHealth programmes from government, public agencies and private actors, not coordinated but often associated

In the context of a fragmented healthcare system, all actors (see I-2.2) have been involved in the development of eHealth (first programmes use "telemedicine" for all eHealth), with no central or collective coordination.

The federal government started deploying actions towards its main objective: universal access in 2005 (I-1.2). These programmes have to gain the adhesion of states, except in special areas such as ensuring citizens' fundamental rights, national security against epidemics etc. Federal actions also concentrated on infrastructure, in order to obtain efficient and low cost network services.

The government and states defined general rules. eHealth is a strategic domain where cooperation and notably public-private one is well developed. Cooperation has always been important also for accessing foreign markets.

Most of the programmes that were initiated in the first years 2000 are still pursued until present days.

Albeit the great optimism of many announcements, there is still a long way to go to confront the the very difficult situation of the poor and the lack of trained personnel.

Chapters 5 and 6 of this document are not differentiated mainly by time period but by objectives. The present Chapter 5 concerns main objectives for sustainable programmes that, albeit evolving sometimes profoundly in time, are fundamental for India eHealth development. Chapter 6 identifies programmes launched in the 2012-2017 period which corresponds to India' 12th Five Year Plan and especially those launched after the political change of 2014 – see Preamble – which has notably been that of the "Digital India" programme.

5.1 The basic layer

The main steps towards the definition of a eHealth national policy (called Telemedicine in the first documents) were

- the First National Standards on Telemedicine (2003) – Non binding guidelines introduction - definitions and concepts, standards required for hardware, software and devices, including the security and process aspects.

- the creation of the National Steering Committee on Telemedicine (2005),

- the inclusion in the federal Budget in the 11th Five Year Plan (2006-2012),

- the preparation of a Draft National Standards of EMR/EHR on Public Domain (2010-2013 then revised). Identification of all standards to be preferred for every component.

Afterwards, the national policy developed rapidly with a special Agency and coordinated programmes for 2012-2017.

5.2 Key national government and public Agencies managed programmes

- **Network infrastructure**

National Rural Telemedicine Network (NRTM)

Since 2001, the MoHFW and ISRO (I – 2.2) work for building a communication infrastructure, using all available communication technologies (mobile, satellite, fiber) and providing hardware and software to public care centres and hospitals. In 2007, the Ministry launched a plan to develop the NRTM. The objective was to create 200 telemedicine centres in the country, to provide health care accessibility in distant areas, rural communities and pilgrimage centres. 4 levels of units and connections were defined:

- Level 1- Primary Health Center (PHC) / Community Health Center (CHC) connected to a District Hospital),

- Level 2: District Hospital connected to a State Hospital / National Super Specialty Hospital

- Level 3: State Hospital / National Super Specialty Hospital connected to each other

- Level-M: Mobile Telemedicine Unit covering few villages connected to nearest PHC / CHC or directly to District Hospital

However, the existing TM nodes in 2016 were underutilized and only around 100 Telemedicine nodes were operational instead of 200 envisioned. The MoHFW and ISRO signed a Memorandum of Understanding (MOU) to revive and reinforce the programme. Village hospitals are to be equipped with a VSAT, videoconferencing equipment, telemedicine software and diagnostic instruments (ECG, scanner).

For areas with poor cell phone coverage, satellite links are even provided to PHCs.

It is to be noted that the fiber network ensuring links between State and Specialty hospitals has benefited of the development of the Research and Health Education high bandwith NKN network (see infra).

National Telemedicine Network (NTN)

NTN has been recently started (see [3]) with providing Telemedicine Services to remote areas by upgrading existing Government Healthcare Facilities in States (not to be confounded with NRTM). Telemedicine nodes interconnect PHCs/CHCs/Sub District Hospital, District Hospital (SDH) and Medical College in every State. NTN will start with the roll out of National Optical Fiber Network. State participation in financing is mandatory. So far 7 States have provided financial aid.

The critical question of citizen's identity - Core Project : AADHAAR

[10] Indians, until recently, had no official registered identity and a majority of the population were only known in their village. However, they acquired a specific registration number when they benefitted of certain administrative and social services.

In 2009, the government decided to introduce a secure system: the Aadhaar card. It was rolled out by the following government in 2014. The Unique Identification Authority of India (UIDAI) is responsible for collecting and managing the data. The system records personal biometric data, including fingerprints and eye scans for access to more secure services. Objective is to ensure that welfare services are being delivered to those who really need them, reducing welfare fraud. The card itself is on paper and gives some information, the main being a number and QR code. The number with validation by a biometric sensor gives access to the Central Identity Data Repository (CIDR). The system is open to private companies. In 2017, 91% of the population was registered – more than 1 B. The card is a candidate to become the Health card.

However, civil rights campaigners object that Aadhaar, which is forced upon Indians and used by private companies, expose the population to privacy risks. Aadhaar triggered a conflict between the government and the supreme court, which eventually ruled that the obligation to present the card for any other system that Social Security was not constitutional (privacy becomes a fundamental right in the constitution). Moreover, the CIDR was hacked and private information is accessible on the Internet.

The card is an example of present Indian evolution, successes and difficulties: ambitious projects that are coherent with the needs of many actors are rushed through with astonishing speed but neglecting often precautions, experimental stage and evaluation. However, the card corresponds to real needs and the system will certainly evolve.

- **Knowledge**

National Medical College Network (NMCN)

In 2012, the MoHFW decided to create NMCN for distance learning, access to resources and telemedicine. Tertiary care academic medical institutes are identified as the Medical Knowledge

Resource Centres in a region (regional hub), each of which will be connected to medical colleges (nodes) in that region. The NMCN rides over the National Knowledge Network (NKN), which provides high speed network backbone for the knowledge-related institutions since 2001.

NMCN will allow also online consultation through connections with the liaisons established for remote populations *(see above NRTM).*

National Medical Library

The NML provides library and information services. It has developed a network of Regional libraries with WHO support and it is linked through WHO with the world library network and medical reference databases.

National Medical Library's Electronic Resources in Medicine (ERMED)

In 2016, the MoHFW created a consortium between 70 state and centrally funded Government Institutions and open to other participants. The consortium is managed by the NLM. It provides member institutions access to medical journals, starting with 242 online e-journals purchased from 5 leading publishers.

- **International action**

Africa

India has become a provider of international help, especially in cooperation with African countries, having launched in 2009 an eHealth network, the Pan-African e-Network Project. The network is *"so far the biggest project for distance education and telemedicine in Africa… and it is equipped to support e-governance, e-commerce, infotainment, resource mapping and meteorological and other services in the African countries, besides providing very very important people (VVIP) connectivity among the Heads of State of the African countries through a highly secure closed satellite network." The network "connects the nodal centres in India with 53 nations of Africa with a satellite and fibre optic network for sharing India's expertise in education and health care". The connection is established with "India's cutting-edge quality education and health care"*[5] - 19 Indian Universities and Hospitals. The operator of the project is TCIL *(see above)* - 33 countries have contracted with TCIL.

South Asia and South-East Asia: JIPMER-BIMSTEC Telemedicine Network (JBTN)

In 2017, the government is active building the JBTM. BIMSTEC is the Bay of Bengal Initiative for Multi-Sectorial Technical and Economic Cooperation, formed in 1997 between Bangladesh, India, Myanmar, Sri Lanka, Thailand, Bhutan, Nepal. Public Health, Communication and technology are areas of cooperation. BIMSTEC countries share many health problems and difficulties (notably remote areas, lack of Health Professional).

JIPMER Hospital in Puducherry is presented as one among the top best five medical institutes in India and the number one center in medical education and training. JIPMER has telemedicine collaborations with institutes in Japan, Korea, Malaysia, Indonesia, United Arab Emirates, Saudi Arabia, Germany, France, United Kingdom, and is part of major international networks (as GEANT [6]in Europe).

Aim of JTBN should be sharing of knowledge, standardization and quality control in surgery by sharing operative videos, evidence-based guidelines for the common disease conditions in the region, tele-consultation for remote areas, preservation of traditional medicine knowledge by digitization of documents, promotion of mHealth.

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[5] Telecommunications Consultants India (TCIL) – A Government of India Enterprise and the African Newsletter Pambazuka News

[6] GÉANT is the pan-European data network for the research and education community. It interconnects national research and education networks (NRENs) across Europe, and has links to research networks in other world regions

JIPMER receives financial and technical support for this project from ISRO, Ministry of Information Technology, MoHFW.

5.3   States

Indian states are the size of a EU country, or bigger (Uttar Pradesh has 200M inhabitants). All have started eHealth programmes, depending on their needs and very unequal resources. Their projects are always massive – for instance an information project for a workers' mutual fund of Rajasthan is the largest in the world. States have developed data banks, for instance to be able to register population through birth and death registration in Gujarat, applications to follow pregnancy (Rajasthan) etc.

However, specific states projects will not be identified as such in this document. Indeed, it is difficult to distinguish them clearly:

- There is often association for the programmes and projects between the federal government and states. Those may also be funded through programmes as National Rural Health Mission, Health Management Information Systems, Mother and Child Tracking System. The twelfth Plan (2012-2017) insisted on Memorandum of Understanding (MOU) as a way to create coordination and better relation between federal programmes and regional application measures.

- Many state programmes and projects are dependent of the federal policy, especially in healthcare domain and play often the role of pilot for other ones having similar characteristics (see examples in II – 6.3).

- States are also closely associated with private groups (for profit or not-for-profit) for all their main programmes.

In fact, federal, state and private systems are entangled and the federal ministries and agencies have an important role in healthcare and eHealth everywhere, being simultaneously often associated to all actors. While respecting federalism and multiple cultural, economic and social differences, the government effort aims to organize convergence, exchanges and standardization.

5.4   Telemedicine Society

The Telemedicine Society of India (TSI) was born in 2001. In 2005, an International Conference on Telemedicine was hosted by ISRO. Members of the executive body were selected from among representative of various Ministries of Government, Academic Organizations and Indian office of WHO. The society got formally registered in 2006 and holds regular conferences. The **International Society for Telemedicine and e-Health has recognized TSI as the official national** society in India. Main concerns of TSI are the shortage of doctors and the access for the population in poor areas. The Society promotes telemedicine as part of the solution.

5.5   The case of Teleradiology: development on a worldwide scale

[4] The first successful use of teleradiology in India was in 1996 by a private-sector imaging center called Jankharia Imaging in Mumbai. A simple system for transferring images from the imaging center to the homes of individual doctors was set up, primarily to report emergency CT scans. The first teleradiology company, Teleradiology Solutions, was set up in 2002.

After a slow start due to caution and/or legislation, the constraints that usually slow down electronic exchanges were removed thanks to the fast installation of high-rate networks – fiber and satellite and the existence of the world standard for image communication DICOM. Moreover, national legal constraints and controls on Telemedicine were light.

Major powerful Indian groups as well as ICT and HIS specialized companies rapidly entered the world market – for instance Wipro Technologies[7], an early mover in providing 3D reconstruction services.

Other advantages helped make teleradiology interpretation an impressive opportunity for Indian companies on the global market:

- the time difference allowing for interpretations during US and other countries night-time

- the presence of many radiologists with US degrees and certification

- lower costs

- the growing demand all over the world as fast imagery development and specialization caused a lack of radiologists

While Indian companies were growing on the international market, the local market also grew due to the development of the middle class, generating demand for internal transmission and interpretation between radiologists in medical college hospitals and private hospitals and middle-size towns hospitals and clinics. In the public sector, a policy was launched to organize the same type of relations.

Hence, there were in 2017 more than 60 teleradiology companies operating in India and abroad.

5.6   The development of a Telemedicine services industry

During the last decade, private companies started providing software geared at private clinics and HPs as well as regional governments programs, designed to link tertiary hospitals (public or private) and other levels of HcPs. At the same time, these companies exploited the development of mHealth to offer solutions towards patients and relations between HPs, HcPs and their patients.

Addressing Government and States programs, oriented towards bringing access to tertiary level hospitals from rural or small towns, allowed these companies to benefit from support from Government research programs and general health programs, as well from private foundations and companies.

All these factors helped Indian telemedicine companies to reach the international market.

Example:

> Televital, created 2007, provides software for server, teleconsultation management, integrated EMR, scheduling, secure access to patient data. Televital also develop eHealth applications for doctors (order lab-tests and prescriptions, get reports) and for labs and pharmacies (deliver medicines, collect samples…) as well as e-learning programs. The company is present in many countries, is associated to Pan African e-network project (see Part I) and is a partner of TCIL and ISRO (engineering and networking government created companies).

Other notable companies include Apollo Telehealth Services (2009) (see under), Continuous care (2011), which "builds two apps - one for patients on mobile and one for health providers on the Web - to help them stay connected and communicate, with patient health data at the centre of everything."

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[7] ICT company (and other activities and joint ventures) – 170 000 employees, revenue 7.2 B€, 34 countries

5.7   Start-ups and innovation: the process continues

[5] *"The factors paving the way for digital health startups in India have been in play for almost a decade now – a rapid growth in GDP, smartphone penetration and half a billion citizens under the age of 25".* The more liberal regulatory framework set up by the government since 2014, with incentives for innovation , start-ups have developed yet more rapidly. A flurry of start-ups continues to emerge, also supported by incubators like HealthStart (mainly oriented towards services and software) and InnAccel (medical devices).

When they start, most of these companies are oriented towards helping HcPs develop their business through better services to clients and customer loyalty. Some are focused on creating solutions for Indians. Others develop global products for international market.

Examples (extracts from [1] – 2015 data):

> Practo (founded 2008) – One of the fastest growing mHealth platforms for management of HcPs patient relations, Practo now features over 200 000 medical professionals and handles upwards of 10 million searches each month. Having raised $30 million in a Series B and $90 million in its Series C, Practo is one of the few startups that has the capital to match its aggressive (so far) growth strategy. Already serving 35 cities in India, the company plans to extend coverage into 100 cities and 10 countries over the next six months through acquisitions and further development. Practo has notably acquired Insta Web based HIS for hospitals.

> Portea medical - Accessibility from home to HPs – which can visit and have mobile equipment.

> Lybrate – 80 000 doctors accessible, live teleconsultation.

> DocEngage (founded 2013) – helps clinics to establish and exploit patients' membership

> LiveHealth (founded 2013) – integrates all citizen data.

> SocialBlood – connect donors to needers.

> Sattya Medtech – "Addressing issues of maternal and infant mortality, this med tech company has developed a non-invasive device that can accurately collect physiological data making monitoring maternal and fetal health easier. Taking into account the non-traditional settings, lack of infrastructure and trained medical personnel, the easily transportable 2-pound device can assist in preventing up to 300,000 perinatal deaths every year."

5.8   HcPs initiatives and developments

- **Private healthcare groups**

The private hospitals groups pursue also the objective of internal liaisons between care centres and hospitals and need to address the population in smaller towns from their higher-level hospitals. To that end, they have often worked with emerging technical companies.

Apollo: a sustained pioneering approach

The Apollo group *(see I-2.2)*, created in 1983, was India's first corporate hospital, and it pioneered the private healthcare revolution in the country. In 2015 it had 9215 beds and operated in Bangladesh, Kuwait, Qatar, East Africa.

Apollo has been an important actor of eHealth development through synergy between key social, health and public health impact and its own position as a leader among private groups and its development in the Indian and foreign market.

Since 2005, Apollo had cooperated with the government *"to enhance the quality of Emergency and Healthcare Management services"* and *"…provide primary healthcare to common healthcare service centres under the Department of Information Technology."*

Apollo started the first pilot project in the country for bringing telehealth in poor areas. It was at a secondary level hospital in a village called Aragonda in Andhra Pradesh, which had registered Medical Practitioners and a PHC with one doctor, no diagnostic equipment (biology, imagery). A 50-bedded hospital was set up with CT Scan, Ultrasound, X-ray and an array of medical personnel to give good secondary care facilities.

To support and manage its telemedicine activity, Apollo has funded the Apollo Telemedicine Networking Foundation (ATNF), a not-for-profit organization, part of the Apollo Group. Today, ATNF is India's single largest turnkey provider in the area of Telemedicine with over 125 peripheral centers including 10 abroad (Pakistan, Sri Lanka, Middle East). The Telehealth department of Apollo has signed a Public Private Partnership with the Government to provide primary and second opinion tele-consultation services to over 60000 village level CSCs *(see under 6.3)*.

In 2015, the group launched "ASK Apollo" - an online consultation portal and Apollo Home Health that provides the care continuum. Currently, the Apollo telemedicine division has about 150 centres.

- **Non-Profit HcPs and Foundations**

(see 2.2)

Foundations support experiments. For instance, Apollo created the Apollo Telemedicine Networking Foundation. The Cognizant Foundation (*see Part I)* supports the development of telemedicine mobile buses.

In 2016 the Cancer Foundation (CF) Board Members along with CF Bangalore Core Committee members flagged off the newly built Tele-Medicine Mobile Camp Bus "Vidhatree" at Sri Shankara Cancer Foundation (SSCF *see I*), Basavangudi, and Bangalore. CF supported SSCF for the procurement of a customized vehicle for setting up a mobile cancer screening unit as a part of their Community Oncology Services.

"Telemedicine will be the key of Community Oncology Department. The Community Oncology wing with the help of Telemedine will conduct free cancer detection camps, cancer awareness camps, and also train the rural and semi-urban doctors in treatment and awareness of cancer and approximatively 915 patients in a year will be benefiting out of this."

6. Important programmes and projects since the 12th Plan (2012-2017) and Digital India programme (2014)

Main source: National Health Portal - eHealth and Telemedicine [3]

The following programmes and projects are often the continuation of long time actions which are developed to exploit eHealth and especially mHealth. Most are in their starting stage.

6.1 Coordination and national programmes – a global vision and all actors' participation

- **Origin and key objectives**

[6] In 2012, the twelfth Plan developed objectives for eHealth: public health decision making, remote diagnostics, monitoring and case management through telemedicine, education and continued learning, nutritional surveillance, disease surveillance, EMR, registries of clinical establishments and health related actors and products, access of public to their own health information and medical records, while preserving confidentiality of data.

All District hospitals would be linked by telemedicine channels to leading tertiary care centres, and all intra-District hospitals would be linked to the District hospital and optionally to higher centres. The plan proposed that the MoHFW promotes standards, with financing of states for their effort. It insisted also on effective implementation of the Mother and Child Tracking system (see under). According to the Plan, electronic and print media can play a critical role in informing and empowering communities and individuals.

The political change in 2014 reinforced cooperation with the private sector to develop public policies and defining common standards. The government unveiled plans for an universal health care system but implementation was delayed due to budgetary concerns. Simultaneously, applying its Digital India programme, the government announced key objectives for ICT in Health and for eHealth that were to be reinforced:

- o Continuous Medical Education
- o Countrywide Hospital Management Information System (strategy to foster installation of interoperable HIS))
- o ICT in health education,
- o District hospitals linked by telemedicine to leading tertiary care centres
- o m-Health
- o Rural Telemedicine Network over National Optical Fiber Network (see 5.2)
- o National Cancer Network
- o National Tele-ophthalmology Network8
- o National Knowledge Network, National Medical College Network (see 5.2)

In 2015, the government created a new Authority to oversee eHealth (see under NDHA)

A main source for many of the following §: National Health Portal - eHealth and Telemedicine [3]

- **Challenges**

The main objectives try and confront the constant major challenges of India health: the economic and social gap between the poor and the wealthy and the lack of educated and trained HPs.

Other difficulties when it comes to practical programmes include doctors' hesitancy to adopt new products, difficulty in accessing patients, cultural understandings of preventative healthcare, inadequate infrastructure (even for telemedicine) and the disconnect between public and private services and funding. [7]

India is now confronted to the problem of competing priorities between NCDs vs basic needs – here the infectious diseases in the poor population. However, one must not consider this

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[8] not mentioned on the eHealth portal [3] – still in first development phase in States with diverse solutions [14]

simplistically: the poor suffer from both, as their alimentation is not diverse and includes, in urban zones, very few fresh fruits and vegetables.

[8] Moreover, government and interoperability actors and promoters will have to deal with entrenched legacy systems, often of US origin, and not allowing for laboratory results exchange, for example. *"The Agency primacy should be given to the needs of patients and clinicians; adopting human-centered design; abandoning traditional institution-based EMRs in favor of an API-based eco-system."* NDHA will propose evolution of privacy laws in sync with the new technologies.

- **The advantage of being late**

At the same time, MoHfW launches Information Systems services and applications in Hospitals and local clinics, mHealth apps, toll-free phone services, telemedicine. This is in fact one of the advantages of India later industrialization. Data exchanges, Web and mHealth applications are not extensions of existing systems that keep their own structure and inevitably restrict new Internet and mobile applications perimeter. Moreover, there are not ancient regulations to adapt – only new ones to create. Few constraints are imposed. Accordingly, not many precautions are taken and there will be certainly emergence of new difficulties *(see above Aadhaar – 5.2)*, but inside a much more developed and innovative space.

6.2   The central coordination: NDHA and standards

- **NDHA [8][9]**

In 2015, the Ministry of Heath and Family Welfare proposed to create a National eHealth Authority (NeHA) - now called National Digital Health Authority – NDHA - *"as a promotional, regulatory and standards setting organization to guide and support India's journey in e-Health and consequent realization of benefits of ICT intervention in Health sector in an orderly way."*

The objective is to develop an integrated health system, so as to reduce unnecessary examinations that have already been done and to allow transfer of information and development of EHR. Accordingly, standards and interoperability are at the core of the project. *"NDHA will be responsible for adoption and usage of standards and will collaborate with all stakeholders, will develop Health Information Exchanges and will in particular ensure confidentiality and privacy."*

Another important objective is to "understand what is really happening in the healthcare system".

The NDHA oversees the Centre for Health Informatics (CHI) set up at National Institute of Health and Family Welfare by the Ministry. The CHI cooperates with the Centre for Development of Advanced Computing (C-DAC)[9] of the Ministry of Electronics and Information Technology.

- **Standards, Repertories, Interoperability**

- The standardization proposal was enriched: revised in 2013, notified in 2016; India became a member of IHTSDO in 2014 and the Ministry wants all care providers to use SNOMED-CT. [13]

- To facilitate adoption of the notified EHR Standards, a National Resource Centre for EHR Standards is created (NRCeS) (http://snomedctnrc.in).

- A National Unique Identification Number (NIN), *"which is a key requirement for achieving inter-operability and creation of EHRs"*, is being assigned to all health facilities (both public & private) to facilitate inter-operability among health IT systems deployed. So far more than 200 000 Public Health Facilities have been allocated NIN. The process for setting up mechanism for allocating NIN to private facilities is

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[9] C-DAC has also developed its own eHealth solutions for tele-consultation, exchange of EMR data, Mobile Tele-Oncology and Mobile Tele-Ophthalmology

underway." [3] Precise location information will be attached initially, with more attributes when needed. A site allows for confirming and verifying the existence of the facility. This being done, all the Health applications will use NIN in their databases to ensure inter-operability among applications.

- A common patient identifier was deemed central to this architecture and the Unique Identification Authority of India (UIDAI) was created. This aspect is being revised, due to difficulties encountered by the Aadhaar base *(see 5.2)*.

6.3 eHealth for rural and remote areas

- **CSCs**

The Common Services Centres scheme is one of the key projects under the Digital India programme, aimed to facilitate easy access points for delivery of essential public utility services (social welfare, healthcare, financial, educational, agricultural and B2C).

CSCs are created through Public-Private partnership (PPP – Federal, State, Private sector), under the authority of Ministry of Electronics and Information Technology (MEIT). About 200 000 CSCs are operational in 2017.

eHealth is one of the services. For example, Credihealth, a leading online medical assistance company, financed CSC for allowing its consumers to use them in order to consult and book appointments with doctors and specialists from its 630 partner hospitals. Apollo Hospitals opens virtual clinics in CSCs for patients using telemedicine technology. Apollo intends to connect up to 60 000 centres under the Social Endeavour for Health and Telemedicine (Sehat) programme devised with the government *(see 5.2)*

- **PHCs and other state centres**

Many projects are developed in states and then diffuse in the federation. They reflect more and more the strong trend and present policy of alliance between public authorities and private groups.

The state health and family welfare department od Uttar Pradesh plans to tackle the doctors' crisis[10] in rural areas by setting up telemedicine and diagnostic centres at the Primary Health Centres across state. A machine will examine patients and send the report to a doctor seated at a hospital in the city. The department plans to set up 500 such centres. These centres, developed PPP mode in Odisha state, have proven their usefulness. The machine will dispense the recommended medicines to patients. The centres will run by nurses and Auxiliary Nurses Midwives (ANMs).

In other states or areas, agreements between the state department and private groups lead to creation of new specialized centres. Ex: in the Vijayawada Parliamentary Constituency (electoral district) of Uttar Pradesh, the powerful Tata Trusts will establish about 20 Telemedicine Health Centres. Each would have a pharmacist and nurses and ANMs.

- **CHCs**

(extract from https://scroll.in/article/756973/indias-community-health-centres-are-in-dire-need-of-more-specialists)

The CHCs constitute the secondary level of health care and provide specialist care to patients referred from Primary Health Centres, four of which feed into each CHC, serving roughly 80,000 people in tribal, hill or desert areas and 120,000 on the plains.

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[10] Around 7,000 vacant posts of doctors in the health centres and hospitals across the state.

An ideal CHC is a 30-bed hospital providing specialist care in medicine, obstetrics and gynaecology, surgery, paediatrics, dental and ayurveda, yoga and naturopathy, unani, siddha and homoeopathy, according to the Indian Public Health Standards prescribed by the Ministry of Health & Family Welfare in 2012.

Despite this known difficulty, CHCs are preferred to other centres when a specialist Medical Doctor is needed to oversee work of ASHAS, ANMs and other personnel – this is the case for Tele-ophthalmology which needs trained personnel to capture images and send them to upper healthcare level hospitals [14]

6.4 Mother and Child: eHealth empowering those who empower the users

Maternity and birth are one of the greatest health problems for India, which has been addressed by the creation of ASHAs, trained women of the community and their relation with ANMs *(see I – 1)* . eHealth brings here the possibility for them to become a real access intermediary between the patient and the healthcare system.

Mother and Child Tracking System (MCTS) in the public sector

The MoHFW introduced this web-based tracking Information management system in collaboration with the National Rural Health Mission and National Informatics Centre (NIC)[11]. MCTS establishes a two way communication between the service providers and beneficiaries in India's public health system.

Objectives are to facilitate timely delivery of antenatal and postnatal care services and immunization to children, alerts to health service providers, health promotion messages, generation of work plans of Auxiliary Nurses Midwives (ANMs) and ASHAs so that no woman is left without services. MCTS captures delivery details.

Launched officially in 2009, the service was really started in the 12th Plan, in all states. As of 2016, 120 M pregnant women and 110 M infants have benefited from the service.

It is important to note that the Public Health Foundation of India evaluated the expected performance of MCTS in areas in Rajasthan and Uttar Pradesh in 2012, applying a Data Quality Assessment and a survey to identify implementation challenges. The survey comprised semi-structured questionnaires for health staff in the sampled districts, observation checklists and survey investigator notes. This study concluded that there were many practical obstacles for data collection and that the responsible personnel for control were not sufficiently trained to apply the programme. There was still much to do. [12]

- **Public-private cooperation**

PMSMA (Pradhan Mantri Surakshit Matritva Abhiyan– Free Health Checkup for Pregnant Women), launched 2016, is open to all pregnant ladies. They can be given free health check-up and required treatment on 9th of every month, in all Government hospitals across the country.

Inside this programme, a platform for volunteer engagement and participation allowsfor registration of private sector/ voluntary sector/ retired obstetricians, radiologists and physicians willing to provide free antenatal services at Government Health Facilities on 9 th of every month. It is also a platform for receiving their feedback and creative suggestions.

- **Mobile apps**

Kilkari: Toll free, 72 audio messages about pregnancy, child birth and child care delivered to families' mobile phones. Approximately 60M successful calls have been made so far in 10 States.

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[11] NIC is in charge of Information Systems for all administrations and public organizations

ANM on Line (ANMOL): Developed in 2016 with UNICEF support. Application on tablet allows Auxiliary Nurse Midwives to enter and update data for beneficiaries of their jurisdiction in Reproductive and Child Health Register. In three pilot districts, 15 000 ANM use ANMOL.

6.5 Integrated Disease Surveillance Programme Portal

(http://idsp.nic.in)

The key objective of the programme is to strengthen/maintain decentralized laboratory based IT enabled disease surveillance system for epidemic prone diseases to monitor disease trends and to detect and respond to outbreaks in early rising phase through trained Rapid Response Team (RRTs). Online portal for data entry, reports, data analysis, training modules, on which ~90% districts report weekly surveillance data. There is also a 24x7 call centre for disease alerts on a toll-free number for verification and initiating appropriate action.

6.6 Citizen empowerment

- **"Mera Aspataal" (Patient Feedback) (http://meraaspataal.nhp.gov.in)**

Mera Aspataal collects information on patients' level of satisfaction using a multi-channel approach - SMS, Outbound Dialing, Web Portal, and Mobile App. Currently, more than 150 hospitals have been covered. 800 000 feedbacks collected.

- **Project "My Health Record" (https://www.nhp.gov.in/myhealthrecord_pg)**

Citizen controlled PHR accessible web and mobile – allergies, immunizations, lab tests etc., wellness data through smartphones, provision for consultation, printable report (to be launched 2018)

- **Mobile apps**

Many are launched, as Vaccine Tracker, India Fights Dengue etc. to help find information and access to resources and to share feedback

6.7 Specific diseases programmes

- **Cancer: Onconet**

(Onconet.nic.in - from 2012). Objectives: to establish knowledge enabled network between 27 Regional and 108 peripheral Cancer centres. This collaborative network between HcPs, HPs and common citizens is expected to facilitate early detection of cancer patients through peripheral centres, delivery of telemedicine services to them, creation of cancer patients' register, EHR, Continued Medical Education programmes, R&D etc.

- **Tuberculosis Patient Monitoring System "Nikshay"**

(https://nikshay.gov.in/AboutNikshay.htm) Tracking of individuals for treatment-adherence implemented across all States for monitoring of TB patients. Also a Missed Call Centre facility with Toll Free number for reaching to unreached TB patients, for counselling and treatment support. Approximately 8M patients registered.

- **Tele-ophthalmology**

[14] Not yet a network but many experiments in stand-alone primary eye care services in PHCs and CSCs – more and more in mobile primary eye care services. However, due to the lack of trained personnel and sometimes insufficient communication network, CHCs are preferred.

- **Mobile apps**

mDiabetes *(http://mdiabetes.nhp.gov.in)*

India is home to over 60 million adults with diabetes (7.8% of the population), of which more than 30 million are undiagnosed or untreated. The programme is launched in collaboration with the WHO Country Office for India and other partners. Through proven algorithms for prevention and care, the system uses missed call to deliver information to population and recruit users, delivering then information and advices from diagnosis to dietary control and observance. In 2017, 100 000 users were registered.

Tobacco Cessation Programme *(http://www.nhp.gov.in/quit-tobacco)*

Interventional initiative for counselling and helping people to quit tobacco, by giving a missed call. Over 2M calls have been captured and around 1,5M users are registered.

6.8 Information

National Health Portal *(http://www.nhp.gov.in)*

Information on health Government programmes & services, in different languages (currently six), through the Web, a voice portal, or Mobile App.

NHP Swasth Bharat *(https://www.nhp.gov.in/nhp-swasth-bharat_pg)*

Mobile app access to information resources on lifestyle, disease conditions (A-Z), symptoms etc.

NHP Directory Services *(http://www.nhp.gov.in/nhp-health-directory-services-mobile-application_pg)* Information to find hospitals and blood banks.

6.9 Organization

Online Registration System (http://www.ors.gov.in):

Citizens registration & appointment, payment of fees, online viewing diagnostic reports, enquiring availability of blood online etc. in public hospitals. Starting stage (launched 2015)

Many systems are launched to create common windows for all parties on health related products

Drugs authorization and distribution, Food Safety, Organ and Tissue Transplant, Blood banks, etc. Each system is accessible to the concerned stakeholders, actors and beneficiaries, allowing for registration, authorizations, appointments, workflow control, information etc.

Health Management Information System (HMIS) *(https://nrhm-mis.nic.in)*

Web-based portal for monitoring the programmes under National Health Mission (NHM). Approximately 200 000 Health facilities are regularly reporting on the Portal – open to the public

6.10 Capacity building

Mobile Academy: Free audio training course for the ASHAs *(see above)*. Launched in 2016. Over 70000 ASHAs have completed the course since inception in 7 States.

Training Management Information System (TMIS)

(http://ghf.g2hp.net/2014/02/25/training-management-information-system-as-a-tool-for-addressing-public-health-workforce-needs-and-rational-deployment-in-india/)

A wide group of public and research institutions provide a web based "single window" software application to create a nationwide database for health personnel that can be updated in real time at the training centres. The TMIS software pilot, launched in five states, helps collate individual level training information about each health personnel as well as health facility level information about the availability of trained health personnel. The TMIS facilitates monitoring and decision-making for the policy makers and program managers.

6.11   Well being

A growing number of start-ups addresses the India mobile market (1 billion contracts). An interesting example:

No More Tension Mobile App.   (https://www.nhp.gov.in/mobile-no-more-tension). Stress management application: help to measure, analyze, reduce it, methods, choices of music…

- III -
Main conclusions

7. Draw on all available means

Even if there has been policies changes due to political evolutions and also harsh nationalist oppositions, some constant factors and trends emerge. A main and perennial one is: "when confronted to a strong obstacle, take another way, drawing on all available means while keeping in mind the distant objective. Also: follow if necessary multiple approaches simultaneously, for instance technical ones, drawing on all available means *(see for instance Mother and Child)*.

7.1   A starting point

India went a long way in a short time from the difficulties of the 1947 independence to a powerful emerging country (the sixth-largest economy by market exchange rates, the third-largest by purchasing power parity) and from a 327 M population in 1950 to 1344 M in 2017. This striking evolution left open the divide between a huge poor population and a new India, with very rich people, a fast-growing middle class and global companies.

Hence, even Hospital IS System were not well developed and exchanges of data was impossible or very rare still around 2005.

This green field effect turned to be an advantage. India healthcare information systems were not blocked by entrenched. To progress, it was mandatory to let innovation play its role and it was often frugal innovation. So, Indians could fully exploit mHealth, obtaining better with less.

7.2   An implicit Indian strategy

At first, it could appear that the divide between the two Indias was deepening. However, in 2017, the situation is slowly evolving in the other direction. Evolution of the Indian society and economic growth created a wider awareness of the challenges for Indian healthcare and better conditions to try and confront them for human, social and economic reasons. Necessity of communication made every manager aware of usefulness of data and communication standards and interoperability.

eHealth was viewed as a key tool. Moreover, India governments and private sector knew also that working on remote and/or poor areas would open great opportunities in developing countries, especially Africa, and in South and South-East Asia. However, the most impressive development appeared firstly on existing developed foreign markets, notably USA for imagery interpretation, drawing on time differences and much inferior costs.

The new forces, often allied with ancient powerful families and states administrations, did create rapidly a great number of ICT in Health and eHealth programmes. There were multiple actors cooperating in diverse ways: government, states, public agencies and companies, private firms, not-for-profit associations and funds etc. This led to a growing awareness on the necessity of a National regulation and coordination on key aspects as standards.

This strategy was in fact greatly facilitated by the lack of regulation on eHealth and mHealth. Even if general rules for ICT and for privacy existed, their application to eHealth was not fine-tuned and controlled. This risk has been neglected, and protection leaved to the owners and developers of services and applications. This has already caused serious difficulties.

7.3   A brilliant future and three daunting challenges

India is in position to become a very strong actor in eHealth domain and to be one of the world centres, notably in Africa and South/South-East Asia.

However, three main challenges remain, that eHealth cannot solve alone and which hamper its real efficiency. In many cases, statistics show adhesion of multiple actors but practical blockages:

- Health and digital divide. Evolution of society leads to difficulties and conflicts as the differences deepen between upper class and the still enormous poor part of the population – the fast-growing middle class being the political arbitrator. This tension could derail the present evolution, as universal access is at stake and as the progress of the poor population is still a huge challenge.

- HPs and Health personnel. The lack of trained and educated Health personnel and HPs is the most immediate difficulty and cannot be solved rapidly – the government and states have addressed the problem but it is by nature a long way to go.

- Security, safety and privacy have been neglected (as in many similar developments in other countries); anyway, combination of multiple developments will lead to difficult problems. It will be the next challenge.

8. Good practices

Since long, governments have understood that the only way to reduce the gap with the poor, especially in remote areas was to work with local people, especially for the critical problem of maternity, childbirth and child mortality. They created ASHAS and their relation with ANMs at the village level and eHealth was the way to empower them.

A strength of India appears to be the capacity of compromise, developing cooperation between contradictory interests and even opposite conceptions. A characteristic of this capacity is the original relation between scientific healthcare of western origin and traditional non-scientifically proven techniques. In the poor population and in particular rural zones, non-registered doctors practicing Ayurveda, Yoga, Naturopathy, Unani, Siddha, Homeopathy were the only "medical" resource. The Ministry of Health and Family Welfare created conditions for registration and enrolled those that were conform in the Universal access effort and even eHealth. Indeed, they were associated with the development of connected Common Service Centres, themselves of diverse origins, and in government campaigns.

Another characteristic of Indian practices is the distinction between regulation and management power in programmes and projects and financing structure and responsibilities. In many cases, the federal or state authorities maintain a strong power on objectives and rules while other actors are investors.

- IV -
Potential for cooperation

9. Main domains and axes for exchanges and cooperation

India is a great and powerful country, with a long history and a vibrant cultural life. Relations with the EU and EU Member States are ancient and well developed. It is important to build on this base and to take into account the growing role of Indian companies in worldwide eHealth when considering more precisely projects of interest for information exchange and cooperation.

For the eHealth Network, it is essential to understand the somehow complex and multiple roads that the federal government follows to define what should be a common rule and to obtain consensus.

9.1 Strategic opportunities

Considering India needs and policy choices in the coming years, three critical domains present great opportunities for mutual exchanges and, possibly, cooperation:

- Remote and/or poor areas Universal Access - jointly with Telemedicine used for linking these areas to the healthcare system and specialized centres

- Education and training (tools, application of AI, Big Data etc.). In particular, consider cooperation with CHI, C-DAC and NIC (depending on problems – see above their respective domains)

- Security and safety: much is at stake for India's sustainable development of the new applications. Given EU MS excellence in the domain, cooperation should be rewarding for both – here exploring probably more with NIC (as public services are heavily concerned).

- Patient empowerment

Based on present cooperation agreements between the EU and India, three main domains can be extended to eHealth by the eHN:

Extend cooperation on ICT standards to eHealth domain.

Systematize Research Cooperation, extending relations with India National Knowledge Network and National Medical College Network.

Consider possible links for ICT with EU-India Joint Working Group on Pharmaceuticals, Biotechnology and Medical Devices, especially Medical devices and IOT.

9.2 To be studied: international cooperation

What relations with the Pan-African e-Network Project?

What possible cooperation with the JIPMER project?

9.3 Indian fundamental structures and orientations where information exchanges could be fruitful

NDHA on cross state cross border etc.

Private-public strategy should be observed – considering precise cases (for instance between Ministry of Health and Social Welfare with Apollo Hospitals for Sehat).

10.   Programmes and projects

The following paragraphs use basic elements of the provisional grid described in the D8.1.4 main document (II – 12.3). There are four categories:

- Learn: the project is a rich source of information for a country confronted to similar problems or working in a similar international action

- Mutual enrichment: development of exchanges between project actors and concerned parties among eHN MS, active in similar projects in their country or abroad.

- Help and support: which can be technical, promotion, financing.

- Participation: co-construction of the project and similar ones.

The chapter is organized around main themes as announced above in 10.1 It will be important to distinguish for each programme or project the diverse characteristics that have been proposed in the D.8.1.4 grids (II – 12.1, 12.2). Here programmes and projects have been detected with respect to their importance from Indian actors point of view and some key elements of the grids, as foundations.

All the proposed programmes and projects have been presented in this document. Many are new ones or revised ones after insufficient impact.

Programmes concern main policies while projects are sets of actions that are conjointly managed. It can be a component of a wider policy or programme, or it can be an independent development. *(D8.1.4 II-12.2).* In this document, many projects are specific actions that are organized under a very general and diverse national programme – as projects that are conceived in the very general framework of CSC, PHC, CHC.

10.1   Universal Access

- **Programmes**

National Rural Telemedicine Network (NRTM) (see 5.2)

Multi-technology network access. In fact, it is proposed to follow this programme state and evolution from 2016 MoHFW and ISRO MOU - Real usage indicators? Difficulties (human resources, others)?

> Objective for following
> Learn: for cooperation with developing countries which encounter similar problems

National Telemedicine Network (NTN) (see 5.2)

Recently started (see [3]) to provide Telemedicine Services to remote areas by upgrading existing Government Healthcare Facilities in States - Real usage indicators? Difficulties (human resources, others)?

> Objective for following
> Learn: for cooperation with developing countries which encounter similar problems

- **Projects**

Tele-Medicine Mobile Camp 2016 – (see 5.2)

Project of the Cancer Foundation and its Bangalore Core Committee – Bus for cancer screening unit

> Objective for following
> Participation: this is a problem in European populations as well as in developing countries

Common Services Centres (CSCs) 2014 (*see 6.3*)

In this key very general programme, it should be interesting to select and follow one or two specific projects, probably those indicated above: the tele-consultation project SEHAT (called programme) with Apollo, the Credihealth project to deliver service to its affiliates.

Follow development, difficulties, workforce training, evaluation tools, observe the conditions of this public-private partnership.

> Objective for following
> Learn: for cooperation with developing countries which encounter similar problems

Primary Health Centres (PHCs) – for eHealth: 2012 (6.3)

Selected projects could be the Uttar Pradesh automated tele-transmission and the Odisha projects, whose impact was the Uttar Pradesh reference. Follow development, difficulties, workforce training, evaluation tools, comparison.

> Objective for following
> Learn: for cooperation with developing countries which encounter similar problems

Mother and Child Tracking System (MCTS) 2009 *(6.4 and [12])*

Two-way communication between the service providers and beneficiaries in India's public health system. Here, projects to follow should be those of Rajasthan and Uttar Pradesh, where a 2012 evaluation showed difficulties and insufficient impact. What happened after, how were addressed difficulties, present impact…

> Objective for following
> Mutual enrichment: for cooperation with developing countries which encounter similar problems and for some European population in poor zones

Kilkari 2015 – *(6.4)* - mobile audio messages for pregnancy, childbirth

https://www.gsma.com/mobilefordevelopment/programme/mhealth/an-overview-of-kilkari-a-maternal-and-child-health-service-in-india

Rapid progression – follow to observe specific messages impact, coordination with the healthcare system, with MCTS etc.

> Objective for following
> Participate: for cooperation with developing countries which encounter similar problems and rely most on first generation mobile phones

ANM on line (ANMOL) 2015 *(6.4)*

3 pilot districts – tablet application for Auxiliary Nurse Midwives to update and use Reproductive and Child Health Register

http://unicef.in/Story/1183/ANMOL-ANMs-Online

Objective for following

Learn: useful in any context

Integrated Disease Surveillance Programme Portal 2004, restructured 2012 *(6.5)*

Decentralized laboratory based system to detect and respond to epidemic outbreaks through trained Rapid Response Team.

Practical impact, workforce actors and training.

Objective for following

Mutual enrichment: useful in any cont

Tele-ophthalmology – not yet a national programme, but many projects (6.7, [14])

Two projects to analyze and probably follow:

-   All India Institute of Medical Sciences (AIIMS), (20) New Delhi is rendering community eye care services through 20 primary eye care (PEC) centers, serving a population of nearly one million in the urban slums.

Objective for following

Participate: there are numerous projects in Europe and in developing countries – a specific interest in this project which concerns slums of big cities

-   The Sankara Nethralaya mobile tele-ophthalmology model for comprehensive eye care delivery in rural India. 2009

Objective for following

Participation: many projects in all contexts

10.2   Education and training

-   **Project**

Mobile Academy – 2016 *(6.10)*

Free audio training course for the ASHAs. Impact, evaluation tools, conception of messages, etc.

Objective for following

Learn: for cooperation with developing countries which encounter similar problems

10.3 Security, Safety, Privacy

- **Project**

AADHAAR (hindi for trust) – effective launch 2014 – *(5.2)* – National biometric ID

Objective for following

Help: AADHAAR has suffered privacy and security difficulties (and has already EU security specialist's relations)

10.4 Patient empowerment

- **Project**

My health record – to be launched 2018? *(6.6)*
Citizen controlled PHR accessible web and mobile

Objective for following

Learn (at this stage, as it is not launched) – could be Help and support, as the project is very ambitious

10.5 Standards, interoperability

- **Programme**

NDHA 2012 (*6.2*)
A specific problem is trans-border interoperability (methods, recommendations, tools)

Objective for following

Mutual exchange: on trans-border rules and tools

- **Project**

All care providers to use SNOMED-CT 2014 *(6.2)*
Methods, progress evaluation…

Objective for following

Mutual exchange: this is an ambitious and notoriously difficult objective

10.6 Research, Knowledge

- **Programme**

National Medical College Network (NMCN) 2012 *(5.2)*
*D*istance learning, access to resources and telemedicine. Organization, internal and international relations.

> Objective for following
>
> Mutual exchange: around similar European networks

- **Project**

National Medical Library's Electronic Resources in Medicine (ERMED) 2016 *(5.2)*

Grouping access to Journals

> Objective for following
>
> Mutual exchange: around similar developments, with librarian specialists

10.7 Products

- **Project**

Drugs and Vaccines Distribution Management System (DVDMS) – 2017

Web based supply chain management - purchase, inventory management and distribution to warehouses of State, Hospitals, CHC, PHC, to distribute drugs to patients, etc.

http://t7news.in/drug-and-vaccine-distribution-management-system-e-aushadhi-application-launched/

> Objective for following
>
> Mutual exchange: around European specialists

10.8 International cooperation

- **Projects**

Pan-African e-Network Project 2009 *(5.2)*

Inside the general sustained African policy – telemedicine and access to India resources

> Objective for following
>
> Learn: and find perhaps how to join efforts in Africa when useful and possible

JIPMER–BIMSTEC 2017 *(5.2)*

Proposal of eHealth cooperation to South and South-East Asia.

> Objective for following
>
> Learn (at this stage, as the project is now trying to recruit partners in its zone): could be a basis for developing relations in this geographic zone

- V -
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