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Clinical Engineering/Health Technology Management 2015 Global Update

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ABSTRACT

Medical device systems Clinical Engineering (CE)/Health Technology Management (HTM) strategies and best practices are now well established in most first world and many developing countries (DC).

Progress is being made to address identified gaps in DC CE/HTM, such as appropriate equipment selection and lifecycle management. One contributor to this progress is the 25 years of CE/HTM Seminars provided by WHO-PAHO, ACCE, and more recently, IFMBE CED, to 80 countries. There is also a new emerging challenge; the requirement for medical device (clinical data) integration (MDI) into electronic health records (EHRs) to improve care quality and safety (aka CE-IT).

This study will review CE/HTM progress, gaps, and new challenges since the last study in 2011. It will provide a framework to direct the global CE/HTM movement forward in collaborative fashion, alongside other initiatives in 2015, such as the 1st International CE-HTM Congress and the Global CE Summit held in Hanzhou, China, in October, 2015.

Keywords: *Clinical Engineering, Health Technology Management, CE, HTM, CE/HTM seminars, medical device lifecycle management, CE education, CE-Information Technology (CE-IT), medical device integration, IFMBE CE Division.*

INTRODUCTION

"In the 1980s, it became clear to the World Health Organization (WHO), academia, and various global non-government organizations (NGOs) that there were many failed medical device technology transfer projects in the previous 2 decades, resulting in a large amount of inoperable sophisticated equipment and unmet healthcare needs in spite of significant financial investment."[1]

"In 1988, WHO organized a virtual international roundtable with input from experts around the world and published the discussion in World Health Forum.[2] The roundtable not only confirmed the 2 challenges identified earlier – acquisition planning and maintenance, but also pointed out fundamental underlying issues. First and foremost is the fact that unlike drugs and vaccines, medical equipment requires continual outlay of funds, on order of 6–15% of original acquisition price, for the life of equipment, often up to 10–20 years after acquisition.[1] Thus, it is useless for NGOs and financing organizations to provide equipment donations or investment loans if the recipient countries cannot pay for recurrent expenses,

even if adequate planning and maintenance are available. Another serious deficiency is the lack of a framework for proper HTM in most developing countries. Without a framework defined and supported by policies, procedures, defined responsibilities, and earmarked resources for HTM, it is difficult to perform technology planning in harmony with the country's health policies and priorities, ensure appropriate human and material resources necessary to operate the equipment, and maintain it in safe and operational conditions."[1]

DEFINITIONS AND CONTEXT

Definitions

Health Technologies (HT): The term refers to the application of organized knowledge and skills in the form of devices, medicines, vaccines, procedures & systems developed to solve a health problem and improve quality of lives.[3]

Clinical Engineer: A Clinical Engineer (CE) is a professional who supports and advances patient care applying engineering and managerial skills to health care technology. (Sometimes also referred to as a Biomedical Engineer [BME].)[4]

Health Technology Management (HTM): For USA CE certification, defined by the ACCE Body of Knowledge survey of CE practitioners, HTM is broadly defined as "lifecycle management of medical devices and systems."[5]

Context and Key Acronyms

The main elements of developing country HTM and its key health system relationships are outlined in Figure 1.[1]

The 60th World Health Assembly, convened by WHO in 2007, passed the Resolution WHA60.29 relating to Health Technologies.[6] This resolution urges Member States:

1. "to collect, verify, update and exchange information on ***health technologies*** **(HT);** in particular medical devices as an aid to prioritization of needs and allocation of resources";
2. "to formulate as appropriate national, strategies and plans for the establishment of systems for the assessment, planning, procurement and HT management in particular medical devices, in collaboration with

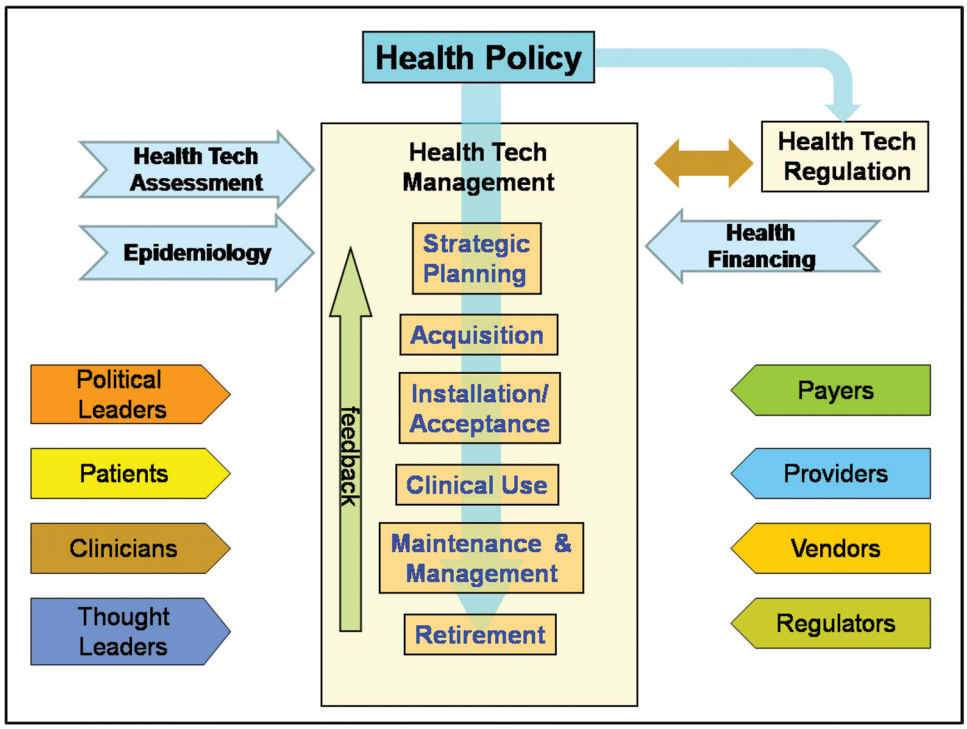

FIGURE 1. The main elements of developing country HTM and its key health system relationships.

personnel involved in ***health technology assessment*** **(HTA)** and ***biomedical engineering"*** **(BME);**

3. "to draw up national or regional guidelines for ***good manufacturing and regulatory practices***, to establish surveillance systems and other measures to ensure the ***quality, (risk,) safety and efficacy*** of devices and where appropriate participate in international harmonization" **(HTR, Risk & Safety or R&S);**
4. "to establish where necessary ***national and regional*** institutions of health technology, and to collaborate and build partnerships with health care providers, industry, patients' associations and professional, scientific and technical organizations;" **(e.g., MOH HT units**); and
5. "to collect information that interrelates medical devices which deal with ***priority public health conditions*** at different levels of care and in various settings and environments, with the required infrastructure, procedures and reference tools;" (to improve Maternal Child Health (**MCH)**, such as **HT improving MCH care outcomes**).

To illustrate these points, we include a figure from our previous article, which is a graphical representation of the main elements of Health Technology Management, and how it relates to other areas of the health system (see Figure 1).

As a capital investment, equipment needs to be managed from deployment (strategic planning, acquisition, installation / acceptance) until retirement, guided by a country's ***health technology policy*** (**HTP**).

During its useful life, proper maintenance and management are essential to ensure safe, efficient, and cost-effective patient care. Often neglected, feedback provided by users and maintainers is essential to continually improve **HTM** within the country or system, and avoid mistakes made previously.

HTM is intimately related to but distinct ***from health technology regulation*** (**HTR,** and **Risk & Safety**), as the latter is focused on safety and efficacy, with little concern on costs and management challenges.

Health Technology Assessment (HTA) is a multidisciplinary process that summarizes information about the medical, social, economic and ethical issues related to the use of a health technology in a systematic, transparent, unbiased, robust manner. Its aim is to inform the formulation of safe, effective, health policies that are patient focused and seek to achieve best value. Despite its policy goals, HTA must always be firmly rooted in research and the scientific method.[5–7] **HTA** provides the foundation for successful planning and subsequent use of health technologies.

HTM GAPS AND PROGRESS

Earlier HTM Study: Our prior article[1] described progress in HTM *in 51 countries, including Africa (11 countries) Asia (11 countries), Latin America & the Caribbean (19 countries), and other (10 countries).* In that article, the following gaps in HTM were identified:

- A lack of competent staff (*Human Resource development* - **HR**)
- Limited access to technical documentation & spare parts **(HTM)**
- Poor planning and lack of commitment **(HTM)**
- Irrational HT incorporation and deployment **(HTM)**
- Limited influence with decision makers (e.g., <10 countries then had designated Ministry of Health, Health Technology-**HT** Units)
- Donations provided that do not align with Ministry of Health **(MOH**) priorities

In addition, the article identified the following root causes of HTM challenges:

- Lack of: training to develop human resources-HR; experience; awareness; and influence with decision makers regarding HTM
- Equipment is often considered a status symbol instead of a service production tool
- Greed and short-sightedness of manufacturers and distributors
- Selfishness of some "aid," "cooperation," and "donation" programs that are actual sales-promoting schemes or publicity stunts
- Lack of vision and courage among HTM professionals

Global HTM Seminars: Further progress in HTM has been documented in a series of Seminars presented from 1991-2015 by ACCE and WHO-PAHO.[8]

As a result of these seminars, progress was seen in the following areas *(with aggregate evidence noted below summarized):*

- HT Policy (**HTP**) developed, *e.g., in 27 of 51 countries (>50%)*
- HTM training provided (**HR**), *e.g., 40+ of 51 countries (>80%)*
- National professional societies created; *e.g., in 20 of 51 (~40%)*

WHO Global Forums: Further progress in HTM was documented in the WHO 2nd Global Forum on Medical Devices, 2013 (2GFMD).[9] This progress was documented in a series of country reports presented at the Forum, and is summarized in the following tables (Tables 1A-D).

The 2013 WHO 2nd Global Forum provided an important update on the information presented in our prior paper.[1] We now see indications of further progress.

Africa (20 countries)

- HTM programs have doubled in the region.
  - Increased NGO HTM involvement has helped, such as, THET-Zambia, MRC-Gambia, and CMBES-Ghana.
- Increasing HT involvement with MOH decision makers.
  - Growing HTA and HTR initiatives.
- Earlier HTM programs now aggressively pursuing MCH.
  - Limited CE-IT initiatives.

Asia (13 countries)

- Big 3: strong national programs in China, Japan, and India.
  - MOH Unit in India comprehensively addressing HT.
  - Continued growth of Japan and its national CE society.
  - Rapid growth of China CEs, societies, & certification.
- Countries with prior HTM (2011) pursuing HTA and HTR.
  - Increasing involvement with MOH decision makers. Limited CE-IT initiatives other than Big 3.

Latin & Central America (12 countries)

- PAHO investment in HTM and HR training anchored in academia.
  - Freeing MOHs to work on HTA and HTR.
- Big 4: historical HT strength of Brazil & *Mexico* + Colombia & Peru.

  Brazil largest CE base; very multidisciplinary approach.
  - *Mexico MOH Unit; wide-ranging with decision makers.*
  - Colombia (strong HT history; introduced IHE to Region); & Peru (developed MOH Unit, key academia partnerships).

Others (26 countries)

- Group with extensive capabilities along HT continuum.
  - Most have mature HTM & are pursuing HTA & HTR.
  - Several key HTM contributors in region and or globally.
  - Also among global leaders for CE-IT and MCH.

2015 HTM Seminar: In June 2015 another major HTM Seminar was organized by ACCE in collaboration with WHO-PAHO, with 32 HTM leaders from 22 countries represented, and one USA NGO.[10] Table 2 lists the participants in this seminar, and their affiliations.

This table illustrates the following indications of progress: HT units now more frequently created at MOH level (15/22 countries) and HTM leaders are emerging with increasing influence at the MOH level.

Table 3 summarizes the gains and challenges in HTM, HTA, HTP, HTR, and CE-IT that were reported at the seminar.

The following detail the gains and challenges identified at the 2015 HTM seminar:

Africa (5 countries reporting)

- Tend to have established HTM, but need HR, HTP, and HTR

Asia (3 countries reporting)

- Rapid growth HT capabilities for 2 high population countries
  - India MOH HT Unit leading country-wide initiatives
  - Bangladesh increasing scope of HT work

Latin & Central America (8 countries reporting)

- Two in early stages of HTM; most mature pursuing CE-IT
  - Mexico MOH HT Unit (CENETEC) a global best practice
  - Most countries also need MOH HTP and HTR

TABLE 1A. Africa – 20 Countries/Entities Presented at 2GFMD

Country	Major Accomplishments	References
AFRO-WHO	HTM	Ndihokubwayo (AFRO), 2013
Benin	HTM	Adjaratou et al (MOH), 2013
Burkina Faso	HTM	Emmanuel et al (MOH), 2013
Cameroon	HTM, CE-IT	Ngaleu-Toko et al, 2013
Cote D'Ivoire	HTM	YriéUDenis (MOH), 2013
Ethiopia	HTM, MCH	Mulegeta et al (MOH), 2013
The Gambia	HTM, MCH	Nyassi et al, Faye et al, 2013
Ghana	HTM, HR, HTA, MCH	Adjabu, THET & MOH, 2013
Kenya	HTM, HR, HTA, HTR, MCH	Owino, Anyango, Mwaru et al (MOH), 2013
Malawi	MCH	Mwanza et al (MOH), 2013
Nigeria	HTM, HTR, MCH	Ilonze et al (MOH), Fatunde, 2013
RSA	HTM, HTA, HTR	Poluta, Khalaf et al, Mueller, 2013
Rwanda	HTM	Mukama et al (MOH), 2013
Senegal	HTM	Sow et al (MOH), 2013
Sierra Leone	HTM	Kabia (MOH), 2013
South Sudan	HTA	Lilford et al, 2013
Tanzania	HTR, MCH	Kijo et al (MOH), 2013
Togo	HTM, MCH	Tsolenyanu et al (NGO), 2013
Uganda	HTM, HR, HTA, MCH	Wanda et al (MOH), Ssekitoleko et al, 2013
Zambia	HTM, MCH	Mullally, Machbani, Musiwa (MOH), 2013

Other (2 countries reporting)

- Albania HT Unit a global best practice for small countries

WHO

- WHO desires the following global Surveys in 2016:
  - Value of Donations, e.g., percent implemented and in use
  - Number BMETs needed at country level, for MOH plans
  - HTM outcome measures; influence MOH decision makers
- WHO facilitating BME/CE global recognition in 2018 by ILO
  - Causing WHO to annually track key CE/HTM measures

The 2015 Seminar Participant Recommendations were:

1. *Increase Awareness of CE/HTM Influence on HT Policy*
   - WHO can assist countries to develop/implement HT policies
2. *Communicate global HTM point of view to help countries*
   - How to address when government not involved in HTM

TABLE 1B. Asia - 13

Bangladesh	HTM, HTA, HTR	Hasan, Rabbani et al (MOH), 2013
China	HTM, HTA, HTR, CE-IT	Zhong et al, 2013
India	HTM, HTA, HTR, CE-IT, MCH	Sharma et al (MOH), Khambete et al, 2013
Japan	HTM, HR, HTA, HTR, HTP, CE-IT	Fukuta (MOH), Nakazaki, Sugiura, 2013
Korea	HTA	Hwang et al, 2013
Laos	HTM	Insal (MOH), 2013
Malaysia	HTR	Rahman (MOH), 2013
Myanmar	HTM	Lin (MOH), 2013
Philippines	CE-IT	Mojica et al, 2013
Singapore	HR, HTR, HTA	Goh et al (MOH), 2013
Sri Lanka	HTA	Galappatthy et al (MOH), 2013
Thailand	HTA	Tantivess, Wibulpolprasert (MOH), 2013
Vietnam	HTM, MCH	Dajer, 2013

TABLE 1C. Latin & Central America - 12

Argentina	HTM	Giles et al, 2013
Bolivia	HTM	Urioste (MOH), 2013
Brazil	HTM, HR, HTA, HTR, HTP, R&S	Garcia, Calil, Conto (MOH), 2013
Colombia	HTM, CE-IT	Quintero, Hernandez, Castaneda, 2013
Chile	HTA	Duarte et al, 2013
Cuba	HTR	Pereira et al (MOH), 2011
Ecuador	CE-IT	Silva et al, 2013
Haiti	HTM	Judd et al, 2013
Mexico	HTM, HTA, HTR, HTP	Cardenas, Moreno (CENETEC) 2013
PAHO-WHO	HTM, HTA	Lemgruber, Jimenez, 2013
Peru	HTM, HTA, HTR	Rivas et al, Pinedo, 2013
Uruguay	HTP, HTA	Galan et al (MOH), 2013

TABLE 1D. Australia, Europe, Middle East, NGOs - 26

Australia	HTA, HTR, CE-IT	Babige, Kearney, Tang, Mcewan 2013
Belgium	HTM, HTR	Demade, Bogg, Merlevede 2013
Bulgaria	HTA	Dimitrova (MOH), 2013
Croatia	HR	Magjarevic, 2013
Egypt	HTA	Salem, ElSaadany (MOH), 2013
EWH	HTM	Malkin, 2013
EURO-WHO	HTA, CE-IT	Pedersen et al (EURO), Kulkarni, 2013
Greece	HTM, HTP, R&S	Pallikarakis, Stavrianou, 2013
Hungary	HTA	Szacsky, 2013
Israel	MCH	Mayaan, 2013
Italy	HTM, HTA, CE-IT	Iadanza, Pecchia, Musi, 2013
Jordan	HTM	Rahim, Dalou, 2013
Kuwait	HR, HTR	Alzawadhi, 2013
KSA	HTA, HTR, CE-IT	Hassanain, Al Tayyar, 2013
Laerdal	MCH	Laerdal et al, 2013
Lebanon	HTA	Rihana, 2013
Netherlands	HR, HTA	Hurts/Hansen (MOH), Linnenbank, 2013
Norway	HTA	Lauvrak et al, 2013
Portugal	HR, HTA, HTR	Secca, Da Silva, Madureira et al, 2013
Slovakia	HTA	Jadud (MOH), 2013
Spain	HTA, CE-IT	Falcon et al, 2013
Switzerland	HTM, HTR	Zaugg, Werlein, Voelksen, 2013
Tunisia	CE-IT	Ouhichi, 2013
Turkey	HTM, HTA, HTR, R&S	Copur, Demirbas, Turgut/Kuru, Ozdemir, 2013
UK	HTM, HTR, R&S	Murray/Gammie/Wasmuth/McNerney 2013
Yemen	HTA	Mujamal (MOH) et al, 2013

TABLE 2. 2015 HTM Seminar Participants

Albania	MOH Health Technology (HT) Director
Argentina	MOH HT Coordinator
Argentina	Private Hospital CE Director
Australia / Egypt	WHO BME Intern
Bangladesh	University BME Professor
Bangladesh	University BME graduate student
Bhutan	MOH Director HT Unit
Botswana	MOH Regional HT Director
Brazil	MOH HT Manager
Brazil	Private CE Company COO
Canada	WHO BME Intern
Colombia	MOH Director HT Unit
Colombia	MOH Laboratory CE Director
Colombia	University BME Professor
Cuba	MOH Hospital CE
Ethiopia	MOH BME Advisor
Haiti	National Hospital CE Director
Haiti / USA	Medical Device Consultant
India	MOH WHO HT Center Director
India	MOH Consultant
Kenya	MOH Hospital CE
Kosovo	Telecommunications Engineer
Mexico	MOH Hospital Coordinator
Mexico	University CE Professor
Mexico	University CE Professor
Nigeria	MOH Director HT Unit
Peru	MOH Consultant, University CE Professor
Sierra Leone/USA	University CE Professor
Suriname	MOH Hospital CE Director
Uganda	MOH Director HT Unit
Uganda	MOH Senior BME
USA	NGO BME Leader

- How to enable, using resources & influence to help drive HTM
- WHO needs data from specific case studies to better assist

3. *Develop Regional Training Centers (RTC) – Improves HR & HTM*
   - Need *Key* HTM *Process Standardization*
   - Lessons learned to be applied: (1) create RTC for maintenance; (2) Training that is university-based is more sustainable
   - Incorporate CE/HTM in health care clinical & business courses, such as for physicians and health administrators
   - Share different methods of risk management across countries
4. *Develop standard medical equipment procurement documents*
   - Incorporate Life Cycle Cost (LCC) Analysis, as World Bank has done for Information and Communication Technologies
   - Make use of WHO resources on Device Specifications
   - Consider central/national Public-Private-Partnership (PPP)
5. *Consider how to best facilitate "our group" ongoing communications and networking* – e.g., INFRATECH and WHO Listservs
6. *Maintenance Management*
   - Need inventory management system on line with history (CMMS); such as, basic inventory, then layers
   - India is working on a national CMMS that can be made available on line for free
7. *WHO & Medical Equipment Manufacturers*
   - How to improve interactions?
   - WHO: Has created a Forum for manufacturers
8. *Improve Domestic production of Medical Devices*
   - Affects HTM, making best use of Technology Transfer
9. *Organize professional societies to extend influence*
   - Many benefits to join locally, nationally, regionally, globally

TABLE 3. Summary of Participant Gains/Challenges [A-Y]

Country (Pop. in M)	Key Gains	Key Challenges
Albania (2.9)	HTM, HTP, HTR	HR, CE-IT
Argentina (43)	HTM, CE-IT	
Bangladesh (157)	HTM, HTA, HTP, CE-IT	HR
Bhutan (0.74)	HTM, HTA	HR, HTP, HTR
Botswana (2.2)	HTM	HR, HTP, HTR
Brazil (202)	HTM, CE-IT	
Colombia (48)	HTM, CE-IT	HTP, HTR
Cuba (11)	HTM, HR	CE-IT
Ethiopia (92)	HTM, HTP	Wider HTP, HTR
Haiti (10)	HTM	HR, HTP, HTR
India (1,250)	HTM, HTA, HTP, HTR, CE-IT	Wider CE-IT
Kenya (44)	HTM, HR	HTP, HTR
Kosovo (1.9)	HTM, CE-IT	HR, HTP, HTR
Mexico (122)	HTM, HR, HTP, HTA, HTR, CE-IT	Wider CE-IT
Nigeria (140)	HTM	HR, HTP, HTR
Peru (30)	HTM, HR, CE-IT	HTP, HTR
Suriname (0.57)	HTM	HR, HTP, HTR
Uganda (40)	HTM	HR, HTP, HTR

CASE STUDIES / SUCCESS STORIES

Ghana

Improved HTM and HR: In 2009, 2 HTM Seminars were organized by ACCE in collaboration with WHO, International Aid, and the Ghana Health Service. Essential HTM topics were covered. The curriculum for the HTM workshop was based on the WHO-adopted "*How to Manage*" series for HT.[11] The seminars were well attended, with 135 at the first and 83 at the second. Participants identified a number of HTM challenges including: (1) A lack of training on HTM topics. (2) Inadequate tools and test equipment. (3) Poor availability of spare parts. (4) A lack of communication between government policy makers and HT stakeholders affected by policies (HTP). This indicates a need for future seminars to include more content for government policy makers.

Results

Professional Society: At the conclusion of the second seminar, the attendees initiated the Ghana Biomedical Engineering Society (GBES). An email listserv was set up to facilitate communication among workshop attendees.

Global Partnerships: In addition, the faculty members from Canada initiated a formal partnership between the Canadian Medical and Biological Engineering Society (CMBES) and GBES. There is also opportunity for CMBES and GBES to partner more closely with WHO via regional African societies under development and through joint WHO and IFMBE CED global initiatives.

The CMBES-GBES partnership has resulted in the successful application for a research grant to examine medical equipment donation practices in Canada, and the experiences of recipients of such donations in Ghana. Members of the 2 societies are in frequent communication. Such ongoing partnerships are considered an important factor in the strengthening of HTM programs.

ALBANIA

Improved Access and HTM: Before September 2014, MOH Albania had no maintenance strategy for its hospitals' highest technology diagnostic equipment – linear accelerators, magnetic resonance imaging, computed tomography scanners and angiography – resulting in higher costs, significant downtime, and poor vendor relationships. They then implemented a new approach based on global best practices: full risk, 2-year service contracts via negotiation; vendor meetings to present our new approach and for authorized distributor confirmation; then open tender procedures for international participation, to avoid speculation of monopoly.

MEXICO

Role Model: Established MOH Unit in 2004, CENETEC; has become a global CE-HTM role model with country-wide HTP, HTM, HTA, HTR, HR, and Practice Guideline development.

BRAZIL

First MOH Unit – established at *São* Paolo state level in 1980s. Key leader in global HTP, HTM, HR, and CE-IT.

FUTURE: 2015–2020

What is needed for CE/HTM profession?[10]

- *CE-IT:* need education for MDI seamlessly into EHRs[7]
  - Technical, Management, Leadership, Health IT (CE-IT) Standards, and Regulatory (HTR) framework
  - Global Drivers: eHealth, Patient Safety & Risk Management, Medical Device Cybersecurity, Patient & Population Health Outcomes
  - *Clinical workflows*: CE/HTM leaders provide improved design
  - *Leading edge initiatives*: CE/HTM leading telehealth, smartphone/mHealth, in their countries and regions to improve quality, safety, access and affordability.
  - Maternal and Child Health (MCH), e.g., Neonatal and Newborn Care, using WHO-vetted Evidence-Based Interventions & Practice Guidelines
  - *Influence*: Stronger leaders, with wider impact on decision makers

CONCLUSIONS

This study showed steady improvements globally in most indicators for Health Technology. Health Technologies will play an increasing role in global health care delivery with the emerging spread of CE-IT (EHR-enabled care) to improve quality and continue to make care affordable.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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APPENDIX

The following listing is the country-level presentations made during the 2015 HTM Seminar in Denver, CO USA, and Toronto, Canada. They can be obtained from the authors and or the presenters.

A. Picari L, *Albania HTM Seminar Country Update*, & *MOH HT Unit Maintenance of Medical Devices* (high technology systems), 2015
B. Giles G, Lencina M, *Argentina HTM Country Update*, 2015
C. Abir AR, Rabbani KS, *Bangladesh HTM Seminar Update*, 2015
D. Penjore T, *Bhutan HTM Seminar Country Update*, 2015
E. Tlhomelang B, *Botswana HTM Seminar Country Update*, 2015
F. Contó M, Katz Z, *Brazil HTM Seminar Country Update*, 2015
G. García Ibarra AR, Rojas Morales JM, *Colombia HTM Seminar Country Update*, 2015
H. Castro Medina J, *Cuba HTM Seminar Country Update*, 2015
I. Mideksa M, E*thiopia HTM Seminar Country Update*, 2015
J. Valliere M, Chery J, *Haiti HTM Seminar Country Update*, 2015
K. Sharma Dr. JK, Arora P, *India HTM Seminar Country Update*, 2015
L. Anyango Amoko P, *Kenya HTM Seminar Country Update*, 2015
M. Abazi N, *Kosovo HTM Seminar Country Update*, 2015
N. Cardenas Alanis C, Leon de Alba F, Orencio E, Moreno ME, *Mexico HTM Seminar Country Update,* 2015
O. Bukola E, *Nigeria HTM Seminar Country Update,* 2015
P. Rivas R, *Peru HTM Seminar Country Update*, 2015
Q. Jie G, *Suriname HTM Seminar Country Update*, 2015
R. Mulepo S, Edward K, *Uganda HTM Seminar Country Update*, 2015
S. Castañeda M, *Business Opportunities in Health Technology Projects*, 2015 (outcomes of August 2013 ACCE HT Seminar, Barranquilla, Colombia)
T. Clark T, Lemgruber A & Caccavo F (PAHO), Molina Velasquez T (Universidad CES Colombia), Graciá F (Universidad National Tech. Argentina), Rivas R & Vilcahuaman L, (Universidad PUCP Peru), *Biomedical Technology Online Courses for the Americas*, 2015
U. Hernandez A, *Trends on IT and Health Technology* (CE-IT), 2015
V. Painter F, *Risk Management,* 2015 (outline of device Risk & Safety issues)
W. Quintero Dr. V, *IHE Colombia Crash Course on Interoperability* (CE-IT), from Universidad Simón Bolívar, Barranquilla, Colombia, 2015
X. Sloane Dr. E, *Medical Device and ICT Convergence (*CE-IT), 2015
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