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Making a Difference – Global Health Technology Success Stories: Overview of over 400 submissions from 125 Countries

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ABSTRACT

Health Technology (HT) is vital to global health care. The dependence of health, rehabilitation, and wellness programs on technology for the delivery of services has never been greater. It is essential therefore, that HT be optimally managed. Clinical and biomedical engineers have been recognized by World Health Organization (WHO) as essential to providing this critical management.

At the 1st International Clinical Engineering and HT Management Congress and Summit held in China in 2015, a resolution was adopted by the global Clinical Engineering (CE) country participants to identify and promote CE unique qualifications, and to record the CE contributions to the improvement of world health status. Review of published literature and submissions of case studies resulted in the first group of CE success stories. The review captured 150 stories from 90 countries – spanning over a period from the prior 10 years and the results were presented to health leaders at the WHO World Health Assembly in 2016. Last year, in 2017, additional 250 case studies from a total of 125 countries were added from the 2016-2017 period. This paper describes the evidence identified during the review, their sources and the 6 major categories they represent.

Keywords – *Healthcare, Clinical Engineering, Technology Management, Safety, Efficacy, Outcomes, Innovation, Success Stories*

INTRODUCTION

Health Technology (HT) is vital to health and the dependence of health, rehabilitation and wellness programs on HT for the delivery of their services has never been greater. Therefore, it essential that competent and trained professionals manage in an optimal and safe way for better response to the burden of diseases and resources. Trained clinical engineers are academically prepared and

appropriately responsible for HT life-cycle management, fulfilling a critical role as members of the healthcare team focusing on availability and reliability of safe and effective technologies and outcomes.

Over the past 50 years growing concerns among Clinical Engineering (CE) professionals about lack of knowledge of government agencies and key stakeholders, coupled with the mute recognition for their vast contributions to the safe and effective creation and deployment of HT, led to programs that address these concerns. Knowledge about

IFMBE-CED is the International Federation for Medical and Biological Engineering (IFMBE)-Clinical Engineering Division (CED), currently representing clinical engineers (hospital-based biomedical engineers) in these roles in 165 countries. See more information about CED at cedglobal.org/organization-and-teams/

and recognition for the professionals of CE community who provide critical services will help recruit students and future practitioners into this needed field. Is CE practice important for health, rehabilitation, and wellness programs and are their contributions recognized? This paper shares the methodology and the findings identified following a three-year examination of published evidence.

Following the international congress on CE and HT management in Hangzhou, China in 2015, a Global CE Summit took place to determine whether regional issues are shared across the world and present common international challenges requiring global strategy for optimal addressing of the critical issues. After order ranking of the issues that identified at the end of the Global CE Summit, the attending members voted that there were 2 major concerns: (1) a lack of understanding of and recognition for the CE contribution to improvements in healthcare delivery. (2) a lack of sufficient education and training for both those who would like to enter the field and for ongoing professional development. An action plan was devised to address these and other issues raised at the summit. At the second global CE summit in Sao Paulo, Brazil, in 2017, these challenges were reviewed and confirmed with attendees adopting resolutions seeking to continue to address these concerns. The action plans from the summit focused first on data collection identifying if CE contributions qualify as improvement to world health and wellness and can they be substantiated through evidence-based records. Addressing the second issue, an international survey of Body of Practice and Body of Knowledge was initiated and has been now completed.

METHODS

Rationale

A task force consisting of senior certified clinical engineers from IFMBE/CED issued a global call for submissions of evidence-supported case studies of CE contributions to the improvement of delivery of healthcare services or of patient outcomes. In addition, literature survey was performed in 2016, and of both sources, the literature and the submitted studies, an aggregate volume of 150 responses from 90 countries was examined and qualified as evidence-based contributions, (see <http://global.icehtmc.com/publication/healthtechnology>).

Results were rated and tabulated into categories (Innovation, Improved Access, Health Systems, HT Management, Safety & Quality, and e-Technology) and incorporated into document <http://global.icehtmc.com/publication/globalsuccess> that was submitted to WHO's World Health Assembly in May 2016.

We expanded our review in 2017, as submissions and publications continued to be collected, to include conference-accepted data that was presented and published at IFMBE sponsored events. Our examination methodology identified 250 additional stories from 35 more countries – now raising the total volume over 2 years to 400 publications from 125 countries. These CE success stories point to improved outcomes with benefit from HT, and present overall demonstration of complex integrated systems that must be effectively managed for their optimal and safe clinical and business impact to be realized. Clinical outcomes included change in human life quality, care management decisions support, improving 365×24×7 readiness, and improving operational efficiency.

Definitions

For the present study, we classified the collected database into 6 categories with definitions:

- **Innovation**

Through provision of new HT solutions, adaptation of existing, or a combination to address several issues.

- **Improved Access**

Ease in reaching HT-related health services or facilities in terms of location, time, and ease of approach.

- **Health Systems**

Positive impact from more efficient and effective deployment of HT at national or policy level.

- **Safety & Quality**

HT's positive impact on health services safety or quality outcomes, or through HT human resource development.

- **Healthcare Technology Management (HTM)**

Establishing or improving HTM methodology resulting in improved population health or wellness.

- **e-Technology**

Improvements achieved due to deployment of Internet-based HT tools.

Measures

During the first Global Clinical Engineering Summit in 2015 the question was raised whether evidence of successful HT innovation, management, accessibility, e-technology applications, safety, and quality outcomes can be identified. To accomplish this, a successful project (or submission) was defined as satisfying 2 objective measures developed by the sponsors. These measures included timeliness, cost saving, deployment or adoption by care providers, impact on services, and overall projection for success. Each success metric was evaluated using 3-point scale against a statement representing the success construct (1= strongly disagree; 3=strongly agree).

- Timeliness refers to whether the project/submission was implemented in timely manner. This was measure by the statement “The submission will impact outcomes on present time.”
- The cost measure was evaluated by whether the submission’s overall costs were within budget constraints and reasonable for the conditions in the region. This was assessed by the statement, “The submission cost objectives can be met in the region.”
- The next 2 metrics were combined into the statements “The submission will be deployed by its intended users” and “The submission will have a positive impact on those who will adopt it.”
- Finally, overall submission success expectations were assessed with the statement “All things considered, the submission will be a success.”

Innovation is the beginning of the technology life cycle where new ideas offer solutions to current problems faced by healthcare providers or their patients. Clinical engineers are well positioned to understand the current problems and guide different or new approaches to resolve them. Innovation, in our category, means to demonstrate the team approach to solving problems all the way from the concept and building of a prototype, to continuing with clinical trials, and a demonstration of compliance with standards, regulations, and intended outcomes. Improved Access to services follows the innovation stage the same as the Safety and Quality category, e-Technology category, and HTM. Products and applications that are considered

in successful deployment were rated high and included in the total count for the evidence-based category.

RESULTS

Summaries of the 6 categories of submissions database are described below. They come from the CED’s 2016 Health Technologies Resources¹ document provided to the World Health Assembly, WHO’s May 2017, 3rd Global Forum on Medical Devices²; (3), the CED’s September 2017 Sao Paulo II ICEHTMC³ (S), and others⁴ from 2016-2017 IFMBE published sources (O):

A new resource summary document of the findings – with links below – demonstrates that a benefit was registered in the 6 categories from every region around the world. Overall this review identified evidence from 400 case studies received from 125 countries where management of medical devices (main component of health technologies) made a positive difference over the past 12 years.

The [2007 WHO WHA Resolution 60.29](#) urges Member States to create national HT management plans in collaboration with biomedical engineers. WHO further clarified the definition of these personnel in 2017- 2018 as part of a global survey⁵ (http://www.who.int/medical_devices/support/en/) in coordination with IFMBE CED.

“Trained and qualified biomedical engineering professionals are required to design, evaluate, regulate, maintain and manage medical devices, and train on their safe use in health systems around the world.⁵” These occupations have various names in different countries like clinical engineers, medical engineers, ... and related professionals and technicians. [WHO and IFMBE CED surveys have identified over 800,000 of these global professionals in 2018.]

The case studies – grouped in 6 categories – aim to formulate national strategies and plans to improve use of health technologies and better manage costs. In several countries, this has best been achieved by developing a HT unit at the Ministry of Health level with CE leadership. The studies provide clear evidence that HT is beneficial; at times, presenting complex systems that must be effectively guided and managed for optimal impact to be realized.

- **Innovation**
- **Access**
- **Management**
- **Health Systems**
- **e-Technology**
- **Quality & Safety**

The case studies are actually Health Technology Success Stories demonstrating, in a limited resource environment, that it is desirable to include professional HT expertise, such as clinical engineers, in national decision-making in order to maximize health systems' services. Case studies from the links on the following pages demonstrate these benefits:

- **Access:** The Ministry of Health HT Unit-led project in Albania that doubled access to critical diagnostic services, such as computed tomography scanners, magnetic resonance and angiography imaging, while reducing equipment downtime to zero, and significantly reducing cost.
- **Health Systems:** Improved coordination between multiple stakeholders in the National Laboratory and its satellites in Colombia, led by the Ministry of Health and clinical engineers who partner with experts from academia and industry.
- **Quality & Safety:** A clinical engineer-led 122-hospital program in the Shanghai region that cooperates with officials, industry, and academic entities, resulting in improved device user satisfaction, tracking of emerging technologies, and closer partnerships with industry.

CONCLUSIONS

HT is vital to health and the dependence of health, rehabilitation, and wellness programs that rely on HT for the delivery of their services has never been greater. Beyond the ongoing healthcare burdens of population growth, political and economic instability, disease management, disasters, the refugee crisis, accidents, and terror attacks, world healthcare technological systems are facing enormous challenges to be innovative and optimally managed. The transition into health programs for the 21st century requires the employment of trained competent CE professionals. Disease prevention, treatment, and rehabilitation is more efficient and effective when health services

are provided with appropriate tools. Along with World Health Organization (WHO), the International Federation for Medical and Biological Engineering (IFMBE) Clinical Engineering Division (CED) recognizes and emphasizes how important the use of appropriate, integrated, and safe health technologies (HT) is to successful outcomes for every healthcare delivery systems. In the May 2016 HT resource document that was prepared for the World Health Assembly (WHA), a recommendation was made: Health technologies must be managed to ensure full clinical benefit and expected financial return on investment.

It is critical, therefore, that with limited resources, HT must be professionally managed and its deployment over its life cycle be appropriately guided. This paper describes the extensive study of published data on the vast contributions by CE that positively impact patient outcomes. This study shows that every region of the world including low-resource regions face a challenge of improving health services while facing varied levels of infrastructure and human resources capacity challenges. CEs play vital roles in all stages of healthcare technology life-cycle management. From creation to planning, and from commissioning to utilization and integration; technology-based systems must and can be managed for optimal performance. In each of the technology life-cycle stages the requirement for trained and competent CE input makes critical difference as shown in the analyzed evidence reviewed here. It is our hope that government agencies and other interested parties will have better understanding of CEs role and thus will support their inclusion in the healthcare team of professionals.

RECOMMENDATION

To encourage the availability, recognition, and increased participation of clinical engineers as part of the health workforce in your national healthcare delivery programs.²

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- WHO Digital Health: http://www.who.int/medical_devices/global_forum/TheDigitalHealthAtlas.pdf
 - WHO Assistive Devices-GATE: <https://mednet-communities.net/gate/>
 - WHO Emergency: www.who.int/medical_devices/global_forum/EssentialResourcesEmergencyCare.pdf
 - WHO NCD Kit Refugees: http://www.who.int/medical_devices/global_forum/NCDkitrefugees.pdf
 - IFMBE, CED, HTA: <http://ifmbe.org/>, <http://cedglobal.org/>, <http://htad.ifmbe.org/>
 - PATH: <https://www.path.org/> (Belgium, China, DRC, Ethiopia, Ghana, India, Kenya, Malawi, Mozambique, Myanmar, Peru, Senegal, RSA, Switzerland, Tanzania, Uganda, Ukraine, Vietnam, Zambia)
 - AWHP: www.ahwp.info; Asian Harmonization Working Party - 30 countries, 3/17 Regulatory Authorities
 - HTAi: <https://www.htai.org/>

ADDITIONAL LINKS AND RESOURCES

- WHO HQ: http://www.who.int/medical_devices/en/
- WHO EMRO: <http://www.emro.who.int>
- WHO AMRO: <http://www.who.int/about/regions/amro/en/>

RESOURCES REVIEWED

Focus Area	Title, authors, with active links
Afghanistan, Iraq, Libya, Occupied Palestinian Territory, Somalia, Sudan, Syria, and Yemen	Medical Devices for Emergency Kits (NCD Kit) , Laura Alejandra Velez, Slim Slama
Australia	Phototherapy to Reduce Exchange Transfusions , Luciano Moccia, Gaston Arnolda, Daniele Trevisanuto
Australia	FREO2 oxygen solutions: the Low-Pressure Oxygen Storage system and FREO2 Siphon , Roger Rassool, Jim Black
Australia	BME development of non-electric portable blood/fluid warmer for roadside trauma , Anne-Louise Smith, Mark McEwen
Bangladesh	Health Technology enhancing rural Primary Care and eHealth , Ahmed Raihan Abir
Brazil	Dynamical Orthostatic Chair Development of a new method of lifting and locomotion for physically disabled people , Walef Robert Ivo Carvalho
Brazil	A multiband reflectance photometric device for reveal gestational age at birth , Rodney Guimaraes, Zilma Reis
Brazil	Prematurity detection by light , Zilma Reis, Rodney Nascimento Guimarães, Gabriela Luíza Nogueira Vitral, Maria Albertina Santiago Rego, Ingrid Michelle Fonseca
Brazil	Actions travelling ECG for Telemedicine - a partnership of academic and public service , Kleber Teixeira de Souza et al
Brazil	Flow Analyzer for Blood Pump , L.R. Rodrigo, A.M. Marcelo and S. Anderson
Brazil	Principal Component Analysis usage in Biomedical Engineering to aid at diagnosing pathologies , E.F. Esmanhoto
Brazil	Digital Storage and System Management for Video surgery Records in a Network Platform , Benedito Fernandes De Lima et al
Brazil	Early stage strategic effectiveness evaluation of high flow nasal therapy (OPTIFLOW®) in the treatment of Acute Pediatric Respiratory Failure , Graziela de Araujo Costa et al
Brazil	Location of electromedical equipment in closed environment using wi-fi technology , William Knob de Souza
Brazil	Remote Equipment Monitoring System , A. Ricardo Maranhão
Brazil	Model fitting and simulation of the respiratory control system under incremental exercise and altitude in healthy subjects , C. A. Sarmiento, A. M. Hernández, L. Y. Serna
Canada	Provincial Respiratory Outreach Program in the Province of British Columbia (BC) , Anthony Chan, Esther Khor
Chile	Clinical Simulations using actors as a patients as part of a strategic plan to reduce risks associated to a "big bang" opening of a new hospital in Santiago , Francisco Acevedo
China	A novel automatic method of renal segmentation in GRF estimation , Xu Lei
Colombia	Modeling and simulation of ciprofloxacin pharmacokinetics: Electric circuits approach , J. D. Otálvaro, A. F. Zuluaga, A. M. Hernández

Focus Area	Title, authors, with active links
Colombia	Autoregressive models of electrocardiographic signal contaminated with motion artifacts: Benchmark for biomedical signal processing studies , F. A. Castaño, A. M. Hernández
Colombia	Parametric modeling of kinetic-kinematic polycentric mechanical knee , A. M. Cárdenas, J. Uribe, A. M. Hernández
Colombia	Motion artifacts recognition in electrocardiographic signals through artificial neural networks and support vector machines for personalized health monitoring , A. Castaño, A. Hernández
Colombia	Learning tool for mechanical ventilation during spontaneous breathing test on patients intoxicated with pesticides , M. B. Salazar Sánchez et al
Colombia	Optimization of spectral analysis of electrophysiological recordings of the subthalamic nucleus in Parkinson's disease: A retrospective study , S. E. Valderrama-Hincapié et al
Colombia	Three dimensional reconstruction and airflow simulation in a realistic model of the human respiratory airways , A. E. Ruiz, J. K. Aristizábal
Colombia	Permanent magnets to enable highly-targeted drug delivery applications: A computational and experimental study , M. Mercado-M et al
Colombia	Brain functional connectivity in Parkinsons disease – EEG resting analysis , J. Carmona, J. Suarez, J. Ochoa
Colombia	Business Opportunities in HT Projects , Mario Castañeda
Croatia	Supporting Diabetic Patients with a Remote Patient Monitoring Systems , S. Zulj et al
Denmark, Norway	Impedance-based monitoring for tissue engineering applications , C. Canali et al
Ethiopia	Producing Oxygen Concentrators for Low Resource Settings , Mekdes Seyoum
Global	Development of an Innovative regulated Affordable Uterine Balloon Tamponade for the Management of Post-partum Hemorrhage , Elizabeth Abu-Haydar, Chris de Villiers
Global	How we drive innovation within medical devices , Kristoffer Gandrup-Marino, UNICEF
Global	A new handheld cordless thermal coagulator , W. Prendiville, S. Rengaswamy, B. Partha, P. Groesbeck, Wallace Dean, Pickett Tim, Riddle Mike, Juan Felix
Global	Safer medication administration for labor/delivery , Beth Kolko; Bradley Younggren
Global	Enabling and scaling early detection of breast cancer in Imics , Mihir Shah, et al
Global	Ultra-low-cost endoscopy for gastroesophageal cancer screening in low-income countries , Pietro Valdastrì, Joseph Norton, Simone Calò, Beatriz Plaza, Andrew Durkin, et al
Global	Unsupervised electronic stethoscope for childhood pneumonia diagnostic , Mohamed-Rida Benissa, J. Solà, F.Hugon,P.Starkov, F.Braun, S.Manzano, C.Verjus, A.Gervaix
Global	Field testing a neonatal phototherapy device: a novel approach , Donna Brezinski, et al
Global	Test for management of preeclampsia , Wendy Davis, et al
Global	Device to save postpartum-hemorrhaging women in advanced shock , M Guha, et al

Focus Area	Title, authors, with active links
Global	Validity of a device for jaundice screening , Anne Cc Lee, et al
Global	CE-IT Innovation: How to Make Health Care Right , Mario Castañeda, Tom Judd
Global	WHO Priority Medical Devices , Adriana Velazquez Berumen; Gabriela Jimenez Moyao, Antonio Migliori & Natalia Rodriguez, Adham Ismael Abdel, Alejandra Velez
Global	Appropriate digital X-ray system with eHealth services , Romain Sahli
Global	Role of biomedical engineer in assessing medical devices , Leandro Pecchia
Global	Challenges in TB Diagnostics , Christopher Gilpin
Global	The Digital Health Atlas for Inventories and Routine Registration of Digital Health Investments , Garrett Mehl
Global	Global Cooperation on Assistive Technology: WHO Priority Assistive Products List , Emma Tebbutt
Global	Essential Resources for (Emergencies and) emergency care , Teri Reynolds & Ian Norton
Global	The role of biomedical engineers , James Goh
Global	Innovative appropriate technologies for low resource settings , Adriana Velazquez
Global	Access to medical devices for Universal Health Coverage and SDGs , Adriana Velazquez
Global	2014: WHO medical device list for Ebola care , Adriana Velazquez
Global	WHO Technical Specifications for Oxygen Concentrators, 2015 , Adriana Velazquez
Global	Quick \$2 test reveals if you caught a superbug in hospital , Hakho Lee, BME MGH, Boston
India	GANDHI: global affordable need driven health innovations , Prashant Jha
India	Hypothermia alert device: saving newborn lives , Ratul Narain; Gini Morgan
India	Novel Technology Policy: Integrating Service Delivery to Industry Promotion , Jitendar Sharma
India	Preventing apneas of prematurity , Ratul Narain; Gini Morgan
India	Remote monitoring for critical infants , Ratul Narain; Gini Morgan
India	MoH "Andhra Med Tech Zone" administering new medical devices manufacturing park , Jitendar Sharma
India	MoH Innovations project , WHO 2GFMD, Jitendar Sharma, 2013

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Italy	<i>Current and Future Trends in the HTA of Medical Devices</i> , Oriana Ciani et al
Italy	<i>HTA of a Large Tablet System in Digital Pathology</i> , Daniele Giansanti et al
Italy	<i>Rapid Clinical Evaluation of Robotic Surgery</i> , Stefano Gidaro & Luca Radice, 2016
Macedonia, Haiti, China	<i>CED Role in Linking Global HT Innovation and Standards: From the Research Lab to the Bedside</i> , Yadin David, Fred Hosea, Tom Judd
Malaysia	<i>Biomechanics of Long Distance Cycling of a Transtibial Amputee</i> , Azman Hamid
Mexico	<i>Semi Active Hand Orthosis</i> , R. Itzel Flores-Luna, Ruben Valenzuela-Montes, David De-Jesus-Cruz, Hanna Garcia-Guerra, Alvaro Ayala Ruiz, Mariano Garcia del Gállego
Peru	<i>Heavy-Metals Point of Care Detection HT to improve care</i> , Herb Voigt, Fred Hosea
Senegal	<i>Oxygen generators type PSA: solution for the supply of oxygen in Senegal</i> , Awa Ndiaye Ep Diouf
Senegal	<i>Innovative Diagnostics for Infectious Diseases</i> , Catharina Boehme
South Africa	<i>Medical device innovation–Local production of medical devices in Africa: characterizing the landscape and assessing feasibility</i> , Mladen Poluta
Tanzania	<i>Maternal Child Health medical devices: potential impact of disruptive technology in rural Tanzania</i> , Mbuyita, Mbaruku, et al,
Uganda, India	<i>Cross Border Learning: Catalyzing Medical Technology Innovation with LMICs</i> , Alexis Steel, Molly Ward
UK	<i>Automating the diagnosis of Childhood Pneumonia, Elina Naydenova, Climent Casals-Pascual</i> , Thanasis Tsanas, Maarten De Vos
UNICEF	<i>Medical Devices for Maternal, Neonatal and Child Care</i> , Paul LaBarre
Uruguay	<i>Clinical Engineering driving new public hospital design & construction</i> , Franco Simini, 2016
WHO	<i>WHO HT Innovations for Low Resource Countries</i> , Adriana Velazquez

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Africa	Medical Devices Situation in the Africa Region , Stanislav Kniazkov
Albania	HTM improves high technology diagnostics access , Ledina Picari
Argentina	HT improving Provincial Access , 2015, German Giles
Australia & Canada	Using Telehealth to improve Diabetes care , E. Sloane, N. Wickramasinghe, S. Goldberg
Brazil	Evaluation of production capacity, the healthcare coverage and the access of computerized tomography imaging in the Brazilian Public Health System , Diana Lima et al
Brazil	Distribution of mammographs by macroregion of Brazil , Ana Claudia Patrocinio
Brazil	The Role of Clinical Engineers for the Management of Healthcare Technologies in a Hospital Network , Eduardo Jorge
China	Survey of Prolonged Mechanical Ventilation in Intensive Care Units in Mainland China , Li J et al
Cuba	A Telemedicine System to follow-up the Evolution of Chronic Diseases in the Community , R.I. Gonzalez-Fernandez et al
Denmark	The mobile laboratory: bringing high-quality testing, to the patient , Susanne Andresen
Global	Market Dynamics: Supporting Country Decision- Making on Medical Devices , Ray Cummings
Global	Equipment Planning, Safety and Maintenance: Planning of Medical Imaging Services in Rural Health Centers , Cari Borrás, Mario Forjaz Secca, Yadin David, (part2)
Global	Surgery: indispensable interventions are not readily available , Walt Johnson
Global	International Atomic Energy Agency: Roadmap to Cancer-Free World , Rajiv R Prasad
Global	The importance of laboratory and pathology for a good diagnosis and treatment, need for recognition and availability , Jagdish Butany
Global	The Rise of Telehealth , Yadin David et al
Global	Linear Accelerators Case Studies , Marcos Martins
India	Prioritisation of medical devices and diagnostics in India , Yogita Kumar, Gupta Madhur, Ameel Mohammed
India	Ministry of Health (MoH) Mobile Medical Units , Jitendar Sharma
India	MoH Free Diagnostics Service Initiative , Jitendar Sharma
India	MoH National Dialysis Program , Jitendar Sharma
India	Telemedicine Reducing Blindness in South India , Niranjana Khambete

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Kenya	<i>Improving Universal Health Coverage Kenya PPP example</i> , Gisela Abbam, Farid Fezoua
Mexico	<i>CENETEC - National inventory of high-tech medical equipment as HTM tool for strategy planning</i> , Roberto Ayala
Mozambique, Tanzania, Malawi, Togo, DR Congo	<i>Global Healthcare Telemedicine</i> , Michelangelo Bartolo
Paraguay	<i>Innovative telediagnosis technology for universal coverage in remote locations without access to specialists</i> , Pedro Galvin
Romania	<i>Telemonitoring Systems and Technologies for Independent Life of Elderly</i> , S. B. Sebesi
Slovakia	<i>Telemedicine and mHealth System for Complex Management in T1DM and T2DM Patients: Results of 6 Months Study</i> , Fedor Lehocki, Tomas Bacigal
Sudan, Egypt, Lebanon, Somalia, Afghanistan and Iraq	<i>Strengthening Health Technologies & Medical Devices Management in EMRO</i> , Adham R Ismail
Syria	<i>Hemodialysis in Syria: a BME Approach</i> , Lana Almohamad
WHO	<i>WHO Cancer Care Initiative 2015-2016</i> , Adriana Velazquez et al

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Benin, Burkina Faso, Burundi, Cameroon, DRC, Ethiopia, the Gambia, Ghana, Ivory Coast, Kenya, Nigeria, South Africa, Tanzania, Uganda, Zambia	THET NGO & South Africa enhancing 15 African HTM societies , Anna Worm & Mladen Poluta
Australia	In-house Endoscopy support, 2016 , Anne-Louise Smith
Bangladesh	Clinical Engineering Approach to Improve Healthcare Technology Management for Enhancing Healthcare Delivery System in Middle Income Countries , A. Hossain et al
Benin	Evaluation of medical devices in Benin , Charles Pascal Soroheye, Adjaratou Seidou Maliki, Marc Myszkowski
Benin	Maintenance management of medical devices in Benin: The case of Papané Hospital , Charles Pascal Soroheye et al
Bhutan	Bhutan Health Technology Management (HTM) and HTA 2015 , Tashi Penjore
Bosnia & Herzegovina	Testing of dialysis machines in healthcare institutions in Bosnia and Herzegovina , Lejla Gurbeta, Berina Alic, Zijad Dzemic, Almir Badnjevic
Botswana	Using HTM to improve care delivery , Bonnie Tlhomelang
Brazil	Impact of clinical engineering in primary healthcare , Priscila Avelar, Renato Garcia, Carlos Alberto Silva
Brazil	Logistics of medical devices for indigenous health care attending in remote sites at Brazilian amazon rain forest , Ryan Ferriera et al
Brazil	GETS System on CE-HTM , Jose Bassani
Brazil	Medical device manuals analysis using heuristic evaluation , J.C. Carneiro et al
Brazil	Proposed Calibration of Apheresis Equipment , A.S. Anderson et al
Brazil	Maternal Fetal Simulator , L.R. Rodrigo et al
Brazil	Evaluation of Sphygmomanometers: comparison between manual and digital measurement , Sousa et al
Brazil	Hospital Maintenance Management , A.S. Forte, J.E.Netto
Brazil	Study involving X-Ray Tube Life span in Computed Tomography Equipment , Petrick Marcellus de Victorio et al
Brazil	HTA Applied to HTM through Clinical Engineering , Santos
Burkina Faso	The problem of acquisition and maintenance of biomedical equipment in Burkina Faso , Zida Ouambi Emmanuel
Chile	Activities of Clinical Engineering in the University of Valparaiso , Guillermo Avendano
Chile	The Chilean Navy Hospitals 15 years of CE , Francisco Acevedo

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China	Preventive Maintenance of Fetal Monitors , LE He-qing
China	The Survey of 3 Departments in Guangdong Province Under New Regulations , Yang Shaozhou
China	Impact of national CE Certification on Health Technology , Zhou Dan
Colombia	CE and impact on financial management of the hospital , Paula Berrio
Colombia	Estimation of the optimal maintenance frequency of medical devices: A Monte Carlo simulation approach , Antonio Miguel Cruz et al
Colombia	Teaching maintenance of medical devices in simulation centers: a pilot study , Daniel Alejandro Quiroga Torres et al
Costa Rica	Clinical Engineering - Health Technology Management (HTM) key areas of challenge and progress in Costa Rica , Gabriela Murillo
Costa Rica	HTM in Costa Rica , G Murillo, M. Ingeana, (part2)
Cuba	Cuba Health Technology Management , Jorge Castro Medina
Dominica	Health Technology Management in Dominica , R. Williams
Ecuador	Development of Biomedical Engineering in the Honorable Junta de Beneficencia of Guayaquil , Freddy Matamoros
El Salvador	Health Technology Management in El Salvador , Juarez S.
Ethiopia	Managing Successful Medical Device Warranty Period Maintenance , Demeru Yeshitla Desta, Tegbar Yigzaw Sendeke, Sharon Kibwana, Mihereteab Teshome Tebeje
Ethiopia	Strengthening Utility and Maintenance of Medical Devices , Demeru Yeshitla Desta, Sharon Kibwana, Firew Ayalew, Ismael Cordero
Ghana	CMBES HTM Donations Study , 2015, Bradley, Yoon, Zahedi, Adusei-poku, Bill Gentles
Global	Medical device ownership models and maintenance contracting approaches , Lisa Smith, Michael Ruffo
Global	The Missing Link: The Role of BMETs Throughout the HTM Lifecycle , Anna Worm, THET; Ismael Cordero, Gradian
Global	Global HTM Update 2011 , Binseng Wang et al
Global	Global HTM Update 2015 , T. Judd, S. Calil, A. Hernandez, B. Gentles
Global	IFMBE CED Development of e-Courses for HTM training 2015-2016 , Ernesto Iadanza
Global	Orbis International Global HTM Training , Ismael Cordero, (part2)
Global	ACCE Global HTM Seminars , 2013 2GFMD, Antonio Hernandez et al
Haiti	Using HTM to improve care delivery , Monette Valliere, Jean Chery, (part2)

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Italy	Launch of the new WHO Collaborating Centre for Research and Training in CE and HTM , Paolo Lago
Italy	A Novel Approach to Improve the Technical Maintenance of Biomedical Equipment , Daniele Bibbo et al
Jamaica	Health Technology Management in Jamaica , 2010, Keith Richards
Kenya	MoH ophthalmic equipment support , Philip Anyango, Mary Nguri & Joseph Rugut
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