Connecting the Dots for Better Health through Informatics

2016 Conference of Asia Pacific Association for Medical Informatics

November 2 (Wed) – 5 (Sat), 2016
The K-Hotel, Seoul, Korea

Sponsored by
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Welcome Message

I am Minister chung chin-youb of the Ministry of Health and Welfare of the Republic of Korea.

I would like to congratulate the successful hosting of 2016 conference of the Asia Pacific Association for Medical Informatics (APAMI).

APAMI initiated this conference in 1994 to together explore a direction to develop medical informatics in Asia Pacific. Ever since, it has taken place every year. I am all the more pleased to have this historic conference in Korea this year. And I extend warm welcome to all of you here today.

The Korean Society of Medical Informatics (KOSMI) is the organizer of this conference. Since 1987, this Society has contributed to produce quality healthcare services by converging tech and intelligence to meet the demands of the information society. And it has enhanced public health standards.

In this regard, my special thanks go to Organizing Chair Kyung-Hee Cho and Ju-Han Kim, President Rong-Min Baek and chairman Jinwook Choi of the KOSMI, and other staff members for putting utmost efforts in organizing this event.

I heard that this conference consists of vibrant discussions and presentations on various themes, including telemedicine, big data, information exchange, standard, and mobile health, under the topic of “Connecting the Dots for Better Health through Informatics”. I expect this conference will be an opportunity to share the future direction of health informatics and mutual growth and cooperation.

Health informatics is a field of science that utilizes data on health maintenance, health care, and patient medical records. This area is gaining more and more importance because the health sector is not immune to the global IT advancement. Population aging is boosting public interest in healthy longevity. Healthcare paradigm is shifting from treatment to prevention.

Under this circumstance, IT health policy tops the list of core national tasks worldwide. Korea is expanding ICT-based medical services such as telemedicine and health information system, and making R&D investment to promote precision medicine using big data, genomic information, and AI.

Korea retains abundant medical big data to be used in disease research and new industry creation. To make the most use of it, Korea is gradually opening national health insurance data to the public.

I hope this conference will serve as a venue for active discussions to bring health informatics to the next level and share open-source health information and technology of the Asia-Pacific countries.

Again, I appreciate all the distinguished participants and APAMI members. Wish you happiness and wellbeing.

Thank you.
Welcome Message

Connecting the Dots for Better Health through Informatics, this conference’s theme, aims to encourage researchers, surgeons, practitioners, young scientists, healthcare workers and suppliers in the world to cooperate and share knowledge and experiences each other about how to use medical technology to improve medical information of the people.

Distinguished guests of the government, business, IT and academic communities will be invited to our conference to present and share their knowledge and experiences. We estimate more than 400 global participants to come to our conference and discussions for the development and application of new technologies in medical and health informatics will be progressed by our prominent speakers.

We will try to provide not only outstanding scientific programs and social events for you and also excellent opportunities to make new relationship with people related to medical and health informatics. As our efforts, we organize a tour program including visiting Korean representative smart hospitals and experience of Korean traditional culture to make your enjoyable and memorable moment during staying in Korea.

We are looking forward to seeing you here.

Dr. Kyung-Hee Cho
Organizing Chair

Dr. Ju-Han Kim
Organizing Chair
## Organizing Committee

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<tr>
<th>Category</th>
<th>Name</th>
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<td>Chair</td>
<td>Kyung-Hee Cho</td>
<td>National Health Insurance Service Ilsan Hospital</td>
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<td>Ju-Han Kim</td>
<td>Seoul National University College of Medicine</td>
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<td>Secretary General</td>
<td>Hasuk Bae</td>
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## Advisory Committee

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## Scientific Program Committee

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<td>CP Wong</td>
<td>Hong Kong Society of Medical Informatics</td>
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<td>Sushil Kumar Meher</td>
<td>India Institute of Medical Sciences, New Delhi</td>
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<tr>
<td>Wu-Chen Su</td>
<td>University of Kentucky</td>
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<td>Vajira H. W. Dissanayake</td>
<td>Health Informatics Society of Sri Lanka (HISSL)</td>
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<tr>
<td>Rakesh Kumar Das</td>
<td>B. P. Koirala Institute of Health Sciences, Dharan, Nepal</td>
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<tr>
<td>Adam Chee</td>
<td>Association for Medical and Bio-Informatics, Singapore (AMBIS)</td>
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<td>Michio Kimura</td>
<td>Hamamatsu University</td>
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<td>Zhi Yang</td>
<td>Capital Medical University, Professor Department of Biomedical Instrumentation School of Biomedical Engineering</td>
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<td>Hun Sung Kim</td>
<td>The Catholic University of Korea, College of Medicine</td>
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<tr>
<td>Dukyong Yoon</td>
<td>Department of Biomedical Informatics, Ajou University School of Medicine, Suwon, Korea</td>
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<td>Sun-Mi Lee</td>
<td>The Catholic University of Korea, College of Nursing</td>
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<td>Chi-Ming Chu</td>
<td>National Defense Medical Center</td>
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<td>Won Chul Cha</td>
<td>Department of Emergency Medicine, Samsung Medical Center</td>
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<td>Shashi Bhushan Gogia</td>
<td>Society for Administration of Telemedicine and Healthcare Informatics (SATHI)</td>
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The Role of Informatics in Digital Health: Integration of individual Genotypes, Phenotypes and Exopotypes

The term ‘digital medicine’ is increasingly being used synonymously with areas such as mobile health, digital health, health IT, or health 2.0. Whilst digital medicine encompasses numerous different concepts, i.e. quantified self, sensors, apps, tele-health, games, electronic health records, interoperability, etc., we are yet to see how Biomedical Informatics is included in this new landscape. If we consider digital medicine to be at the intersection between Biomedical Informatics, Participatory Medicine and Precision Medicine, we can identify new critical roles for our research including self-quantification and the use of social media, as well as new approaches to process, integrate and analyse data originating from the Human Genome, Phenome and Exposome. It could be beneficial to consider a new way of structuring our skills, methods, expertise and educational programs such that biomedical Informatics is placed as the discipline that can deal with all these types of data, as well as with their interplay. Hence, our relevance should clearly be maintained in areas of application like the aforementioned.

A Phone is Worth a Thousand Miles

Many developing countries suffer a scarcity of trained clinicians, who are usually concentrated in urban centres, leaving large rural populations essentially underserved. The adoption of technology could offer new opportunities for patient benefit in term of costs, better care and in turn, better outcomes. Mobile health technology is promising to ameliorate the widening healthcare supply and demand gap through which the reach of consultants can be digitally extended, allowing them to virtually cover larger or remote regions. Smartphone applications have been shown to be a simple, feasible and reliable method for performing store-and-forward teledermatology consultations in rural unpopulated areas. This talk would focus on several m-health applications and their outcomes.

Open Source Strategy for Health Information Technology

The essence of open source software operation is unimpeded collaboration. Successful open source ecosystem consists of software, governance and community. These three components have to work harmoniously to support various business objectives of participants. The largest open source organization in health IT is the Open Source Electronic Health Record Alliance (OSEHRA) established by the US government as an independent non-profit corporation. It is the home the most comprehensive open source EHR, known as VistA which are used more than 2,000 facilities around the world. Recently a major new modern development and testing environment known as enterprise health management platform (eHMP) has been released through OSEHRA o the global community to promote rapid innovation in VistA through collaboration.

Adoption of open source practice is increasing rapidly throughout the software industry. Though open source is relatively new concept in health IT, time has come to look at open source strategy to make health IT readily available to all communities and countries and a way of controlling users’ destiny.

Many computer codes are developed especially in research labs but most of them become useless in long run. Open source strategy offers sustained development and use of the codes beyond research projects. This session will focus on open best practices, useful standards, and business models that can take advantage of open source concept.
Medical Informatics Year in Review

The field of biomedical informatics is advancing drastically, especially in research and practice. In order to highlight the accomplishments of the research work, elicit research trends and identify research patterns of biomedical informatics at a macro level, a 7-person team conducted an extensive review of the literature on clinical and consumer health informatics published from October 2015 to September 2016. Journals reviewed include International Journal of Medical Informatics, Journal of American Medical Informatics Association, Journal of Biomedical Informatics, and Journal of Medical Internet Research. Keywords used in the search include decision support systems, EHR, electronic health records, m-health, consumer informatics, public health informatics, precision medicine, meaningful use, patient reported outcomes, clinical informatics, medical informatics, big data initiative, health information exchange, telemedicine, evaluation of EHR, consumer health informatics, precision medicine, and health informatics. Research topics will be organized under 3 themes: the electronic health records (EHR), consumer health informatics, and the learning health system. Researches will also be grouped under 3 different research methodologies: quantitative, qualitative, and mixed methods.

Key findings include the following: There are significant advances in EHR implementation, however interoperability of EHR data is still an issue to fully realize the benefits of the EHR. Decision support systems are being implemented to improve clinical practice, however evidence of the impact on patient outcomes is still lacking. Mobile applications are being introduced to improve consumer engagement, however evidence of the impact on patient outcomes remains elusive. Big data are receiving increasing attention in healthcare, especially translational aspect, however data access and privacy remain issues. Quantitative methods are being used the most frequently, however we are beginning to see more use of mixed methods in biomedical informatics research.

Realizing Precision Medicine through Translational Bioinformatics

A flood of multi-modal high throughput clinical genomic data and personal health records means that many of the challenges in biomedical research and healthcare are now challenges in integrative and computational sciences for their bidirectional translations. Our ability to ‘connecting the dots’ in the wealth biomedical big data will bring us the ‘big picture’ in a mass of genes, drugs, diseases, and diagnostic, therapeutic and prognostic markers. Precision medicine attempts to determine individual solutions based on the genomic and clinical profiles of each individual, providing opportunity to incorporate individual molecular data into patient care. While a plethora of genomic signatures have successfully demonstrated their predictive power, they are merely statistically-significant differences between dichotomized phenotypes that are in fact severely heterogeneous. Despite many translational barriers, connecting the molecular world to the clinical world and vice versa will undoubtedly benefit human health in the near future.
## Program at a Glance

### November 3 (Thu), 2016

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<td>08:00-</td>
<td>Registration (Geomungo Hall Lobby)</td>
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<td>09:00 - 9:30</td>
<td>Opening Message: Organizing Chair of APAMI 2016</td>
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<td>Congratulatory Remarks: President of APAMI (Shasi Bhushan Gogia)</td>
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<td>President of KOSMI (Rong-Min Baek)</td>
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<td>President of IMIA (Hyeoun-Ae Park)</td>
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<td>[Moderator] Jae Ho Lee, Korea (Geomungo A, B, C Hall)</td>
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<td>09:30 - 10:30</td>
<td><strong>Keynote</strong>: The Role of Informatics in Digital Health: Integration of individual Genotypes, Phenotypes and Expotypes (Fernando Martin-Sanchez, Weill Cornell Medicine, USA)</td>
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<td>[Moderator] Hyeoun-Ae Park, Korea (Geomungo A, B, C Hall)</td>
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<td>10:30 - 10:50</td>
<td>Coffee Break (Geomungo Hall Lobby)</td>
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<td>10:50 - 12:30</td>
<td><strong>Session 1</strong> Telemedicine for Global Health Network</td>
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<td>[Moderator] Suk Wha Kim, Korea (Geomungo A)</td>
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<td>12:30-12:50</td>
<td><strong>Invited Session</strong>: Changing Paradigm of Critical Care ICT: eICU (Sueyoung Yoon, Philips)</td>
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<td>[Moderator] Byung Chul Chang, Korea</td>
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<td>12:50-14:00</td>
<td>Luncheon (Geomungo A, B, C Hall)</td>
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<td>14:00-15:00</td>
<td><strong>Plenary</strong>: Medical Informatics Year in Review</td>
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<td></td>
<td>(Hyeoun-Ae Park, Seoul National University, Korea)</td>
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<td>[Moderator] Shasi Bhushan Gogia, India / Rong-Min Baek, Korea</td>
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<td></td>
<td>(Geomungo A, B, C Hall)</td>
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<td>15:00-16:00</td>
<td><strong>Coffee Break &amp; Poster Presentation</strong> (<strong>Poster session 1</strong>) (Geomungo Hall Lobby / Geomungo C Hall)</td>
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<tr>
<td>16:00-17:30</td>
<td><strong>Session 4</strong> Nursing Informatics</td>
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<td>[Moderator] jeongeun Kim (Geomungo A)</td>
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<td>17:45-18:45</td>
<td><strong>Transfer from The-K Hotel to Korean House</strong></td>
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<td>17:45-18:45</td>
<td><strong>Session 5</strong> Personal Health Record (PHR) and Hospital System</td>
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<td>[Moderator] Adam Chee, Singapore Soo Yong Shin, Korea</td>
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<td>17:45-18:45</td>
<td><strong>Session 6</strong> Clinical Decision Support System</td>
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<td>[Moderator] Rae Woong Park, Korea</td>
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# Program at a Glance

November 4 (Fri), 2016

<table>
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<th>Time</th>
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<tr>
<td>08:00-</td>
<td>Registration (Geomungo Hall Lobby)</td>
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| 09:00-09:50| **Keynote**: A Phone is Worth a Thousand Miles (Yu-Chuan (Jack) Li, Taipei Medical University, Taiwan)  
[Moderator]  
Jin Wook Choi, Korea  
(Geomungo A, B, C Hall) |
| 09:50-10:30| **Keynote**: Open Source Strategy for Health IT (Seong K. Mun, Virginia Tech and OSEHRA, USA)  
[Moderator]  
In Young Choi, Korea  
(Geomungo A, B, C Hall) |
| 10:30-10:50| Coffee Break (Geomungo Hall Lobby)                                       |
| 10:50-12:30| **Session 7** Electronic Health Record (EHR)  
[Moderator]  
Seong K. Mun, USA  
Kap No Lee, Korea  
(Geomungo A) |
| 10:50-12:30| **Session 8** mHealth for Connected Patient Care  
[Moderator]  
Zhi Yang, China  
Hune Cho, Korea  
(Geomungo B) |
| 10:50-12:30| **Government Project 1** IoA3 for Health: Internet of Avatars, Agents, and Apps for Health  
(Language: Korean)  
(Geomungo C) |
| 11:00-12:00| APAMI General Assembly (Geomungo A) (Geomungo B) (Geomungo C) (Haegeum B) |
| 12:30-14:00| Luncheon (Gayageum A, B Hall)                                            |
| 14:00-15:00| Plenary: Translational Bioinformatics for Precision Medicine  
(Ju-Han Kim, Seoul National University College of Medicine, Korea)  
[Moderator]  
Kyung Hee Cho, Korea  
(Geomungo A, B, C Hall) |
| 15:00-16:00| Coffee Break & Poster Presentation (Poster session 2)  
(Geomungo Hall Lobby / Geomungo C Hall) |
| 16:00-17:30| **Session 9** (APAMI Section) Public Health & National Health Strategy  
[Moderator]  
C P Wong, Hong Kong  
Jae Ho Lee, Korea  
(Geomungo A) |
| 16:00-17:30| **Session 10** Mobile Health Application  
[Moderator]  
Rakesh Kumar Das, Nepal  
Kun Ho Yoon, Korea  
(Geomungo B) |
| 16:00-17:30| **Session 11** Artificial Intelligence in Medical Informatics  
[Moderator]  
Naoki Nishimoto, Japan  
Dong Kyun Park, Korea  
(Geomungo C) |
| 17:30-18:00| Best Paper & Poster Award  
APAMI 2018 Promotion (President of APAMI)  
Medinfo 2017 Promotion  
Closing Remarks  
[Moderator]  
In Young Choi, Korea |

**Government Project 2**  
Research Platform as a Public & Government Service using Health BigData  
(Language: Korean)  
(Haegeum B)
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<th>Presenter</th>
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| **Session 1**  
Telemicine for  
Global Health  
Network  
(Geomungo A) | 10:50-12:30 | Moderator: Suk Wha Kim, Korea | |
| | 10:50-11:15 | 1-1 Using eHealth for Addressing Lymphoedema in India | Arun Gekha Gogia, India |
| | 11:15-11:40 | 1-2 Assessing the implementation of the National e-Health Strategic Planning to support telemedicine projects in Indonesia | Sumarsono Surahyo, Indonesia |
| | 11:40-12:05 | 1-3 Informatics beyond boundaries: An experience of technology enabled re-mote support in Natural Disasters (Nepal Earthquake 2015 Relief Portal) | Oommen John, India |
| | 12:05-12:30 | 1-4 Telemedicine setup and consultation process in a remote health post in Eastern Nepal - a cross sectional study | Rakesh Kumar Das, Nepal |
| **Session 2**  
Big Data  
Informatics  
(Geomungo B) | 10:50-12:30 | Moderator: Oommen John, India | |
| | 10:50-11:10 | Invited Session Big Data for Clinical Informatics with Oracle Solution | Jeyaseelan Jayaraj, ORACLE |
| | 11:10-11:30 | 2-1 Data Validation Study for Japanese Sentinel Project | Rieko Izukura, Japan |
| | 11:30-11:50 | 2-2 A Comprehensive Map of Polygenic Susceptibility Associations Among Diseases and Traits Based on Large-scale Individual Genotype Data | Jung Hun Ohn, Korea |
| | 12:10-12:30 | 2-4 Development a minimum data set of the information management system for thalassemia | Leila keikha, Iran |
| **Session 3**  
Health Data  
Exchange  
(Geomungo C) | 10:50-12:30 | Moderator: Michio Kimura, Japan  
Il Kon Kim, Korea | |
<p>| | 10:50-11:10 | Invited Session Experience of Korean Hospitals in Health Information Exchange based on Standards | Jeung-Whun Kim, Korea |
| | 11:10-11:30 | 3-1 Implementation of standards-based, vendor neutral archive-driven API platform and client | Jung Bin Kim, Korea |
| | 11:30-11:50 | 3-2 Unlocking Interoperability Puzzle with the Global Language of Health - SNOMED CT | Michael Bainbridge, Australia |
| | 11:50-12:10 | 3-3 Pilot study for a mapping from HL7/SS-MIX2 to CDISC SDTM | Naoki Nishimoto, Japan |
| | 12:10-12:30 | 3-4 Data Quality Management for Clinical Contents Model | Yookyung Boo, Korea |</p>
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<th>Abstract Title</th>
<th>Presenter</th>
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| **Session 4**  
Nursing Informatics  
(Geomungo A) | 16:00-17:30       | Moderator: jeongeun Kim                                                       |                                                |
|          | 16:00-16:30       | 4-1 Develop and validate an empowerment tool for pregnant women                | Rita Rezaee, Iran                              |
|          | 16:30-17:00       | 4-2 The development and acceptability evaluation of the virtual simulated hospital training program for nursing students | Ying Wu, China                                 |
|          | 17:00-17:30       | 4-3 The Need Assessment of Long-Term Care Information in Taiwan                | Abdulla Ahmed Elbakkoush, Taiwan              |
| **Session 5**  
Personal Health Record (PHR) and Hospital System  
(Geomungo B) | 16:00-17:30       | Moderator: Adam Chee, Singapore Soo Yong Shin, Korea                           |                                                |
|          | 16:00-16:18       | Invited Session: PHR in NHIMC                                                   | Hee-Jin Kang, NHIS Korea                       |
|          | 16:18-16:36       | 5-1 Development of Personal Health Records Architecture for Community Oriented Holistic Care to be in Line with International Standards | Heng-Shuen Chen, Taiwan                        |
|          | 16:36-16:54       | 5-2 Development of a Mobile Application in Conjunction with a Web Service for Personal Health Records regarding Atopic Dermatitis | Bo-Hyeong Jang, Korea                          |
|          | 16:54-17:12       | 5-3 Dynamic relationship between emotion and physical states: an observational study through personal health record | Ye Seul Lee, Korea                             |
|          | 17:12-17:30       | 5-4 From EHR to PHR: a Literature Review                                        | Ching Chu Liao, Taiwan                         |
| **Session 6**  
Clinical Decision Support System  
(Geomungo C) | 16:00-17:30       | Moderator: Rae Woong Park, Korea                                               |                                                |
<p>|          | 16:00-16:18       | 6-1 Classification of clinical prediction rules by design and usage            | Georgie Kennedy, Australia                     |
|          | 16:18-16:36       | 6-2 Association of lipid profile &amp; HbA1c among T2DM patients: A cross-sectional study in Bangladesh | Md.Mohaimenul Islam, Taiwan                   |
|          | 16:36-16:54       | 6-3 The potential use of computer-assisted image processing for detecting Acute Lymphoblastic Leukemia | Lutfan Lazuardi, Indonesia                     |
|          | 16:54-17:12       | 6-4 EMRs- Towards a better User Interphase (UI)                                 | Shashi Bhushan Gogia, India                   |
|          | 17:12-17:30       | 6-5 Impact of a QQ-based Virtual Health Paradise on reducing cardiovascular disease risk factors among healthy Chinese adults | Ying Wu, China                                 |</p>
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<td><strong>Session 7</strong></td>
<td>10:50-12:30</td>
<td><strong>Moderator:</strong> Seong K. Mun, USA                                            Kap No Lee, Korea</td>
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<tr>
<td><strong>Electronic Health Record (EHR)</strong></td>
<td>10:50-11:10</td>
<td>Invited Session                                                                  Strategies for the Standardization of Electronic Medical Record (EMR) Systems in Korea</td>
<td>Youngtaek Park, HIRA Korea</td>
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<td>11:10-11:30</td>
<td>7-1                                                                                 The Overview of Free/Libre and Open Source Software in Medical Domain, from Asia and the World</td>
<td>Shinji Kobayashi, Japan</td>
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<td>11:30-11:50</td>
<td>7-2                                                                                 Strengthen cancer surveillance in Sri Lanka by implementing Cancer Registry Informatics to Enhance Cancer Registry Data Accuracy, Completeness, and Timeliness</td>
<td>Kamal Wasantha Kumara Seneviratne, SriLanka</td>
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<td>11:50-12:10</td>
<td>7-3                                                                                 Determining Morbidity Pattern First Step Deal with Big Data via Electronic Health Record of Primary Healthcare in Indonesia</td>
<td>Dina Nur Anggraini Ningrum, Taiwan</td>
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<td></td>
<td>12:10-12:30</td>
<td>7-4                                                                                 An Viewing System for Health Check-up Result Report using FHIR, CDA IG, and MHD</td>
<td>Mingyu Kim, Korea</td>
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<td><strong>Session 8</strong></td>
<td>10:50-12:30</td>
<td><strong>Moderator:</strong> Zhi Yang, China                                                      Hune Cho, Korea</td>
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<td><strong>mHealth for Connected Patient Care</strong></td>
<td>10:50-11:15</td>
<td>Invited Session                                                                  Digital Healthcare Transformation with Mobility and IoT</td>
<td>Hwa Hyeon Yu, HP Korea</td>
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<td>11:10-11:30</td>
<td>8-1                                                                                 Improving Patients’ Medication Adherence and Lipid Level by Customized Short Message: a Six-Month Clinical Trial</td>
<td>Yisi Liu, China</td>
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<td>11:30-11:50</td>
<td>8-2                                                                                 Impact on Effectiveness of Chronic Disease Management in a Rural Hospital of middle Taiwan by a Case Management Information System</td>
<td>Mei-Chih Chen, Taiwan</td>
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<td>11:50-12:10</td>
<td>8-3                                                                                 Remote Monitoring in Home Peritoneal Dialysis: Seamless User-centered Proactive Provision of Risk-stratified Treatment in Peritoneal Dialysis (SUPPORT-PD)</td>
<td>Oommen John, India</td>
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<td>12:10-12:30</td>
<td>8-4                                                                                 Disruptive Innovation in mHealth: A case of Nutrition Monitoring from a LMIC</td>
<td>Pamod Madusanka Amarakoon, SriLanka</td>
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<td>Session 9 (APAMI Section)</td>
<td>16:00-17:30</td>
<td>Moderator: C P Wong, Hong Kong&lt;br&gt;Jae Ho Lee, Korea</td>
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<td>16:00-16:18</td>
<td>History of Health IT in Japan&lt;br&gt;- Invitation to IMIA's 50th anniversary -</td>
<td>Michio Kimura, Japan</td>
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<td>16:18-16:36</td>
<td>Climate &amp; Health Innovation for Subsustainable Smart Cities</td>
<td>Adam Chee, Singapore</td>
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<td>16:36-16:54</td>
<td>The development and implementation of Stroke risk prediction model in National Health Insurance's Personal Health record</td>
<td>Jae-Woo Lee, Korea</td>
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<td></td>
<td>16:54-17:12</td>
<td>Dialysis Outcomes in India: An online clinical outcomes registry for dialysis outcomes, lessons learned and opportunities for scale up</td>
<td>Oommen John, India</td>
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<td></td>
<td>17:12-17:30</td>
<td>State of Management Information System(MIS) in Tertiary Care Hospitals in Pakistan</td>
<td>Suleman Atique, Taiwan</td>
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<td>Session 10 Mobile Health Application</td>
<td>16:00-17:30</td>
<td>Moderator: Rakesh Kumar Das, Nepal&lt;br&gt;Kun Ho Yoon, Korea</td>
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<td>16:00-16:20</td>
<td>Experience and Preference Factor Analysis for pediatric obesity management mobile app.</td>
<td>Jisan Lee, Korea</td>
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<td>16:20-16:40</td>
<td>Efficacy of Health Management in Rural Area affecting by a Personal Health Records System with Classification Algorithms</td>
<td>Hung-Pin Hou, Taiwan</td>
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<td>16:40-17:00</td>
<td>Analysis of a mobile electronic medical record usage pattern: User interaction and evolution</td>
<td>Yura Lee, Korea</td>
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<td>17:00-17:20</td>
<td>Utility of mobile apps in smoking cessation: A literature review</td>
<td>Shwetambara Vinayak Kekade, Taiwan</td>
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<td>Session 11 Artificial Intelligence in Medical Informatics</td>
<td>16:00-17:30</td>
<td>Moderator: Naoki Nishimoto, Japan&lt;br&gt;Dong Kyun Park, Korea</td>
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<td>16:00-16:20</td>
<td>Evaluating the effectiveness of distributional hypothesis and name entity chunk tagging schemes: a case of HMM for clinical named entity extraction</td>
<td>Wangjin Yi, Korea</td>
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<td>16:20-16:40</td>
<td>Coordinated Markov Modeling of Cancer Metastasis from Multiple Primary Sites</td>
<td>Hyunggu Jung, USA</td>
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<td>16:40-17:00</td>
<td>Structuralization of Variance Text Records in Clinical Pathway</td>
<td>Takanori Yamashita, Japan</td>
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<td>17:00-17:20</td>
<td>Identify factors affecting successful ageing in elderly diabetics in shiraz using data mining approach</td>
<td>Azam Aslani, Iran</td>
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<td>Government Project</td>
<td>10:50-12:30</td>
<td>IoA3 for Health: Internet of Avatars, Agents, and Apps for Health</td>
<td>Ju Han Kim, Korea</td>
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<td>Government Project</td>
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<td>Moderator: Young Sung Lee</td>
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<td>(Haegeum B)</td>
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<td>Gov-1 The biosignal database construction for deep learning based disease prediction</td>
<td>Dukyong Yoon, Korea</td>
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<td>Gov-2 Modeling of prognosis prediction and management system for stroke using big data</td>
<td>Tea Jung Kim, Korea</td>
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<td>Gov-3 Development of Individualized Preventive Management Service Model through Implementation of Disease Risk Atlas and Risk Prediction of Korean Common Chronic Diseases</td>
<td>Suekyung Park, Korea</td>
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<td>Gov-5 LOD typed global healthcare big data platform development</td>
<td>Wan-Sup Cho, Korea</td>
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<td>Gov-6 Basic research on link application of healthcare big data</td>
<td>Myung Jin Jeong, Korea</td>
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<td>Gov-7 Discussion</td>
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<td>1</td>
<td>Online Medical Appointment System</td>
<td>Winnie Hoi Wing Leung, Australia</td>
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<td>2</td>
<td>Comparison of tele-rehabilitation vs face-to-face vs usual care based on community for low income elderly women in Korea</td>
<td>Jeongeun Kim, Korea</td>
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<td>Hyoid Bone Tracking using Tracking-Learning-Detection in Videofluoroscopy Swallowing Study</td>
<td>Dong Heon Lee, Korea</td>
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<td>Characterizing hidden rules linking symptoms and acupoint selection using an artificial neural network model</td>
<td>Wonmo Jung, Korea</td>
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<td>Deep Belief Network based Classification Prediction Model of Pathology Stage in Patients with Prostate Cancer</td>
<td>In Young Choi, Korea</td>
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<td>Developing novel algorithms of approximate entity extraction for laboratory test names in clinical documents based on q-gram</td>
<td>Kyung mo Kim, Korea</td>
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<td>Development of new extravasation alert system by optical hemoglobin sensor in drip infusion therapy</td>
<td>Hiroyuki Nozaka, Japan</td>
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<td>Improving of Medical Supply Purchasing Process by Using Barcode Technology in Thai University Hospital</td>
<td>Laddawan Riponchai, Thailand</td>
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<td>AURORA: Analytic code managing and distributing Unit bridging Research Organizations and Associated users</td>
<td>Junghyun Byun, Korea</td>
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<td>Exploring the possibility of identifying adverse-drug-events from nursing records</td>
<td>Eunjoo Jeon, Korea</td>
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<td>A method of compressing whole slide images (WSI) with multi-focus plane using blur estimation</td>
<td>Manwon Hwang, Korea</td>
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<td>Suggestion of a Phased Classification Method of Requirements for a Registry by the types of Cancer and the Definitions of Items using Electronic Medical Records</td>
<td>Yeong Mi Jang, Korea</td>
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<td>Development of Patient Portal for Exchange Personal Health Record</td>
<td>Ji hae Kwon, Korea</td>
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<td>FHIR for IHE LAW Profile</td>
<td>Sunghwa Lee, Korea</td>
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<td>15</td>
<td>Design of middleware solution for the vendor neutral archive system</td>
<td>Min Soo Park, Korea</td>
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<td>16</td>
<td>Design and Implementation of SMART guide system based on integrated data modeling</td>
<td>Young Hee Lim, Korea</td>
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<td>17</td>
<td>Design and Development of a Medical Information Support System</td>
<td>Peixiang Yang, China</td>
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## Poster Session

**November 4 (Fri), 2016**

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<td>Exploring factors affecting the time to fall from admission using EHR data</td>
<td>Hyesil Jung, Korea</td>
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<td>The development of eHR domain content in HKSAR</td>
<td>Hung Hung TSUI, Hong Kong</td>
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<td>A Fast Microbial Detection Algorithm based on High-Throughput Sequencing Data</td>
<td>Dongsheng Zhao (Xiaolei Wang), China</td>
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<td>Patient Engagement Function Usage Trends in a Hospital-tethered Mobile Personal Health Records</td>
<td>Jae-Ho Lee, Korea</td>
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<td>User requirement analysis for hyperlipidemia management application</td>
<td>Joo Yun Lee, Korea</td>
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<td>6</td>
<td>Identification of Strategies to Promote Positive Mental Health among the Adolescents using a Mobile App</td>
<td>Ji-Hyun Lee, Korea</td>
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<td>7</td>
<td>A Design of Smartphone App for Children’s Weight Control with Their Parents</td>
<td>Ah Jung Byun, Korea</td>
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<td>Prescribing Error Reducing After the Implementation of Computerized Physician Order Entry (CPOE) in Thai University Hospital</td>
<td>Ratchadaporn Soontornpas, Thailand</td>
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<td>Computerized Physician Order Entry(CPOE) Improved Financial Outcome in Thai University Hospital</td>
<td>Cholatip Pongskul, Thailand</td>
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<td>An Investigation Report of Citizen’s attitudes toward the handling of Electronical Medical and Medicine Information.</td>
<td>Mayumi Yoshida, Japan</td>
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<td>A Research Study on the Design of Secure HIS that Based on International Standards for General Hospitals: with a focus on ISO 17090, ISO 22600 and ISO 27799</td>
<td>Yong-En Lee, Korea</td>
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<td>12</td>
<td>Non-smoking Webtoon opinion mining, a non-smoking awareness through the Analysis of posting comments</td>
<td>In Young Choi, Korea</td>
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<td>13</td>
<td>Childhood Vaccination Ontology for Social Data Analysis</td>
<td>Jeongah On, Korea</td>
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<td>Development of Medical Informatics Principles for Data Repository in Different Healthcare IT Platforms in Singapore</td>
<td>Swee Jin Mok, Singapore</td>
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<td>15</td>
<td>The mediating effect of depression on sleep disorder and fatigue among reproductive aged women with Psoriasis</td>
<td>Hee Jung Jang, Korea</td>
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<td>Reliability and Validity of the Persian Version of the Decisional Conflict Scale in Selecting Mode of Child Delivery</td>
<td>Azam Aslani, Iran</td>
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<td>Using Simulation to assess user needs for the Point of Care (POC) Robot development</td>
<td>Hyeong-Suk Lee, Korea</td>
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Social Program

I  Smart Hospital Tour
  - Date & Time: Nov. 2 (Wed), 2016, PM 3:30-5:30
  - Venue: Seoul National University Bundang Hospital [Link]
  82, Gumi-ro 173, Bundang-gu, Seongnam, Gyeongi-do, Korea

I  Welcome Party
  - Date & Time: Nov. 2 (Wed), 2016, PM 6:30-8:30
  - Venue: Slow Village Brewery and Pub in Yangjae [Link]
  67-2, Yangjae-dong, Seocho-gu, Seoul

I  Gala Dinner
  - Date & Time: Nov. 3 (Thu), 2016, PM 6:30-9:30
  - Venue: Korea House [Link]
  10 Toegye-ro 36-gil, Jung-gu, Seoul

I  Samsung d'light Tour & Seoul City Tour
  - Date & Time: Nov. 5 (Sat), 2016, AM 10:00-12:00
  - Venue: Samsung d'light [Link]
  11, Seocho-daero 74-gil, Seocho-gu, Seoul
Floor Plan

- Conference Room: Geomungo A, B, C Hall, Haegeum B Hall
- Luncheon: (11/3) Geomungo A, B, C Hall
  (11/4) Gayageum A, B Hall
- VIP & Speaker Room: Cello (3F)
- Secretary: Violin (3F)
Exhibition

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<td>HP</td>
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<td>CHUNGBUK NATIONAL UNIVERSITY</td>
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Venue Information - Location

The-K Hotel Seoul: 70, Baumoe-ro 12-gil, Seocho-gu, Seoul / TEL : 82-2-571-8100

Subway

No. 9 Exit at Yangjae Station of Line 3
(Take the shuttle bus in front of Seocho-gu Community Center)
No. 5 Exit at Yangjae Citizen’s Forest Station of Sinbundang Line
(Take the shuttle bus & 5 minutes on foot)
* Line 2 Gangnam, Yangjae Station Sinbundang Line 3 Transit

Bus

General blue bus 405A, 405B, 408, 421, 140, 470, 441
No. 10 Exit at Yangjae Station of Line 3
Get off the bus at AT Center, Yangjae Flower Market (10 minutes on foot)
Take the Town bus (NO. 08) at Yangjae Station No. 11 Exit

Trails

Yangjae Citizens’ Forest 0.5km (5 minutes)
Yangjaecheon 0.5 km (5 minutes)
Seocho Culture & Art Park 0.2km (3 minutes)
Session 1: Telemedicine for Global Health Network

- **Session 1-1** Using eHealth for Addressing Lymphoedema in India
  - Arun Rekha Gogia

- **Session 1-2** Assessing the implementation of the National e-Health Strategic Planning to support telemedicine projects in Indonesia
  - Sumarsono Surahyo, Lutfan Lazuardi

- **Session 1-3** Informatics beyond boundaries: An experience of technology enabled remote support in Natural Disasters (Nepal Earthquake 2015 Relief Portal)
  - Oommen John, Senthil K. Nachimuthu, Klaus D Veil, S B Gogia, Vivekanand Jha

- **Session 1-4** Telemedicine setup and consultation process in a remote health post in Eastern Nepal - a cross sectional study
  - Das RK, Bhattarai A, Gupta PP, Bhatta N
Using eHealth for Addressing Lymphoedema in India

Arun Rekha Gogia
Chairperson, LE&RN India Chapter
Lymphoedema Consultant and SATHI Member

ABSTRACT

Introduction and Background
Lymphoedema affects almost 20 million people in India. Many are ascribed to Filariasis. But despite adequate control of filariasis due to MDA, lymphoedema, incidence has remained the same even while other causes like venous disease, cancer and trauma are causing a rise in number of cases. Without adequate treatment, lymphoedema can have long-term adverse social, economic and psychological effects, including disability, difficulties with work and emotional problems.

Lymphoedema is now recognized to be a chronic disease, no different from Diabetes and Hypertension. So care has to now go beyond hospital based care. Early diagnosis and care for example at onset, immediately after surgery or trauma prevents serious problems. But at no stage should the patient be considered as too late for improvement. Unlike Diabetes, however, knowledge of how to care is missing not only among patients but also care givers of all kinds including health professionals of all levels. IT has a role in Knowledge dissemination, training as well as monitoring of this chronic problem.

There is a dire need to spread awareness that lymphoedema is both treatable as well as manageable. This has to be done on a mass scale so that care can be delivered to a large number of patients quickly.

SATHI – short for Society for Administration of Telemedicine and Healthcare Informatics has been propagating use of Telemedicine to promote healthcare in remote areas. It recently partnered with Lymphatic Education and research Network, a US based organization to promote research and care for Lymphoedema. This work covers aspects of long term community based group and home care. This program is aimed at patients, village-level NGOs and health workers with tele-monitoring and tele-training after creating the required motivation physically through advocacy and orientation of the need for such a care program.

Background
With an estimated 16.7 Million Patients worldwide, Lymphoedema due to Filariasis is a major health problem. Of late, thanks to the WHO’s motivated Program for Elimination of Lymphatic Filariasis (PELF), the incidence of Filariasis has gone down in many parts of India. However, the incidence of Lymphoedema is not decreasing and is not expected to do so at least for the next 10-15 years as that is related to infection occurring in early childhood. In addition, many new diseases as well as their treatment, like cancer, trauma, venous disease, recurrent infections are resulting in fresh cases. The total patient load is estimated at 20 million in India roughly 1-2% of the population.

Methods
For addressing the public health problem of lymphoedema. The major concerns are:

a. Poor availability and accessibility to required services
b. Poor uptake fo single day mass therapy of DEC/Albendazole in some areas.
c. Lack of awareness
d. Inadequate capacity for clinical management
e. Inadequate facilities for care
f. Telemedicine is used to improve access to health services for management of lymphoedema. Alongside the same infrastructure is used for building capacity and skills of bandaging, taking measurements etc. Online monitoring is done as well as discussions on problem cases with relevant experts.
g. The same centres also provide care for related common limb problems like, varicose veins, Varicose ulcer and diabetic foot
Results:
A Centre for Capacity Building for appropriate and technically sound management of lymphedema is being created. Through this centre training program will be carried out for service providers, managers of the program, application of ICT for management of lymphoedema etc. It also co-ordinates research on the most suitable treatment protocols
a. A centre at AIIMS is already working and doing various trials for materials like bandages garments and pumps in Lymphoedema care.
b. Best use case scenarios can be extrapolated for community and rural settings where materials can be provided but training on how to use is required.
c. Remote area use was piloted in a recent camp in Sitapur District of UP. There were long term physical gains with tele-monitoring.
d. The same tele system is now being modified for Online training and further dissemination to patients as well as training of trainers (TOT)
e. A common Database allows sharing and transfer of patient data.

Conclusions:
While this is the starting phase of a long term program, we do see hope in long term management of this chronic problem on a mass scale. IT has a key role in program implementation

Keywords: Tele-health, Lymphoedema, Tele-monitoring, Volume measurement
Assessing the implementation of the National e-Health Strategic Planning to support telemedicine projects in Indonesia

Sumarsono Surahyo, Lutfan Lazuardi
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ABSTRACT

e-Health and the urgency to integrate information and communication technologies (ICT) in national Health Information Systems and health infrastructure is growing, and in fact is one of the aim of Indonesia National e-Health Strategic Planning. Based on current situation in Indonesia, e-Health ecosystem is very complex and still partial. Most of the e-Health implementations are fragmented and not standardized which caused difficulties to system interoperability, consolidation of data (multi-format and standard), and limited network access to public health information. The aim of this research is to assess the implementation of the National e-Health Strategic Planning in supporting healthcare improvement projects in Indonesia. In particular, the research focuses on the telemedicine projects that have been piloted in a number of regions in Indonesia. Through this project, the implementation of the National e-Health Strategic Planning will be evaluated. Factors contributing the success or failure of telemedicine projects will also be investigated.

- Objectives
Objectives of this research are to identify how the National e-Health Strategic Planning affected the telemedicine pilot projects. This study uses the Information Systems Research (ISR) framework to guide our understanding of the environmental context, which includes people, organization, and technology.

- Results
Problems discovered in the telemedicine pilot projects were low-technology digital devices (scanner) which caused high pixel lost and low quality images, small capacity bandwidth of VPN, and consultation fee had not been dealt. Meanwhile, there were also some positive outputs such as centralized server in the MoH which gave low cost acquisition and maintenance, easy to monitor and easier network re-routing when there is a change in referral system. Improvement planning has been done by doing assessment to map infrastructure condition in rural areas, IT human resources, commitment from hospitals and local governments, survey before installation, and network fulfilment based on regionalization of referral system.

- Conclusion
The assessment within the field of telemedicine shows that the program is in its infancy and while its promise is great, the improvement of the program ensure maximization of benefit. More information on the infrastructure requirements needs to be studied to develop telemedicine solutions. Overall, Indonesia faces some issues such as underdeveloped infrastructure, high costs implementation and maintenance, and lack of technical expertise and motivation from the users. Meanwhile, legal issues surrounding patient privacy and confidentiality, and health financial system to enable the sustainability of the program are the next considerations. Lastly, Indonesia has a national agency for the promotion and development of telemedicine. However, scientific institutions should be more involved with the development of telemedicine solutions.

Keywords: National e-Health, Telemedicine, assessment
Informatics beyond boundaries: An experience of technology enabled remote support in Natural Disasters (Nepal Earthquake 2015 Relief Portal)

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Keywords: Natural Disasters, Disaster Relief, Humanitarian relief, Web-based communication and coordination systems, Open Source, APAMI

\textbf{ABSTRACT}

\textbf{Background}
In April 2015, a massive earthquake struck Nepal leaving over 8,000 people dead and more than 21,000 injured. The major disruption to the healthcare infrastructure in the landlocked mountainous country added significant stress to the fault lines of an already fragile healthcare delivery system. Informatics professionals from across the globe quickly formed a relief team which was coordinated by the leadership and members of the Asia-Pacific Association for Medical Informatics (APAMI) to create a communication and relief coordination virtual platform to support the health professionals in Nepal at this time of humanitarian crisis.

\textbf{Objective}
Testing an online platform for disaster support

\textbf{Methods}
A web-based electronic communication and project monitoring tool was deployed using the Sahana platform. The APAMI team set up a dedicated website and twitter handles with an aim to create awareness and garner support for the relief work in Nepal. An online portal in collaboration with the American Nepal Health Association was established. This served as a tool for the Nepali doctors and healthcare facilities to share information on the materials, medications and other logistic supplies as well as when and where exactly they were required. Based on this detailed information volunteers from the Informatics communities then leveraged their affiliations and partnerships to identify donors and coordinate the delivery to Nepal through appropriate channels. One of the specific needs expressed was for clinical inputs and guidelines on management of medical emergencies as many specialists were called to attend to mass causalities. Through the Relief for Nepal website and twitter accounts, the authors distributed stepwise evidence based guidelines on management of crush victims and also as to how to prevent and manage acute kidney injury based on the field guide produced by the International Society of Nephrology Renal Disaster Relief Task Force. This was disseminated through the communication channels established by APAMI as well as the International Society of Nephrology.

\textbf{Results}
We describe in this presentation a multi-national coordinated approach trialed by members of APAMI. We also outline the lessons learned that could inform key stakeholders on creating virtual communities for disaster relief and humanitarian action across borders.

\textbf{Conclusion}
From the 2015 Nepal earthquake relief support activities we have learned that an informatics community utilizing a real-time information system can quickly create a support and coordination infrastructure for health professionals working in a disaster-affected country. The communication tools established were found to be very useful in disseminating knowledge that helped understand the needs for relief in real-time enabling earlier commencement of life-saving activities. We propose setting up a task force under APAMI for ‘Health Informatics Beyond Borders’ which could further develop effective strategies for use of health information technology in natural disaster relief and supporting health-professionals at the point of need.
Telemedicine setup and consultation process in a remote health post in Eastern Nepal - a cross sectional study

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ABSTRACT

Background
In a country like Nepal where more than half of populations are in rural areas where the nearest hospital is situated more than 4 hrs of distance. The people faces lots of difficulties due to various factors like provision of timely advice on the health status, little knowledge or information regarding the health access. The current hyperbole surrounding telehealth suggests that it is a revolution in the delivery of health care. The term telehealth as well as the specific boundaries for possible applications is difficult to define, as the technological tools and systems are consistently changing. Telehealth enables continued education, allowing such educated health professionals, despite location and distance, to contribute to a better interdisciplinary and overall expansion of Health care facility. According to Reid, telehealth means the use of advanced telecommunication technologies to exchange health information and provide health care services across geographic, time, social, and cultural barriers.

Methods
It is a cross-sectional study done in one of the Primary health care centre where we installed and run Telemedicine program from B.PKoirala Institute of Health Sciences. The data was collected from the records of patient enrolled during the tele consultation process and all statistical tests have significance level of p<0.05. Statistical analysis was performed by using SPSS version 11.0 and confidence interval analysis for windows.

Results
Total 154 patient were enrolled in the study during 8 months of the study begins. There we faced very difficulties to set up Telemedicine equipments which include Internet limitations, knowledge of target population and cost of set up. The referral rate was decreased by 42% after starting the tele consultation process. About 72 % people satisfied with this technique as this saves their time, money, and at the same time they get consultation by specialist directly.

Conclusion
Telehealth is a relatively recent and complex technology, which explains why it has not been used to its full potential, especially in the providing health care, where it is extremely promising. We are now at the point where possibilities are clearly seen. Telehealth can be a tool of prime importance to rural health care deliveries in Nepal. Though, telehealth is not a magical solution to all the difficulties about information on health care, but it is a powerful tool capable of transforming the way with which information is dealt with. It can reduce the number of referrals and emergency visits of poor people to the hospitals.

Keywords: telemedicine, teleconsultation, rural health
Session 2: Big Data Informatics

- **Session 2-1**  Data Validation Study for Japanese Sentinel Project  
  - Rieko Izukura, Takanori Yamashita, Chinatsu Nojiri, Yasunobu Nohara, Naoki Nakashima

- **Session 2-2**  A Comprehensive Map of Polygenic Susceptibility Associations Among Diseases and Traits Based on Large-scale Individual Genotype Data  
  - Jung Hun Ohn

- **Session 2-3**  FCM-EM: Discovering DNA Motifs by Machine Learning Technique  
  - Ali Yousefian, Jinwook Choi

- **Session 2-4**  Development a minimum data set of the information management system for thalassemia  
  - Reza Safdari, Marjan Ghazi Saeedi, Seiede Sedigheh Seied Farajollah, Tayebeh noori, Leila keikha
Data Validation Study for Japanese Sentinel Project

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ABSTRACT

- **Objectives**
  Referring to the successful aspect of the Sentinel Initiative in United States, Medical Information Database Network (MID-NET) project (called as “Japanese Sentinel Project”) was launched by Japan Ministry of Health, Labour and Welfare, and Pharmaceuticals and Medical Devices Agency (PMDA) in 2011. This project has been aiming to establish new databases (MID-NET) at 10 selected medical institutions and to develop a new analysis system, which integrates electronic medical data from these databases through the ICT network and analyzes quantitatively to identify the adverse effects of marketed drugs, to PMDA, in addition to conventional spontaneous reporting system. Kyushu University hospital, one of 10 medical institutions, has conducted data validation study with PMDA so far, to prepare the full operation in 2018. In this paper, we examined the scripts to extract one of the actual drug-induced adverse events from MID-NET and showed how to assess data quality.

- **Methods**
  We focused on relative hyperglycemia after the prescription (Rp.) of Antipsychotic drugs (ADs). The data collection period was six months and four data entities (Diagnosis, Prescription, laboratory test, and Medical reimbursement information) were used to describe the scripts on MID-NET. Subjects, who were already diabetic before ADs Rp, were previously excluded by using the diagnosis of diabetes mellitus (DM), the prescription of anti-diabetic drugs, and DM-related nutritional education program (Script 0: n=2129). Then Script 0 was each combined with 3 keys of hyperglycemia: DM diagnosis (Diagnosis: Script1), anti-diabetic drugs Rp. (Prescription: Script2) or high blood glucose (HBG) (Results of laboratory test: Script3). HBG, a criterion to detect the relative hyperglycemia, was defined as “<140 mg/dL before and >199 mg/dL after ADs Rp.” by DM specialist. The data from single or combined scripts were counted and calculated coincidence rates.

- **Results**
  The smallest number of patients was by Results of laboratory test at Script 3 (n=32, 1.5%). However we found 1086 patients (51%) out of 2129 patients did not receive BG test after ADs Rp. and some of them probably have hidden hyperglycemia. Both combination of Script 1 & Script 3 and Script 2 & Script 3 were low coincidence rate (0.2%, 0.5%, respectively), which would be reflected that HBG were not necessarily after diagnosed DM or/and prescribed DM drugs.

- **Conclusions**
  Since a script used Results of laboratory test alone is difficult to identify hyperglycemia as an adverse effect of ADs Rp. The combination of scripts, which connects scripts with “OR”, but not with “AND”, is able to identify more hyperglycemic subjects (5.2%), would be desirable to improve a level of sensitivity. Additionally, it was indicated that MID-NET will make it possible to detect such an adverse event with less laboratory test or with less data collection.

<table>
<thead>
<tr>
<th>Table1</th>
<th>The coincidence ratio of MID-NET data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Script 0</td>
</tr>
<tr>
<td>Script 0</td>
<td>2129</td>
</tr>
<tr>
<td>Script 1 DM diagnosis+</td>
<td>50 (2.3)</td>
</tr>
<tr>
<td>Script 2 DM drug Rp.+</td>
<td>66 (3.1)</td>
</tr>
<tr>
<td>Script 3 HBG+</td>
<td>32 (1.5)</td>
</tr>
</tbody>
</table>

Keywords: MID-NET, adverse effects, big data, drug exposure
ABSTRACT

- **Objective**
The aim is to explore the landscape of diseases or traits with respect to genetic risk correlations to find clinically relevant associations.

- **Methods**
Based on 2,504 individual genotype data and database of genetic variants linked with human diseases or traits, genetic risk scores (GRS) of diseases or traits are calculated for each individual. Association between traits and diseases is statistically evaluated by pairwise correlation analysis of GRS. The significant associations are compared to disease comorbidity correlations obtained from hospital claims from more than 30 million patients in US.

- **Results**
Correlation analysis of GRS reveals 823 significant correlations among 78 diseases or 89 traits (q value < 0.01). It reveals the existence of common genetic backgrounds between diseases or traits, such as atrial fibrillation vs. ischemic stroke (r=0.59), venous thromboembolism vs. susceptibility for severe malaria (r=0.40), coronary heart disease vs. open angle glaucoma (r=0.29), type 1 diabetes vs. vitiligo (r=0.31), type 2 diabetes vs. low birth weight (r=0.26), and Helicobacter pylori infection vs. self-reported allergy (r=-0.28). Significant polygenic risk correlations are found in 464 (56.4%) associations, especially among autoimmune diseases, despite the absence of shared genetic variants or in linkage disequilibrium. When 312 significant correlations between diseases are mapped to disease comorbidity correlations from Medicare claims data from the US, 108 (34.6%) polygenic susceptibility correlations are validated to have epidemiologic evidence, such as coronary heart disease vs. intracranial aneurysm (r = 0.26 and relative risk, 1.57 [99% CI 1.56-1.58]), asthma vs. obesity (r = 0.07 and relative risk, 2.18 [99% CI 2.14-2.22]), and open angle glaucoma vs. coronary heart disease (r = 0.29 and relative risk, 1.08 [99% CI 1.07-1.09]).

- **Conclusions**
The study suggests that common genetic background exists between comorbid diseases or traits. The polygenic risk correlation approach provides candidate disease comorbidity associations warranting further epidemiologic investigations.

**Keywords**: genetic risk score; disease network; the 1000 Genomes Project
**ABSTRACT**

This study aims to develop a framework for discovering DNA motifs, where fuzzy C-means (FCM) membership functions, and an EM technique are employed to extract putative motifs allowing Indels. We present FCM-EM, a motif discovery algorithm designed to find DNA-binding motifs in ChIP-Seq data. The discovered motifs in ChIP-Seq dataset are matched to known motifs using TOMTOM and its calculated E-value shown the statistical significance of each discovered motif as well.

**Objective**

Understanding genetic sequences is one of the fundamental tasks of health advancements due to the high correlation of genes with diseases and drugs. An important problem within genetic sequence understanding is related to transcription factors (TFs), which are regulatory proteins that bind to DNA. Each different TF binds to specific transcription factor binding sites (TFBSs) on the DNA sequence to regulate cell machinery. In this work, we focus on accurately classifying and understanding the DNA subsequences that TFs bind to, which will allow us to better understand the underlying biological processes and potentially influence biomedical studies of human health.

**Methodology**

However, MEME scales poorly with large datasets and shows inability to find the motifs including insertions and deletions. This study aims to develop a framework for discovering DNA motifs, where fuzzy C-means (FCM) membership functions, and an EM technique are employed to extract putative motifs allowing Indels. The method proposed in the study follows the following steps: (a) clustering subsequences into a certain number of clusters using FCM (b) utilization of fuzzy membership values of each subsequence as an initial posterior probability values in EM technique (c) testing each PWM, clusters center, to see whether it is statistically meaningful or not.

**Experimental Results**

To evaluate the proposed algorithm, we use ChIP-Seq data generated by the Myers Lab at the Hudson Alpha Institute for Biotechnology. The discovered motifs are aligned and matched to known motifs using a tool called TOMTOM and the significance of results are considered by calculated E-value of each discovered motif as well.

**Conclusion**

In this study, employing FCM clustering algorithm for initializing EM technique, has been proposed to provide a novel tool to find the motifs in DNA sequences. Unlike MEME, this algorithm is able to find the motifs with Indels, and EM algorithm can also converge in the first few iterations as well.

**Keywords**: Motif discovery, fuzzy C-mean, expectation maximization.
Development a minimum data set of the information management system for thalassemia

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ABSTRACT

Thalassemia as the most common chronic genetic disorder in 60 countries, affecting lives of about 10,000 people annually. Also, in Iran the thalassemia disease recognized as the most important genetic disorder. But there is not a minimum data set to management thalassemia disease. The aim of the study was to develop and create a minimum data set on the information system of thalassemia for Iran. Descriptive, cross-sectional study was conducted in 2015.

Material and methods

Data was collected from patient medical records of ALI ASGHAR special hospital affiliated with Zahedan University of medical sciences. Moreover resources were included in research such as, guidelines about thalassemia, articles, books and forms which supplemented on hematology books. Different medical records in D-56 category related to thalassemia based on international classification of diseases 10th revision (ICD-10) were randomly selected. In order to extract the data element from the source listed above, a form was used. Collected data were divided into clinical and administrative categories using a checklist. Then, in order to make consensus about collected data, the Decision Delphi technique was used via a questionnaire. The content validity and reliability of questionnaire were evaluated by expert’s viewpoint and test-retest method, respectively.

Results

MDS of thalassemia was developed. This MDS divided into two categories: administrative and clinical with 5 and 17 sections were 157 and 284 data elements, respectively.

Conclusion

this study showed that uniform data element about thalassemia do not create in Iran. Thus, a MDS was designed for thalassemia in Iran. Development of thalassemia MDS reinforces the interoperability of data and information of thalassemia disease throughout registry system, health information management system and electronic health records (HER). Moreover, it can be used by reimbursement for pay treatment cost and claim. Information provided from MDS creates valuable resources for assessment, treatment planning, continuous evaluation of patient progress and performance. In addition to, establishment of MDS enables comparability data which extracted from different sources which results in the improvement of the quality care.

Keywords: thalassemia, minimum data set, information management system
Session 3: Health Data Exchange

- **Session 3-1** Implementation of standards-based, vendor neutral archive-driven API platform and client
  - Jung Bin Kim, Dong Ouk Kim, Yong Seok Kim

- **Session 3-2** Unlocking Interoperability Puzzle with the Global Language of Health - SNOMED CT
  - Dr Michael Bainbridge

- **Session 3-3** Pilot study for a mapping from HL7/SS-MIX2 to CDISC SDTM
  - Naoki Nishimoto, Jun Kunikata, Koji Uemura, Sumiko Akahori, Tomoaki Sogo, Yuma Tani, Hideto Yokoi

- **Session 3-4** Data Quality Management for Clinical Contents Model
  - Yookyung Boo, SoJeong Han, JaeWoo Lee, YoungTaeq Koh, and KyungHee Cho
Implementation of standards-based, vendor neutral archive-driven API platform and client

Jung Bin Kim, Dong Ouk Kim, Yong Seok Kim

R&D Center, INFINITT Healthcare Co., Ltd. Seoul

ABSTRACT

**Objective**

This study is aimed at implementing a vendor neutral archive (VNA)-based platform for medical images that enables the use and consumption of API. The VNA to be developed uses various profiles suggested by Integrating the Healthcare Enterprise (IHE) and connects them to operate as a standards-based API platform. Such API platform-related technologies can further be applied to VNA in creating an ecosystem for medical images. The objectives of this study include: i) to implement resources of IHE XDS.b, IHE MHD, and HL7 FHIR to a VNA and apply OpenAuth to the VNA for constructing a platform for medical image data. ii) to allow users to obtain right to access the platform, consume resources, and publish medical images and documents through an OpenAuth-based client application. iii) to verify that the entire system is operable through the built platform and the client application that uses the platform.

**Methods**

Metadata can be input to the medical images and documents via IHE XDS.b. This enables the archiving and viewing of the medical data in a patient-centric way. IHE MHD, which allows XDS.b to interface with Representational State Transfer (REST), enables querying, retrieving, and displaying of data in even low-specification devices such as mobile gadgets. The platform was constructed to enable users to permit designated client applications to access the data in the VNA and to upload medical data, by applying OpenAuth 2.0.

**Results**

To realize the system, an IHE MHD-based scenario and a SMART on FHIR-based scenario were combined. IHE MHD is defined to be able to provide a FHIR bundle and consume FHIR resources, when combined with IHE IUA. FHIR provides atomic resource objects rather than composite ones. SMART on FHIR suggests that scope management should be done to allow access to each resource via OpenAuth. To verify if the system is operable when the two scenarios are combined, Healthcare Content Uploader, a client application that supports OpenAuth, FHIR, and MHD was developed.

**Conclusions**

The purpose of this study is to develop a VNA-driven API platform that is easy-to-use and secure, by applying MHD that can provide SOAP-based XDS.b via RESTful; FHIR resources as suggested by SMART on FHIR; and OpenAuth. The study shows that it is possible for third party applications to use API of the VNA based on the system. The results verifies that VNA resources can be shared across different applications via security measures; non-DICOM objects can be saved and managed; and HIE can be further achieved. It is our expectation that this technology can enhance existing PACS to realize an API platform through medical image-based VNAs and build health IT ecosystems based on API platforms in which users can develop and use various healthcare applications.

Keywords: Vendor Neutral Archive, Application Programming Interface, Healthcare IT Platform, Healthcare IT Standards, Healthcare IT Security
Unlocking Interoperability Puzzle with the Global Language of Health - SNOMED CT

Dr Michael Bainbridge
Clinical Engagement Lead (APAC) on behalf of International Health Terminology Standards Development Organisation (IHTSDO)

ABSTRACT

Introduction

In healthcare, interoperability and exchange of data is facilitated by ensuring that different information systems and software applications communicate, exchange data, and are able to use the information that has been exchanged. However, the healthcare sectors across the world are faced with a mixed economy of paper based medical records, local Document Management Systems, Electronic Medical Records and other data capture and exchange formats. Healthcare providers are attempting to deliver care through summarising patients’ medical records using these various formats and different approaches, including free text (using regional dialect and acronyms), local and proprietary terminologies, classifications and other coding systems designed for reporting and reimbursement purposes. Proliferation of terminologies and coding schemes increase the number of errors and hinder clinical data exchange and meaningful use. In order to improve patient care and safety both at individual and national levels, patient data needs to be captured accurately, shared effectively, and its meaning interpreted consistently. While the use of Electronic Health Records has enabled healthcare providers to capture and share clinical data effectively within a single system, it is important that different clinical systems are also able to communicate and understand each other. The only way to safely achieve this shared understanding is for clinical systems to speak a common language. A clinical terminology, such as SNOMED CT, provides this common language for healthcare systems and providers to communicate in this way. In addition, however, it also enables shared clinical data to be effectively utilized for clinical research, analytics and decision support and multiple other secondary uses, which contribute to improvements in healthcare delivery.

Healthcare organisations and governments across the world are turning their attention to semantic interoperability – the ability of two or more systems to exchange information and to use the information that has been exchanged. As large volumes of information (often referred to as big data) become available as a result of the increased use of Health Information Exchange systems, so much of this information will have little value if it cannot be processed and analysed dependably. SNOMED CT provides a standardised representation for clinical phrases and concepts captured by clinicians, in a way that supports the electronic interpretation of their meaning. SNOMED CT enables clinical information to be represented consistently, reliably and at a level of granularity required by clinicians, while also enabling clinical data aggregation, clinical research, data analytics and decision support.

SNOMED CT is the most comprehensive, multilingual clinical healthcare terminology in the world. It is used in over 50 countries including the US, UK, Sweden, Spain, India, Hong Kong (P.R.C), Malaysia, Australia, Canada and many others. SNOMED CT supports the representation of high quality clinical content in digital health records. The implementation of SNOMED CT enables a broad range of benefits to a wide variety of stakeholders – including healthcare providers, consumers and administrators, medical researchers and entire populations.

In this presentation, we will discuss the key features of SNOMED CT and the significant benefits that can be achieved through its implementation. We also consider both the key determinants for effective benefit realization, and how the increasing utilization of SNOMED CT’s power can increase the benefits achieved.
SNOMED CT provides a number of features, which can be used in the implementation of health records, including:

- uniquely identified meanings (i.e. concepts);
- human-readable labels (i.e. descriptions);
- specialization hierarchies and formal description-logic based definitions (i.e. relationships); and
- the ability to customize the terminology, by adding content, language preferences, subsets, translations, mappings and other implementation-specific requirements (i.e. extensions and reference sets).

However, not all of these features need to be implemented in order to achieve benefits from SNOMED CT. Systems that only require a few of these features to be implemented using a simple approach, still benefit from the opportunity to exchange data using a common language. Similarly, while SNOMED CT spans a wide range of clinical topics and specialties, systems can achieve a variety of substantial benefits using only a small subset of this content.

A number of different strategies may be used to deliver benefits with SNOMED CT. These range from an incremental approach, which starts with a simple subset of SNOMED CT’s features and evolves to meet emergent requirements, through to planning upfront to achieve the depth of benefits enabled by a sophisticated implementation.

This presentation draws upon the work done by the IHTSDO on SNOMED CT benefits realization and the general business case for adoption of SNOMED CT to achieve semantic interoperability. Some of the key areas covered by the presentation include SNOMED CT use in data analytics and decision support, and how it contributes to achieving the benefit realization.

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**Conclusion**

SNOMED CT contributes to the improvement of patient care by supporting the development of high quality, clinical content in digital health records. SNOMED CT supports semantic interoperability, which improves quality, safety, efficiency, and efficacy of healthcare delivery. The range and depth of benefits achieved through the implementation of SNOMED CT is determined by a number of factors, including the design decisions that are made. Through considered design and an increasing utilization of SNOMED CT’s power, the effective delivery of these benefits can be further enhanced.
Pilot study for a mapping from HL7/SS-MIX2 to CDISC SDTM

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Keywords: CDISC SDTM, LB domain, HL7, mapping, Bayesian estimation

ABSTRACT

- **Objectives**
The purpose of the study was to explore the exchangeability between HL7/SS-MIX2 and CDISC SDTM (Clinical Data Interchange Standard Consortium, Study Data Tabulation Model) formatted data for laboratory test results. And the secondary purpose was to explore evaluation framework and to evaluate mapping precision.

- **Methods**
We mapped HL7 field name to CDISC SDTM variable name. LB (Laboratory test results) domain was selected because the HL7 variable name of laboratory test has less variability than others, such as disease name or past histories. To test the exchangeability, we accumulated 77 cases over 330 subarachnoid hemorrhage patients from EMR in Kagawa university hospital. The test data were obtained from April 1, 2014-March 31, 2015. Bayesian sample size estimation was conducted to construct the evaluation framework (J Whitehead, 2008). We set \( U_n \) as a mapping proportion, \( \eta = 0.95, \zeta = 0.90 \).

\[
P(p \geq \eta | y) \geq \eta \\
P(p < p^* | U_n - 1) \geq \zeta
\]

We applied a Bayesian method to estimate the mapped count using simple Binomial prior distribution. MCMC procedure, which uses Markov-Chain Monte Carlo technique, was used in SAS 9.4 (SAS Institute Inc.).

- **Results**
LB domain contains 45 variables as it is, we identified 11 one-to-one variables (11/45=24%), such as LBORRES(results in original unit). And LBORRESU, which contains unit of test result, required variable transformation dividing small portion of variable name because the data was stored in HL7 format like “g/dl^g/dl^99Z15.” 12 out of 45 variables (27%) were seen as this category. Other variables could not be transformed because they were specific to a clinical trial. These type of variable should be transformed with encoding the standard code set of JLAC10 or LOINC code. Interim structure for transformation was inspired. 108 mapped count over 193 cases were estimated for the sample size calculation in evaluation framework. In this study, we used only variable names for mapping, mapped proportion was estimated using Bayesian technique. We obtained 10.83 one-to-one variable and its 95% highest posterior density credible (HPD) interval was 5-16 variables.

- **Conclusion**
Limiting the LB domain in CDISC SDTM, we obtained only 24% mapped variable from HL7 field name. Mapping precision had a wider 95% HPD interval. The result of this pilot study indicated that refined mapping algorithm was required for the future development research. We are trying the contents specific mapping from 77 cases.
ABSTRACT

- Objectives
Healthcare system’s interoperability is one of the most important goals for meaningful use of the Electronic Health Records (EHR). It is essential to facilitate IT support for workflow management, decision support systems, and evidence-based healthcare, as well as the secondary use of EHR across healthcare organizations. In Korea, the researches on structured data elements in EHRs have been progressed since 2008. The clinical contents model (CCM) is an information model designed to represent clinical information in EHR systems across organizations. In order to ensure EHR system’s semantic interoperability in clinical information, the development principle for clinical information model is required to reflect its objective and function. Data validation is often a topic of great importance when it comes to databases. By practicing simple data validation rules, databases become more consistent, and functional providing more values to their users. This research performed data quality control on previously developed CCM for medical facilities’ users before CCM loading is done on CCM platform. In the research, the data quality control strategy is investigated for CCM, which is continuously usable in the future, based on the results of CCM’s data quality control.

- Methods
The subject of the research is the clinical contents models (CCM) developed between 2008, and 2015. CCM data quality control tools such as guideline for CCM development, and CCM instance review form developed by EHR organization in 2009 are used. The reviews are composed of 22 checkpoints in 8 categories. The reviews are randomly sampled in 5 domains of CCM, and evaluated by 5 health information professionals who worked more than 3 years in EMR document development to ensure its suitability as assessment tool.

- Results
After evaluating 452 CCMs in total, the significant improvements seem to be required. For naming convention, common expressions are generally followed except for some case sensitivity, typing errors, and etc. In case of CCM model, it is found that the laboratory domain is developed in E-V platform instead of E-Q-V platform. Common terminology system for mapping of entity, qualifier, value set, and value unusually assign codes such as SNOMED CT, UMLS, Korean Standard Terminology (KOSTOM), Korean Drug Code (KDC). However, local codes existed in some cases. In case of evaluation scale tool, metadata elements like development main body, revision year, and etc were omitted. In addition, considerable number of omission of the information for CCM development main body, and description on cases of application is found. CCMs developed after 2012 omitted all the expressions of markup language such as CCML.

- Conclusion
Considerable change and supplement on review object are required, and each CCM should be reviewed before publication. In order to support semantic interoperability, clinical contents model makes the standard terminology system mapping as a principle regarding all the elements such as entity, qualifier, value, and etc. In general, KOSTOM is designed to map with other terminology systems such as UMLS.
and SNOMED CT when some concepts are missing. However, some CCMs require mapping standard terminology system as they are only assigned of local code. In addition, there are some cases where CCM development principle, and methods are not followed as CCM is developed as annual research project by different organizations since 2012 after the establishment by Center for EHR between 2008 and 2010. This suggests that the verification and evaluation of developed CCM, and observance of CCM development principle were missing due to absence of governing body. Therefore, management system is required in order to promote use in medical facilities, and continuous development and quality control for CCM.

| Table1 | Current state of CCM development, and number of sampling |
|---|---|---|
| CCM development year | Target Domain | Number of CCM development | Number of Random sampling |
| 2008 - 2010 | Clinical observation, Procedure, Medication & Laboratory | 3,276 | 327 |
| 2012 | Clinical observation | 114 | 11 |
| 2013 | Clinical observation & Laboratory | 334 | 33 |
| 2014 | Laboratory | 106 | 10 |
| 2015 | Clinical observation & Laboratory | 713 | 71 |
| Total | | 4,543 | 452 |

| Table2 | Composition of CCM instance review form |
|---|---|---|
| Category | Description | Check points |
| Naming Convention | To check whether the CCM Filename complies with the Naming Convention | 1. CCM filename and Entity Name match up 2. Does CCM filename match up with Value representation? 3. Is Panel, and Cluster used appropriately in the CCM Filename? |
| CCM Model | To check whether the CCM complies with the E-Q-V model | 1. Does CCM instance follow the formal structure of the CCM model, which is Entity – Attribute (Qualifier/Modifier) – Value or Entity – Value model? |
| Entity | To check whether the entity complies with the rules of CCM model | 1. Does Entity Name comply with the value representation? 2. Does Entity Name belong to appropriate Entity Domain? 3. Is Entity Name mapped to a standard terminology system? |
| Qualifier | To check whether the qualifier complies with the rules of CCM model | 1. Does Qualifier Name comply with the Value representation? 2. Does Qualifier Name belong to qualifier set according to the Entity domain? 3. Does Qualifier comply with atomicity? 4. Is Qualifier Name mapped to a standard terminology system? |
| Modifier | To check the appropriateness of using Modifier | 1. Subject 2. Negation 3. Uncertainty |
| Value | To check whether the Value complies with the rules of CCM model | 1. Does the Value Name comply with the Value representation? 2. Do Qualifier Name, and Value Set match up? 3. Is Value entirely composed of those of the same nature? 4. Is Value Name mapped to a standard terminology system? |
| Panel | To check whether the Panel complies with the rules of CCM model | 1. Is CCM Panel instance composed of items having the same datatype eValue of two or more? 2. Does CCM Panel Instance have the same qualifiers? |
| Cluster | To check whether the Cluster complies with the rules of CCM model | 1. Is CCM Cluster instance composed of items having a datatype with 2 or more of the other eValue, and does the CCM Cluster instance include more than 1 Panel? |
| Data Type Use Case | To check the compliance of standard data type | 1. Complying data type of HL7 V3 |
| Metadata | Inclusion of metadata | 1. In order to continuously manage the changes in model, it has metadata information. |
| CCML | Definition of marking language | 1. All the CCM is marked as CCML. |

Keywords: structured data element, clinical contents model, electronic health records, semantic interoperability, data quality control
Session 4: Nursing Informatics

- **Session 4-1**  Develop and validate an empowerment tool for pregnant women
  - A. Aslani, F. Erfanian, S. Yaghoutikhorasani, A. Dadashi, R. Rezaee,

- **Session 4-2**  The development and acceptability evaluation of the virtual simulated hospital training program for nursing students
  - Yanling Wang, Fangqin Wu, Meihua Ji, Ying Wu,

- **Session 4-3**  The need Assessment on Long-term Care Information In Taiwan
  - Abdallah Ahmed Elbakkoush, Suleman Atique, Chien-Tsai Liu
Develop and validate an empowerment tool for pregnant women

A. Aslani¹, F. Erfanian², S. Yaghoutikhorasani², A. Dadashi³, R. Rezaee¹,

1. Health Human Resources Research Center, School of Management & Information Sciences, Shiraz University of Medical Sciences, Shiraz, Iran.
2. Nursing and Midwifery School, Mashhad University of Medical Sciences, Mashhad, Iran.
3. Department of Medical Informatics, Mashhad University of Medical Sciences, Mashhad, Iran.

**ABSTRACT**

- **Objective**
Women empowerment especially pregnant women are a basic approach to improve women’s health status and reduce complications during pregnancy. The “right to health” cannot be achieved only through direct service, though the aim of this study was to develop and validate an empowerment tool for pregnant women which is applicable in prenatal training.

- **Method**
To develop the tool five steps were taken: literature review, generating item pool, content validity testing, administration of draft scale and finally explanatory factor analysis. The appropriate and final version of the tool with 14 items administered to 125 pregnant women undergoing prenatal visits at 4 public health centers in Mashhad.

- **Findings**
Item-total and subscale-total scores correlated significantly with Cronbach’s alpha coefficients of 0.71 and 0.73-0.76 respectively, which confirmed the internal consistency of the tool. Evaluation of construct validity through factor analysis revealed 8 items adapted to three factors: self-esteem, optimism over the future, and self-efficacy.

- **Conclusion**
The established tool is a valid and reliable tool with 10 items for evaluating prenatal training in pregnant women.

**Keywords**: prenatal training, pregnancy, empowerment, evaluation
The development and acceptability evaluation of the virtual simulated hospital training program for nursing students

Yanling Wang, Fangqin Wu, Meihua Ji, Ying Wu
School of Nursing, Capital Medical University, Beijing, China (# co-first author)

ABSTRACT

- **Objectives**
  Nursing educators often face a dilemma of assigning inexperienced nursing students to a real clinical setting in which skilled techniques and solid knowledge base are required in providing safe patient care. The training in a skills lab is not adequate in addressing this need and tends to be attentive to students in developing practical skills and abilities, and does not fully reflect real clinical scenarios in training and promoting clinical thinking as well as other higher level nursing competencies. Together with limited clinical resources and high demands in patient care, there is a need in developing a training program which could adequately prepare nursing students in improving their clinical competencies without violation of patient’s safety before they enter a real clinical setting. The purpose of this study is to develop a virtual simulated hospital training program and evaluate its technological acceptability and usability among student nurses.

- **Methods**
  This study includes two phases: development of the virtual hospital and evaluation of its acceptability and usability. The virtual hospital is structured via a game engine software named “Unity 3D”. A modified acceptance evaluation questionnaire based on Technology Acceptance Model (TAM) was used to test the usability of the program, which includes four domains: Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Attitudes Towards Usage (ATU) and Behavioral Intention to Use (BIU), with 41 items and rated with 5-point Likert scale.

- **Results**
  Nursing tasks reflecting different levels of nursing competencies within this interactive virtual hospital include health assessment, observation, clinical analysis and decision making, prioritization, nursing intervention, daily nursing care, and communication. Interactive interfaces of the training program are shown in Figure 1. A total of 129 student nurses tried the program and completed the questionnaire. The means of the four domains regarding to the system are: PU: 4.02-4.16, PEOU: 3.83-4.19, ATU: 3.81-4.22, BIU: 4.08-4.26. The Cronbach’s α of each domain is 0.967, 0.967, 0.929, 0.972 respectively. The average scores of items perceived to improve clinical nursing competencies were scored higher than those perceived to help students building nursing knowledge and practical skills. The students considered that the virtual hospital training program could provide adequate training in following physician orders, improving clinical thinking, and conducting health observations, communications and so on.

- **Conclusion**
  This training program has easy to use interfaces, the mean scores of the four domains indicated that this is a useful training tool in developing clinical nursing competences for nursing students before they enter a real clinical setting, and it is user friendly and pertained to improve clinical thinking competencies as major objectives in using this training program.

Keywords: Virtual simulated training, technology acceptance model (TAM), patient’s safety
The need Assessment on Long-term Care Information In Taiwan

Abdallah Ahmed Elbakkoush, Suleman Atique, Chien-Tsai Liu
Graduate Institute of Biomedical Informatics, Taipei Medical University, Taiwan

ABSTRACT

Objective
This study aimed to investigate the information needs along with future challenges and recommendations for long-term care in long-term care institution residents and their families in Taiwan. We want to find out the method of information retrieval adopted by population regarding Long Term Care.

Methods
It is a survey based study which involved convenience sampling. We developed a questionnaire to investigate the state of long term care information services in Taiwan. The questionnaire mainly included questions regarding Long Term Care needs Requirements and Long Term care funding experience and satisfaction information regarding information sources. For this we used 5 point Likert Scale from ‘Very Satisfied’ to ‘Very Dissatisfied’. Another important component consisted of demographic information like Age, Gender, educational level and occupation. It describes public long term care services and information needs. To enhance the credibility of our findings we used Chi-square test to find out difference between demographic characteristics and long term care needs.

Results
A total of 265 questionnaires were collected including 201 copies of manual questionnaires and 64 online questionnaires. Among them 5 were invalid questionnaires and 260 valid questionnaires. Table 1 shows the demographic characteristics of the survey participants. Results showed that website search was the most popular method to gain long-term care information, although the government had built websites to provide information, both the utilization rate and satisfaction regarding these portals was low. Public mainly uses websites as source of long-term care issues information network (54.6%) and television news (48.8%), followed by the information leaflets (27.3%) and social media (18.5%), through friends and relatives, and apparent network TV multimedia is mainly transmitted by long-term care information interface, most people are mostly from the Internet to reach the issues related to long-term care; fewer people use leaflets, radio (both 6.2%) and telephone (5.4%), other sources include information retrieval by individuals through insurance agents, and related organizations or associations who actually work in long-term care services.

Conclusion
To improve the policy acceptance and fulfill the information need of general population, it would be necessary to refine and improve the websites providing information regarding long term care in Taiwan.

Keywords: Long-term Care, information need assessment, questionnaire survey
### Table 1: Basic Demographic Characteristics

<table>
<thead>
<tr>
<th>Feature</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 20-29</td>
<td>73</td>
<td>28.1%</td>
</tr>
<tr>
<td>Age 30-39</td>
<td>62</td>
<td>23.9%</td>
</tr>
<tr>
<td>Age 40-49</td>
<td>47</td>
<td>18.1%</td>
</tr>
<tr>
<td>Age 50-59</td>
<td>51</td>
<td>19.6%</td>
</tr>
<tr>
<td>Over 60 years</td>
<td>27</td>
<td>10.4%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Educational Level</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
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<td>2.7%</td>
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<tr>
<td>Secondary</td>
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<td>4.6%</td>
</tr>
<tr>
<td>High school level</td>
<td>40</td>
<td>15.4%</td>
</tr>
<tr>
<td>Graduate</td>
<td>144</td>
<td>55.4%</td>
</tr>
<tr>
<td>Post Graduate</td>
<td>57</td>
<td>21.9%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class engineering and manuf-</td>
<td>59</td>
<td>22.7%</td>
</tr>
<tr>
<td>turing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free services</td>
<td>53</td>
<td>20.4%</td>
</tr>
<tr>
<td>Medical long-term care</td>
<td>47</td>
<td>18.1%</td>
</tr>
<tr>
<td>industry</td>
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<td></td>
</tr>
<tr>
<td>At home</td>
<td>39</td>
<td>15.0%</td>
</tr>
<tr>
<td>student</td>
<td>30</td>
<td>11.5%</td>
</tr>
<tr>
<td>Military and government</td>
<td>24</td>
<td>9.2%</td>
</tr>
<tr>
<td>Finance and insurance</td>
<td>8</td>
<td>3.1%</td>
</tr>
</tbody>
</table>

### Table 2: Main Source of Information Retrieval

<table>
<thead>
<tr>
<th>Information Source</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web Search</td>
<td>200</td>
<td>76.9%</td>
</tr>
<tr>
<td>Word of mouth</td>
<td>86</td>
<td>33.1%</td>
</tr>
<tr>
<td>Newspapers and magazines</td>
<td>79</td>
<td>30.4%</td>
</tr>
<tr>
<td>Community Media</td>
<td>60</td>
<td>23.1%</td>
</tr>
<tr>
<td>Advisory long-term care services</td>
<td>55</td>
<td>21.2%</td>
</tr>
<tr>
<td>City and county long-term care management</td>
<td>50</td>
<td>19.2%</td>
</tr>
<tr>
<td>consulting center</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information leaflets</td>
<td>22</td>
<td>8.5%</td>
</tr>
<tr>
<td>Advisory long-term care associations</td>
<td>22</td>
<td>8.5%</td>
</tr>
<tr>
<td>others</td>
<td>1</td>
<td>0.4%</td>
</tr>
</tbody>
</table>
Session 5: Personal Health Record (PHR) and Hospital System

- **Session 5-1** Development of Personal Health Records Architecture for Community Oriented Holistic Care to be in Line with International Standards
  - Heng-Shuen Chen, Ching-Chu Liao, Pei-Shan Yang, Yu-Yuan Yu, Hung-Pin Hou, Heng-Chang Chen

- **Session 5-2** Development of a Mobile Application in Conjunction with a Web Service for Personal Health Records regarding Atopic Dermatitis
  - Younghee Yun, Hyunho Kim, Wonmo Jung and Bo-Hyeong Jang

- **Session 5-3** Dynamic relationship between the emotion and the physical statues: an observational study through personal health record
  - Ye-Seul Lee, Won-Mo Jung, Hyunchul Jang, Sanghyun Kim, Sun-Yong Chung, Younbyoung Chaé

- **Session 5-4** From EHR to PHR: a Literature Review
  - Ching-Chu Liao, Heng-Shuen Chen, Pei-Ni Chuang, Yi-Hsuan Huang, Shin-Yu Yeh, Shou-Jen Lan
ABSTRACT

In recent years the aging process of Taiwan society become more rapidly. In current health system referral system was not established and medical resource was unevenly distributed. Rural and urban area faced different problems of inaccessibility and fragmentation of healthcare. Medical expenditure was escalating due to increasing medical needs of the elderly and disability.

Objective
The goals of this study are to explore personal health records architecture with contemporary health information technology, and apply the concept of holistic care and community oriented primary healthcare, in order to be in line with the international electronic health records standard.

Methods
In this study, literature reviews of PHR and EHR were performed. Renowned experts of EHR and PHR from foreign countries were invited to visit Taiwan for an international symposium and academic exchange to share experience. A comprehensive content architecture was proposed after thorough discussion and revisions among panels and committee. Implementation of a prototype of PHR system was be tested in a rural community hospital

Results
Firstly, literature searches from academic database such as PubMed, EMBASE, MEDLINE and document repositories of government and academic association were retrieved and selected about 50 most important papers for review. Secondly, Presidents of IMIA (Prof. Hyeoun-Ae Park), AMIA (Prof. Thomas Payne) and Vice President of JAMI(Prof. Naoki Nakashima) were invited to attend and give key note speeches in the international symposium of consumer health informatics and PHR, Aug 12, 2016, in Puli, Taiwan. In return delegates from Taiwan will visited foreign academic institutions and attend APAMI 2016 in Korea and AMIA 2016 in US. Thirdly, a multidimensional architecture of PHR content was proposed with: 1. natural history of the disease and stages of preventive medicine, 2. continuum of healthcare with 6 stages including preventive care, emergency care, acute care, subacute care, long term care and terminal care, 3. Holistic care of bio-psycho-socio-spiritual model of approaches, 4. Assisted living with 6 categories including food, clothing, housing, transportation, education, and recreation.

Conclusion
In future, PHR could support not only rural area and in underdeveloped countries but also inspire the advanced countries troubled with expensive high medical technology and many people lacking health care.

Keywords: electronic health records, personal health records, holistic care, community medicine
Development of a Mobile Application in Conjunction with a Web Service for Personal Health Records regarding Atopic Dermatitis

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4. Department of Preventive Medicine, College of Korean Medicine, Kyung Hee University, Seoul, Korea

Keywords: Personal Health Records; Electronic Health Records; Atopic Dermatitis; Application

ABSTRACT

• Objective
Although a myriad of mobile applications that provide health or medical information have been developed for various diseases including atopic dermatitis (AD), most of them are not used by physicians in clinics. Usually they are used by patients themselves only to record their symptoms or get information about diseases. The purpose of this study was to develop a smart system which can record and retrieve medical symptoms and clinical information generated in daily life in order to connect physicians and patients and to enhance the quality and the efficiency of medical care.

• Methods
Task force team consisting of three physicians and two developers has developed the system. Patient centered informatics tool for AD was developed by implementing a mobile application to collect daily information related to AD from patients and a web service to assist physicians for retrieving and integrating symptom information. User interface of mobile application was designed under consideration of convenient daily input. On web service for physicians, visualization and tabulation of the time-series recorded symptoms were designed based on the practical need of physicians. The developed system has been evaluated from July 2015 to August in clinical situation.

• Results
The smart phone application, ‘Atopy Mobile Note’, has been registered in Google Play Store from March 2016. Patients can record AD score, episodic events of their illness, food diary, treatment and management diary using their mobile devices. Recorded information is saved in database of central server immediately. Physicians can retrieve a sequence of records in the clinic using web service program.

• Conclusion
We have developed an mPHR application for patients and corresponding web service for physicians. To take advantage of this system in health care will require more research to find out how much it actually more beneficial to patients and/or physicians.

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Keywords: Personal Health Records; Electronic Health Records; Atopic Dermatitis; Application

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Dynamic relationship between the emotion and the physical statues: an observational study through personal health record

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5. Dept. of Neuropsychiatry, College of Korean Medicine, Kyung Hee, Seoul, Korea
6. Acupuncture and Meridian Science Research Center, College of Korean Medicine, Kyung Hee University, Seoul, Korea.

ABSTRACT

Objective
The need to develop a Personal Health Record (PHR) have increased in order to support the prevention and management of diseases both inside and outside the medical institutions. Management of chronic disorders on a daily basis is possible by collecting and analyzing data on the patient's condition. In this research, we developed an evaluative form of daily psychological and physical conditions in the format of mobile application which we named “Mind Mirror”. This study aims to show that PHR can be a useful tool to assess the relationship between emotion and physical condition.

Methods
In the development of “Mind Mirror”, parameters to measure emotional valence and physical state of pain and fatigue were developed based on different theories. Using a 30-day observational data from 20 participants using this mobile platform, we analyzed the relationship between the affective state and physical condition through cross-correlation analysis of time-series. Based on the cross-correlation between three parameters, a multilevel multivariate regression model (MGLM, Multivariate Generalized Linear Mixed Model) with subjects as random effects was carried out. By selecting model that minimizes AIC, BIC, and log-likelihood, the dynamics among three parameters were determined. The relationships between emotion, pain and fatigue was visualized in a dynamic network structure.

Results
The strongest cross-correlation in this emotion and physical state data was at lag 0, which implied that emotion and the body condition changed concurrently. MGLM model showed that emotion and fatigue were significantly associated with one another (emotion → fatigue: $\beta = -0.233$, $p<0.001$; fatigue → emotion: $\beta = -0.150$, $p<0.001$). Fatigue and pain were significantly associated one another as well (fatigue → pain: $\beta =0.250$, $p<0.001$; pain → fatigue: $\beta =0.398$, $p<0.001$). Emotion and pain influenced each other but without significance (emotion → pain: $\beta =-0.021$, $p=0.063$; pain→emotion: $\beta =-0.022$, $p=0.063$).

Conclusion
This study implies that the relationship between emotion and the body interacts instantaneously. Dynamics between emotion and body through PHR indicates the need to examine the mind and body as a whole. This study suggests a possible solution to manage health through mobile platform on a daily basis.

Keywords: Personal health record (PHR), time-series analysis, cross-correlation, Multivariate Generalized Linear Mixed Models (MGLM)
From EHR to PHR: a Literature Review

Ching-Chu Liao\textsuperscript{1,3}, Heng-Shuen Chen\textsuperscript{1,2}, Pei-Ni Chuang\textsuperscript{2}, Yi-Hsuan Huang\textsuperscript{2}, Shin-Yu Yeh\textsuperscript{2}, Shou-Jen Lan\textsuperscript{3},

\textsuperscript{1} Puli Christian Hospital, Puli, Taiwan)
\textsuperscript{2} National Taiwan University Hospital, Taipei, Taiwan)
\textsuperscript{3} Asia University, Taichung, Taiwan.

**ABSTRACT**

Personal health record (PHR) is an innovative health information technology that empowers patients to take more active role in their own health and make informed decisions. PHR systems may be effective in improving preventive care and plays an important role in reducing medical costs in this rapidly ageing Taiwan society.

- **Objective**
  The purposes of this study are to 1. Explore contemporary health information technology and to be inline with the international electronic health records for the aging society in Taiwan. 2. Review well established PHR systems and provide a summary of future direction for personal health records in Taiwan. 3. Define the role of family physician in connecting the patient and the PHR system.

- **Methods**
  Our study was a qualitative literature review and we tried to obtain full-text and review articles from PubMed, EMBASE and MEDLINE. Key terms used in the search included “personal health records,” “PHRs,” “Electronic personal records,” and “EHRs.”

- **Results**
  Meaningful Use (MU by HITECH Act) emphasized the three stages EHRs to improve quality, safety, efficiency, and health inequality. PHRs were in MU stage 2 patients and their families to be involved in their healthcare. MU stage 3 is to improve health outcomes through quality, safety, efficiency, and access to PHRs and allow communication between patients and physicians. PHR were applied in UK using Summary Care Records (SCR) and HealthSpace portal. In the US, PHR in the Veterans Health Administration (VHA) system, Google Health by Google and HealthVault by Microsoft were developed. However, some operations were not so smooth, and the Google health and HealthSpace were discontinued in 2011 and 2012. The difficulties in PHR adoption include: 1. Technical barriers, 2. Policy barriers 3. Computer Competency, Internet Access, and Health Literacy, 4. Economic and market forces. For elderly, cognitive and physical impairments in addition to compromise the situation. Since communication of provider is an important part of patient portal, there is concern over potential increased workload. However, it is helpful for family physicians to directly engage patients by using a portal and integrate with individual health care. Besides computer, the rise of mobile phone also makes new opportunities to overcome behavior change, cost, legal concerns, privacy concern, inconvenience, design shortcomings, and the inability to share information across organizations. The government should address the issues to ensure the e-health services to be effectively, efficiently, and safely accessed, to promote PHRs’ standards, and a series of possible legislative actions such as tax deduction for whom adopt PHR.

- **Conclusion**
  The management of a PHR is primarily the responsibility of the patient. To break down the barriers to PHR adoption the most effective mechanisms are education and research. Future research on the field should focus not only in the evaluation of PHR systems functionality and architecture, but also on other critical aspects such as accessibility, usability and effectiveness especially for disabled and elderly people.

**Keywords**: personal health records, electronic health records, family physician, review, aging society
Session 6: Clinical Decision Support System

- **Session 6-1** Classification of clinical prediction rules by design and usage  
  - Georgina Kennedy, Blanca Gallego

- **Session 6-2** Association of lipid profile & HbA1c among T2DM patients: A cross-sectional study in Bangladesh  
  - MM Islam; Tahmina Nasrin Poly; Usman Iqbal; Suleman Atique; Navneet Kumar Dubey; Phung-Anh Nguyen; Yu-Chuan (Jack) Li; Shabbir Syed-Abdul

- **Session 6-3** The potential use of computer-assisted image processing for detecting Acute Lymphoblastic Leukemia  
  - Lutfan Lazuardi, Annisa Ristya Rahmanti, Ika Candradewi, Sari Rahmawati Kusuma Dewi, Agus Harjoko

- **Session 6-4** EMRs- Towards a better User Interface (UI)  
  - Dr S B Gogia

- **Session 6-5** Impact of a QQ-based Virtual Health Paradise on reducing cardiovascular disease risk factors among healthy Chinese adults  
  - Bin Li, Ying Wu

November 3 (Thu), 2016
Classification of clinical prediction rules by design and usage

Georgina Kennedy, Blanca Gallego

Macquarie University, Australian Institute of Health Informatics, Sydney, Australia

ABSTRACT

• Objective
With the uptake of Electronic Medical Records worldwide, clinical prediction rules (CPR) have proliferated in the medical literature, more than doubling between 1995 and 2005. CPRs vary widely in their design and intended use. This makes them a challenging target when searching the literature. Furthermore, lack of standards on the evaluation of these tools and the fact that few have undergone formal impact analysis, makes it harder for clinicians and researchers to assess their utility and safety in clinical practice.

This work presents a meaningful classification scheme for CPR research, which may go some way to crystallising the definition, reducing the inconsistency of terminology in their publication and pedagogy, and guiding the generation of appropriate standards for their evaluation and inclusion in clinical guidelines.

• Methods
As part of a more broad systematic review, publications were sought that observed health provider perspectives on CPR. Descriptions of CPRs as provided by retrieved publications were grouped by their methods and intended usage. Comparisons were made across rules to identify the dimensions by which CPRs can differ, and to categorise these differences into meaningful groups.

• Results
CPRs were found to be definable across 3 dimensions – predictor or factor type (inputs), clinical goal (methods), and intended action (outputs).

I. Predictors: The most significant criterion on which to assess the input factors is if they are modifiable. This dictates if the model can be used actively, to direct the clinician or patient to change behaviours or treatment in order to target a desirable outcome, or simply to present a baseline or conditional risk.

II. Clinical Goal: The majority of publications divide CPRs into diagnostic and prognostic models. A small number included in their definition models which recommended a specific therapeutic path, however when reviewing the rules themselves, none were identified which made a treatment recommendation on their own — more typical is a guideline-based recommendation that interprets the rule’s output within a specific context. Therapeutic rules were therefore not considered.

III. Intended Action: The dimension in which there was the least consensus was that of the intended action. This is because researchers, policy makers and clinicians have differences in opinion on how prediction rules can and should be used in practice. Some clinicians view CPRs as an assistive tool, useful only for novices and to help patients understand their status and impact of potential treatment options. Other stakeholders treat CPRs as prescriptive, expecting 100% coverage to meet a specific outcome goal, such as reduction in unnecessary testing burden.

• Conclusion
The classification of CPRs across the dimensions of predictor type, clinical goal and intended action is expected to simplify the literature and solve some of the issues observed with their search and synthesis.

Keywords: Clinical Prediction Rules
Association of lipid profile & HbA1c among T2DM patients: A cross-sectional study in Bangladesh

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ABSTRACT

Objective
Uncontrolled hyperglycemia due to impaired lipid metabolism has been entanglement with cardiac disease in diabetic patients. We aimed to explore association between lipid profile and HbA1c, considering that early detection of lipid, and HbA1c abnormalities could reduce the risk of cardiovascular disorder in type-2 diabetic’s patients.

Methods
This cross sectional study included type 2 diabetes (T2DM) patients who undergone treatment at primary level hospital in Bangladesh. The study was undertaken since August 2015 to January 2016 in the inpatient and outpatient department in three diabetes hospitals in Dhaka, and 300 subject with T2DM (more than 6 month’s duration) were randomly selected. The patients with kidney and metabolic bone disorders were excluded as these conditions might affect the lipid metabolism in diabetes. We also asked some questionnaire and checked medical record of each subject regarding age, body mass index (BMI, Kg/m2), duration of diabetes, total cholesterol level, low-density lipoprotein (LDL), high-density lipoprotein (HDL), triglyceride (TG), creatinine level etc. Record were carefully reviewed and further checked and corrected in case of missing. We calculated means and standard deviation for continuous data and percentage for categorical data. Gender-based patients characteristics were compared using unpaired t-test and chi-square test for categorical variables. Patients characteristic according to HbA1c quartile were compared using one-way analysis of variance (ANOVA) and descriptive analysis for percentage of categorical variables. The correlation (Pearson’s correlation) studies were performed between lipid profile and HbA1c. Significance level in each case was set P<0.05.

Result
Overall, 300 type 2 diabetic patients were enrolled, out which 89 were males (29.67%) and 211 females (70.33%). The average age of male and female patients was were 54.65±12.04 and 53.08±10.86 respectively. The mean age of diabetes diagnosis for male patients was 46.88±10.99 and female patients was 45.51±10.04. The mean BMI of male and female patients were 24.66±3.67 and 26.52±4.17 respectively. Among males, the mean value of TC, LDL, HDL, and TG were 201.42±55.26 mg/dl, 113.30±46.05 mg/dl, 44.66±14.90 mg/dl, and 193.48±102.59 mg/dl respectively while among females, the mean value of TC, LDL, HDL, and TG were 205.16±55.17 mg/dl, 115.23±43.91 mg/dl, 45.12±14.03 mg/dl, and 209.98±120.74 mg/dl respectively. A positive relation was observed for male between increasing the values of HbA1c and BMI, total cholesterol. But in the case of females, a positive relation was observed in total cholesterol and creatinine level. Further, in the females, higher level of HbA1c was also associated with the greater percentage of smokers, and patients undergone both oral and insulin medication. There was significantly positive correlation between HbA1c and TC (r=.131). Both LDL (r=.025) and HDL (r=.016) had positive correlation with HbA1c and negative correlation with TG (r = -.062). However, there was a linear relationship between HbA1c and dyslipidemia.

Conclusion
This study showed lipid abnormalities among T2DM patients with dyslipidemia, hypercholesterolemia and hypertriglyceridemia. Our study suggest that early diagnosis of dyslipidemia would be useful to minimize the unfavorable cardiac risk of type 2 diabetic patients in Bangladesh.

Keywords: Lipid profile, HbA1c, Type 2 diabetes, Dyslipidemia, Hyperglycemia etc.
The potential use of computer-assisted image processing for detecting Acute Lymphoblastic Leukemia

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ABSTRACT

Acute Lymphoblastic leukemia (ALL) is a cancer that affects young children and adult. It is characterized by the proliferation of abnormal number of malignant and immature white blood cells that can spread in the bloodstream and other vital organs. In Indonesia, the cases are increasing with relatively high fatality rate. Early identification of acute leukemia is very important in reducing the high mortality rate. Currently, acute leukemia detection is conducted using microscope observation by identifying the morphology and number of blast cells in the peripheral blood smear cells and bone marrow aspiration. However, this manual method is time consuming and requires highly skilled health professionals. This study aimed to develop an automatic acute leukemia detection based on digital image processing and pattern recognition. We used Haar classifier and segmentation based on HSV color space and watershed method to separate white blood cell and red blood cell in the peripheral blood smear image. The result using hough circle transform involving 128 white blood cell images of acute leukemia patients have produced 78% accuracy.

♦ Objectives
The study aimed to develop an automatic acute leukemia detection based on digital image processing and pattern recognition.

♦ Methods
An action research approach introduced by Davison et al. (2004) was used to develop the system. This approach consists of several stages i.e: 1) Initiation phase, to assess the current method for acute leukemia detection and to observe the need to develop a low cost automated early detection 2) Design & development phase, to develop the prototype using proposed algorithm for white blood cell (WBC) classification and to conduct system optimization and adaptation, 3) Testing & implementation phase, to perform system validation by identifying the normal and abnormal blood cell (blast cell). 4) Improvement and Evaluation phase, to evaluate the performance of the system. The system was developed using Microsoft Visual Studio 2012 and EMGU CV image processing library (.NET wrapper of OpenCV) and C#.NET programming language. Windows Presentation Foundation (WPF) was used as the Graphical User Interface (GUI) framework of the application. Digital image processing and pattern recognition technique were performed to provide information on the white blood cells or leukocytes morphology from blood microscopic image. The identification and classification of white blood cells were divided into several classical sequences/stages i.e: 1) Image acquisition 2) Preprocessing, to improve the quality of the captured image, 3) Segmentation, to mark the white blood cells objects as the foreground and eliminate the background objects (plasma, red blood cells and platelets), 4) Feature extraction, to obtain the numerical characteristic of each image characteristic parameter that can be used to detect Acute Lymphoblastic Leukemia (ALL) or normal blood cell (shape features and color features), 5) Classification (pattern analysis) using k-nearest neighbors algorithm, to classify the cells as blast cell or normal cells. This study has obtained the ethical clearance from the ethical committee at Sardjito Hospital/Faculty of Medicine-Universitas Gadjah Mada.
Results
To validate the system, we evaluated 128 blood smear images from already diagnosed ALL patients. All samples were obtained from Clinical Patology Laboratory at Sardjito Hospital/Faculty of Medicine-Universitas Gadjah Mada. All blood samples were digitized under digital microscope Olympus BX-41 with 100x magnification and were captured using Optilab Advance and saved in JPG format of size 1280 x 960 pixels. The purpose of segmentation process is to detect the white blood cells and differentiate with other blood cells. Image segmentation of white blood cells by using hough circle transform was done in 128 samples and the system has been able to detect 100 of the samples and failed to identify the 28 samples. Based on this, the accuracy of segmentation process is 78%. The example of the segmentation result is shown on Figure 1. This step is also able to identify that white blood cells roundness is usually more than 75. Another steps after segmentation process is feature extraction, which found to be useful in quantifying the parameter of each blood cell type. In general, the shape, size, roundness and the value of red, green and blue color of each cell types i.e. neutrophil eosinophil basophil lymphocyte monocyte and lymphoblast are measured. On the classification stage, k-nearest neighbors algorithm was implemented and shown the accuracy of 64% based on the confusion matrix analysis.

Conclusion
Our preliminary result showed that the system has been able to detect the abnormal white blood cells and differentiate with other normal blood cells. This feature is potentially useful to help the diagnosis of patient with Acute Lymphoblastic Leukemia (ALL) especially in the primary health centers, which usually have limited resources and lack of hematologist expert. This system may help health practitioners at primary health centers to identify the abnormal blood cells and to captured and documented the blood samples for further consultation with hematologist at referral hospital. Further development and evaluation is needed to improve the function and to test the sensitivity, specificity, accuracy and feasibility for application in the clinical setting.

Figure 1 Example of the successful segmentation process

<table>
<thead>
<tr>
<th>Original image</th>
<th>Detection Process</th>
<th>Result of Segmentation</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Original Image" /></td>
<td><img src="image2.png" alt="Detection Process" /></td>
<td><img src="image3.png" alt="Result of Segmentation" /></td>
</tr>
<tr>
<td><img src="image4.png" alt="Original Image" /></td>
<td><img src="image5.png" alt="Detection Process" /></td>
<td><img src="image6.png" alt="Result of Segmentation" /></td>
</tr>
<tr>
<td><img src="image7.png" alt="Original Image" /></td>
<td><img src="image8.png" alt="Detection Process" /></td>
<td><img src="image9.png" alt="Result of Segmentation" /></td>
</tr>
</tbody>
</table>

Keywords: Acute Lymphoblastic Leukemia, computer assisted image processing
EMRs- Towards a better User Interphase (UI)

Dr S B Gogia

President APAMI, President SATHI

ABSTRACT

• Background
Even while Moore’s law and fast connectivity has ensured faster processing and easy access, data entry remains the slowest link in value chain inhibiting growth of EMRs and its attendant benefits related to Meaningful use. Record keeping should be a pleasure and not a pain. Cost and labour of conforming to meaningful use requirements has more than offset the incentives being provided. EMRs are less used since data entry takes time out from genuine patient care. We have found that easing entries makes clinicians desirous to use an EMR as against manual entry or even dictation. The key is a faster and easier User Interphase (UI), which can cater to a wide range of individualized clinician’s needs. This gets eased whenever the clinicians themselves, like the current author, were involved in making the EMR. While making the complete solution is beyond the scope of most clinicians, easy customization conforming to individual needs is what can and should be provided.

• Objectives
Demonstrate a working solution wherein data entry is speeded up. Specialized Rheumatology as well as Plastic Surgery solutions are offered as an example.

• Methods
1. Identify clinician’s needs for a customized solution
2. User developed forms which includes terms they are familiar with
3. Easing Data reporting and Analysis through merging with Standards

We had initially made a generalized template for a few specialities and later expanded the scope to be configured to a more diseases. Once the user has identified the specific ICD10, a descriptive template conforming to the same crops up.

This is done through
- A generic content table with facility for term and attribute value pairs.
- Users create the front end field names matching the terms for which attribute is required
- Code compatible attribute lists are created by the user or preferably selected from SNOMED CT terms
- During data entry time, there is a choice of either of entry through single select or multi select drop down lists
- Once selections are complete, the name value pairs are placed as together as readable to text. These are searchable through simple SQL
- The system displays only user understandable terms.
- Use of Numeric codes – like those used in SNOMED we find are not preferred by clinicians at least in printed reports. If required they are at available at the backend.

• Results
In addition to minimal keystroke access and default entries, EMR adoption has been eased by vendor assisted but user created templates. Software use has resulted in a jump in patient turnover patient satisfaction as well as better research output. The methods developed for making data entry easier faster and easier has been appreciated. Such forms have helped us to widen the scope of our existing user base to newer specialities.

• Conclusion
A software that is not used can be deemed useless. Clinicians need to be involved in EMR creation for better adoption.
Impact of a QQ-based Virtual Health Paradise on reducing cardiovascular disease risk factors among healthy Chinese adults

Bin Li, Ying Wu

School of Nursing, Capital Medical University, Beijing, China

ABSTRACT

Objective
Peer education and support have become increasingly attractive as intervention strategies to combat cardiovascular disease (CVD) risk factors. Considering communication via Instant Messaging (IM) tools has become a main media for people to socialize, using QQ, a popular IM platform in China, we established ‘Virtual Health Paradise’ (VHP), an internet communication group to facilitate information exchange on healthy lifestyle. This study aimed to evaluate the effectiveness of VHP in the reduction of CVD risk factors.

Methods
Weekly face-to-face educational sessions regarding CVD and healthy lifestyle were offered to employees of a Chinese company in Beijing, China for four weeks. Based on two different work sites, employees who attended all educational sessions and possessed at least one CVD risk factor were blindly assigned into intervention group (IG) and control group (CG). After collection of baseline data (including demographics, lifestyle, perceived stress, CVD related physical examination and blood tests), interactive and personalized counseling on lifestyle modification and CVD risk factors was provided to IG via VHP. Utilizing personal experiences and strategies to establish and sustain healthy lifestyle were frequently shared within IG for 5 months, while CG had no access to VHP. Framingham risk score was introduced as the primary endpoint. The second set of data was collected at the end of the VHP exposure period.

Results
The mean age of 156 participants was 34±5.58 (Male: 63.5%, Female: 36.5%). All baseline data were comparable between CG (n=76) and IC (n=80). At the end of the study, the reduction of Framingham risk score in IG (-2.43) was significantly larger than in CG (-0.42, P <0.001). (Figure 1.) The chi-square test revealed that the abnormal rates of BMI, triglyceride, cholesterol and blood sugar in IG were significantly lower than those in CG (p<0.05). IG had significantly higher rates of having a more healthy diet and moderate exercise than CG (P<0.001). Contrary, no significant difference was found in CG when pre-post comparison was made.

Conclusion
QQ-based VHP could promote a healthy lifestyle and reduce CVD related risk factors.

Keywords: cardiovascular disease; Virtual Health Paradise; lifestyle; risk factors

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Conclusion
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Keywords: cardiovascular disease; Virtual Health Paradise; lifestyle; risk factors
Session 7: Electronic Health Record (EHR)

- **Session 7-1** The Overview of Free/Libre and Open Source Software in Medical Domain, from Asia and the World.
  - Shinji Kobayashi, Seong K. Mun

- **Session 7-2** Strengthen cancer surveillance in Sri Lanka by implementing Cancer Registry Informatics to Enhance Cancer Registry Data Accuracy, Completeness, and Timeliness.
  - Kamal Wasantha Kumara Seneviratne

- **Session 7-3** Determining Morbidity Pattern First Step Deal with Big Data via Electronic Health Record of Primary Healthcare in Indonesia
  - Dina Nur Anggraini Ningrum, Yu-Hsuan Shao, Chien-Yeh Hsu, Suleman Atique, Hanif Pandu Suhito, Yu-Chuan (Jack) Li

- **Session 7-4** An Viewing System for Health Check-up Result Report using FHIR, CDA IG, and MHD
  - Kim Min Gyu, Kim Dae Young, Il Kon Kim
The Overview of Free/Libre and Open Source Software in Medical Domain, from Asia and the World.

Shinji Kobayashi\textsuperscript{a}, Seong K. Mun\textsuperscript{b}

\textsuperscript{a} The EHR Research Unit, Kyoto University, Kyoto, Japan
\textsuperscript{b} Open Source Electronic Health Record Alliance (OSEHRA), Virginia, USA

\textbf{ABSTRACT}

Free, Libre and open Source Software (FLOSS) has been one of the key players of ICT development in the Internet era. Although, most of the OSSs have started form product by volunteer community, some FLOSS products have been developed by commercial companies for commercial uses.

In medical domain, FLOSS products were widely adopted and anticipated that have effects to reduce high cost of medical information system and to avoid ‘vendor-lock-in’. In Asia, Japan medical association has promoted their information infrastructure as FLOSS in the ORCA project from 2000, and AeHIN (ASEAN eHealth Information Network) declared to use FLOSS, DHIS2 and OpenHIE as their working base.

Nevertheless, there are much problem on the medical use of FLOSS, such as the sustainable business models. In this session, we review the current status of FLOSS in medical domain in Asia and the world, and discuss the future work on FLOSS for our benefit.

\textbf{Keywords:} FLOSS, Open Source Software,
ABSTRACT

Objective
A total of 13,635 new cancer cases had been diagnosed in 2007 with a crude cancer incidence rate of (CR) 68.0 per 100,000 population. There were 16,888 new cases diagnosed in 2009 with a CR of 82.6. It is evident that the cancer prevalence in Sri Lanka is on the rise. The National Cancer Control Programme (NCCP) of Sri Lanka was established in 1980 based on the recommendation made by WHO after a detailed study on mortality and morbidity of cancers in Sri Lanka. NCCP is the national focal point for prevention and control of cancers in the country. Sri Lanka Cancer Registry (SLCR) plays a pivotal role in cancer control and is maintained by NCCP. The value of a cancer registry depends on the quality of its data. Cancer control planning without high quality cancer registry data from the cancer registry leads to misplaced emphasis and wasting of investment. Since a considerable number of private health care institutions and government hospitals have started diagnosis and treatment of cancer patients, the necessity of using information technology in cancer surveillance domain to solve the problems for collecting, storing, processing, and analysing of cancer registry information received from those institutions have become absolutely essential in order to improve the data quality, accuracy and completeness.

Methods
Cancer surveillance informatics is the systematic application of information and computer science and technology to cancer surveillance practices, research, and learning. It deals with the resources, devices, and methods required to optimize the acquisition, storage, retrieval and use of cancer surveillance information for above mentioned purposes. Thus, using emerging technology to incorporate automated process and electronic data exchange in cancer surveillance business is an efficient, fast and cost effective way to obtain quality, accurate and complete cancer registry data. Therefore the new web-based application replaces the current paper-based method which covers about 80% of data collection and a standalone database system which covers remaining 20% of data collection. The basic software infrastructure will be based on Free and Open Source Software with the two-tier client-server system architecture.

Results
The system is able to capture real time cancer registry data from 09 provincial Oncology and Surgical Oncology units, 67 Histopathology and Haematology laboratories and 25 Oral and maxillofacial units. It will increases the efficacy in collecting, storing, processing and analyzing of data, improving data quality, accessibility, timeliness and completeness, reducing data redundancy, time, and resource consumption.

Conclusion
The system will ensure timely availability of cancer registry information that is needed for better improvement in cancer surveillance. Among the goals expected to achieve are: determine the incidence of cancers with respect to geographic and demographic characteristics, monitor trends and pattern of cancer incidence over time, identify high risk populations, provide data for epidemiological studies, and prioritize health resource allocations.
Determining Morbidity Pattern First Step Deal with Big Data via Electronic Health Record of Primary Healthcare in Indonesia

Dina Nur Anggraini Ningrum¹,², Yu-Hsuan Shao¹, Chien-Yeh Hsu³,⁴, Suleman Atique⁵, Hanif Pandu Suhito⁵, Yu-Chuan (Jack) Li¹,⁶

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ABSTRACT

Semarang City is a miniature of Indonesia with a population of 1.5 million citizens. Electronic Health Record (EHR) was implemented in 37 public primary healthcare centers (PHC) in 2004 with limited resources and new challenges. One of the major challenges after 12 years’ implementation of EHR is to analyze the morbidity pattern with big scale and velocity data.

- Objectives
  We determining the morbidity pattern by age and gender in the Semarang City via EHR data.

- Methods
  We used EHR data of 37 PHC’s from 2011-2014 comprising around 1.8 million visit records. After validation we got 1,632,782 valid visit records. We did descriptive analysis of prevalence rates based on ICD-10 [21 chapters] in each of 11 age group i.e. baby, child under 5 years old, 5-14, 15-24, …, till >85 years old and gender (male and female). We used Spearman Rank Correlation to determine the correlation between the prevalence rates of each ICD-10 chapter with the age group. We used Mann Whitney U Test to compare the prevalence rates of each ICD-10 chapter by gender. All of the analysis generated using SAS.

- Results
  The visit by patients was dominated by female (63.78 %) overall, especially in age 15 - 74 years old. The morbidity pattern has been shown in Figure 1. Diseases of the respiratory system are dominated in age range of 0-54 years old. Above the age of 54 years old, diseases of circulatory system are dominant. Diseases related with injury and external causes have presented significant differences between both gender. There are diseases groups which are not correlated with the age (diseases related with blood, mental and behavioral, ear, digestive system, pregnancy, injuries, and external causes). Diseases related with circulatory system, endocrine and metabolism, eye, musculoskeletal, neoplasms, nervous system, and genitourinary system have shown positive correlations with the age. Diseases related with skin, symptoms and findings, perinatal period, health status, infectious, respiratory system, and congenital malformations have been found to be negatively correlated with the age.

- Conclusion
  From this morbidity pattern we know which diseases groups are influenced by the gender and age. This information can be used in PHC as tool to predict the morbidity pattern and to help public health decision making based on gender and age to make future intervention and strategies.

Keywords: Public health informatics, morbidity pattern, primary health care, electronic health care, ICD-10
Figure 1: Morbidity Pattern in Primary Healthcare Semarang City, Indonesia 2011-2014

Table 1: Spearman Rank Correlation for Prevalence Rate of 21 ICD-10 Cluster and 11 Age Groups
ABSTRACT

Objective
Individual’s demand for self-health care is increasing with the advance of health care services. To meet the request, the Ministry of Health and Welfare, and National Health Insurance Service, Korea provides regular health check-up service for all the people over 40 years old. There are some major problems: health check-up result report by snail mail, transfer of the check-up result report to the healthcare service provider by patient themselves, no interoperability because of applications not compliant with standards. To solve these problems, we developed the mobile health service based on international health information exchange standards which helps the subject receive and view the check-up result report in both mobile and desktop environment.

Methods
The system consists of three components. Each component complies with each domain’s standards: HL7 CDA(Clinical Document Architecture) IG(Implementation Guideline) based on C-CDA(Consolidated-CDA) for Check-up Result, FHIR(Fast Health Interoperability Resources) for health data transfer using MHD(Mobile access to Health Document profile) and HTML5, CSS3 for CDA Viewing. The CDA IG supports up to entry level and refers to LOINC(Logical Observation Identifiers Names and Codes) for terminology standard. We use the CDA IG generation library developed in a previous our study. We adopted the Spring Framework for this mobile health server. The Server transfers this health check-up result report CDA to viewer application using RESTful services by MHD transactions and uses Bundle, DocumentManifest, DocumentReference resources specified by FHIR. The viewer is based on check-up result report format which the Ministry of Health and Welfare provides. The viewer displays this health check-up result report using XSL with HTML5 and Google chart library.

Results
The system may be operated in a series of processes such as clinical document generation, transmission and viewing. But for now, the service is only applied to the 1st general health check-up result report. This check-up CDA generator library and viewer are in testing and stabilization phase in Android Platform. This interoperable data in Health check-up result report is very valuable for the health big data analytics services. This system is being applied to the real data in HESEL related some hospitals.

Conclusion
We used the international standards for the system implementation such as CDA, FHIR, HTML5, etc. The system guarantees the interoperability of contents using standard document format and is platform independent. This system can serve as a data pre-processing for analyzing health data which is produced by standardized and structured data format. Using the same interface of standards-based data transmission method like FHIR, it is very useful in health care application ecosystem establishment. We will upgrade the system to support the 2nd general health check-up result report. The architecture of the system can be applied to other health care systems related to clinical data exchange. We are considering to applying not only national health check-up but also comprehensive health check-up done by hospitals.

Keywords: Health Check-up, HL7 CDA, HL7 FHIR, MHD Profile, Data Exchange
Session 8: mHealth for Connected Patient Care

- **Session 8-1** Improving Patients’ Medication Adherence and Lipid Level by Customized Short Message: a Six-Month Clinical Trial
  - Yisi Liu, Yang Gong, Yiran Li, Qiannan Zhang, Boya Yu, and Ying Wu

- **Session 8-2** Impact on Effectiveness of Chronic Disease Management in a Rural Hospital of middle Taiwan by a Case Management Information System
  - Mei-Chih Chen, Heng-Shuen Chen, Ching-Chu Liao, Chin-Yao Chen, Ting-Hsuan Chen, Pei-Chia Lo, Hung-Pin Hou, Yu-yuan Yu

- **Session 8-3** Remote Monitoring in Home Peritoneal Dialysis: Seamless User-centered Proactive Provision Of Risk-stratified Treatment in Peritoneal Dialysis (SUPPORT-PD)
  - Oommen J, Kazem R and VivekanaRR J

- **Session 8-4** Disruptive Innovation in mHealth: A case of Nutrition Monitoring from a LMIC
  - Pamod M. Amarakoon and Roshan Hewapathirana
Improving Patients’ Medication Adherence and Lipid Level by Customized Short Message: a Six-Month Clinical Trial

Yisi Liu\textsuperscript{a}, Yang Gong\textsuperscript{b}, Yiran Li\textsuperscript{a}, Qiannan Zhang\textsuperscript{a}, Boya Yu\textsuperscript{a}, and Ying Wu\textsuperscript{a},

\textsuperscript{a} School of Nursing, Capital Medical University, Beijing, China
\textsuperscript{b} The University of Texas Health Science Center, Houston, USA

ABSTRACT

\textbf{Objective}
To explore the effect of customized short message service (SMS) over six months on medication adherence, lipid level, and clinical outcome of patients with acute coronary syndrome (ACS) after percutaneous coronary intervention (PCI).

\textbf{Methods}
In this clinical trial, patients with ACS after PCI were randomly assigned into an intervention group and a control group. A health educational kit, based on ACS secondary prevention guideline, was designed with five themes, i.e. medication, lipid, exercise, diet, smoking and drinking. A SMS pool was generated on the basis of the health education kit and customized for each study subject according to his/her geographic data and health history. Participants of the intervention group received one individualized SMS per week, 24 SMS in total over six months. No SMS was sent to the control group. Primary outcomes were measured at the baseline and sixth month, including medication adherence measured by Morisky Scale, lipid level by intravenous blood sample, readmission rate, and cardiovascular events, comprised of the occurrence of unstable angina, ST-segment evaluation myocardial infarction, non-ST-segment evaluation myocardial infarction, and coronary revascularization.

\textbf{Results}
68 patients completed the entire follow-ups, with 34 in each group. No significant difference was observed in baseline geographic and clinical characteristics (age, gender, education, medical history, etc) between two groups. After six-month SMS intervention against the control group, the intervention group exhibited higher medication compliance (59.4\% vs 90.60\%, \(P=0.004\)), borderline lower triglyceride level (1.67±1.04 vs 1.27±0.50 mmol/l, \(P=0.061\)), and a downward trend in the occurrence of CV events (40.60\% vs 21.90\%, \(P=0.106\)). Pre-post test showed low density lipoprotein cholesterol (LDL) level was significantly lower than the baseline in the intervention group (2.02±0.67 vs 1.83±0.56, \(P=0.027\)), while no difference was observed for the control group. See Figure 1.

\textbf{Conclusion}
Continuous customized SMS could help patients with ACS after PCI improve medication compliance and better manage their dyslipidemia. Smart SMS platform with customized SMS appears valuable in CVD secondary prevention. Effects longer than 6 months are worth further investigations.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{fig1.png}
\caption{Effects of six months SMS on medication adherence, TG, and LDL. TG=triglyceride; LDL=low density lipoprotein cholesterol}
\end{figure}

Keywords: Short Message Service; Medication Adherence; Cholesterol; Acute Coronary Syndrome
Impact on Effectiveness of Chronic Disease Management in a Rural Hospital of middle Taiwan by a Case Management Information System

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ABSTRACT

Morbidity compression hypotheses burden of lifetime illness may be compressed into a shorter period before the time of death. So healthcare should be started at an earlier period in elderly and chronic diseases. In this study a case management information system for chronic diseases was developed in Puli Christian Hospital using cloud computing technology to monitor checking points and quality index, and provide automated reminders for instant medical management.

- Objectives
The purposes of this study are to 1. understand the impact on time efficiency of chronic disease management by case manager, and 2. understand the impact on chronic disease complication (diabetes mellitus as an example) after introduction of the case management information system.

- Methods
First, time duration of chronic disease case management of each patient and the total patient visits in 2014 before introduction of case management information system and after in 2015 were measured. Second, diabetic patients received medical care in Puli Christian hospital from 2014 to 2015 were retrieved and divided to managed group included in case management information system and non-managed group which was not included. Statistic analysis with SPSS20 were performed including complete rate of fundus examination and percentages of diabetic complications including retinopathy, peripheral neuropathy, cataracts, peripheral vasculopathy and nephropathy.

- Results
In 2014 the number of patient visits to a case manager was 1,779. In 2015 after system launched, the number of patient visits became 1,900 with increase of 121, and the average duration of visit was 2.4 minutes less than in 2014. 73 hours was saved per case manage after using information system. In addition to the time efficiency, case managers could expand their service from one disease to two diseases. With integration and transparency of the system, case manager can understand the overall health condition of the patients and share health information with other medical professionals to achieve effective communication and holistic health care. From 2014 to 2015, 1,764 diabetic patients received regular medical care in Puli Christian Hospital divided to managed group 886 and non-managed group 878. The average age was 63.34 and 51.8% of them are male. Statistics analysis revealed relative higher retinopathy 16% (P <0.001) in managed group, however the complete rate of fundus examination 28.9% (P <0.001) was even higher.

- Conclusion
Chronic disease patients in rural areas would have more complications due to relative poor access to medical resources. Case management is important for morbidity compression in chronic diseases, however time consuming and complicated care flow for multiple diseases management are burdens for case managers. Introduction of case management information system can not only reduce the service time for each patient visit but also enhance the complete rate of examinations for disease complications by automatic reminders especially useful in rural area.

Keywords: chronic disease, case management information system, reminder, effectiveness
Remote Monitoring in Home Peritoneal Dialysis: Seamless User-centered Proactive Provision Of Risk-stratified Treatment in Peritoneal Dialysis (SUPPORT-PD)

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2_ The George Institute for Global Health UK, University of Oxford, UK
3_ The George Institute for Global Health India & James Martin Fellow, Oxford, UK

ABSTRACT

◆ Objective
To design a remote health monitoring and non-pharmacological self-management system that has good usability among home based peritoneal dialysis patients using a mobile application. Approximately 200,000 Indians develop end stage renal disease each year. As in many parts of the world, hospital-based hemodialysis is still the main modality of treatment for patients with ESRD. Reduced frequency of contact with healthcare providers is considered to be a barrier to more widespread use of home-based dialysis therapies. Home monitoring using smartphone enabled health solutions will allow early recognition of problems, reduce morbidity and improve treatment adherence in patients on peritoneal dialysis (PD).

◆ Methods
Low and high fidelity qualitative usability feedback was collected from PD patients by semi-structured interviews. User needs and perspectives on PD were transcribed into software requirement specifications, which was used for the solution design. Prototype application screens were built using Java eclipse and deployed on 10-inch Android tablets, respondents asked to evaluate the functionality and features, with iterative refinement of features. The mobile interface was build an android native application with support for android 5.1, SQLite database and AnD APIs for interfacing with external blood pressure monitors. Web services were built using the bootstrap framework, with PHP and MySQL for the server side. The application has been built to ensure intense engagement by the patients and highly interactive step by step decision support to ensure compliance to treatment guidelines and feedback in case of any complications or deviations in the parameters such as weight / BP / Fluid balance.

◆ Results
We present the end user defined design approaches, technological design and preliminary evaluation of the SUPPORT PD application. A total of 10 patients (mean age 60 years, time on PD 2.5 years) on peritoneal dialysis at two centers in India (Delhi and Hyderabad) were engaged in the usability reviews. All respondents were satisfied with PD, reasonably independent and managing their therapy. Current practice included record of fluid intake, output and number of exchanges. Patients appreciated the value of a remote monitoring tool and described the desirable features (exchange details, detect complications, guidance of changes in therapy, ease of input, ability to review progress on certain parameters, alerts for impending complications, automatic information to treating team and educational materials). About 60% responded that they would use the device themselves, others would be supported by the immediate caregiver. The study is currently ongoing and recruiting subjects for home based monitoring while on PD.

◆ Conclusion
Patient centered M-health Interventions are feasible and considered of value by patients on home-based dialysis. Engaging with the end-users early in the design process gave us insights on patient preferences for home based monitoring. We propose to expand the SUPPORT PD application to other chronic diseases and evaluate usability and user acceptance to provide a comprehensive continuum of care.

Keywords: Remote health monitoring, m-health, clinical decision support, chronic diseases
Disruptive Innovation in mHealth: A case of Nutrition Monitoring from a LMIC

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ABSTRACT

Objective
Malnutrition has been a major public health concern in Sri Lanka, and all Low and Middle Income Countries (LMIC). Care for malnourished children in Sri Lanka is provided primarily at field level by Public Health Midwife (PHM). Paper based collection of data at field level is currently used to generate nutrition information. This result in major data quality issues, especially related to multi sector collaboration needed in nutritional interventions. The objective of the study is to introduce Disruptive Innovation (DI) to current information flow to improve the process in long run.

Methods
The DI is the process of developing new products or services to replace existing technologies and gain a competitive advantage. With the DI principles in mind, an Android based mobile application was developed with primary aim of registering malnourished children, routinely following up their nutritional parameters at field level and assessing risk factors at households leading to malnutrition. The aim of this approach to challenge the conventional paper based record systems as well as Desktop based data collection. The implementation was followed by series of focus group discussions (n=540).

Results
Several major issues of the traditional paper based system were revealed by PHMs even though this was not in the agenda of higher officials. The mHealth approach was not only challenging the paper based records, but also a paradigm shift from the desktop based electronic data gathering taking the data collection process to the field level. PHMs were of opinion that use of smart phone for data entry was a value addition for their job role with a better social recognition, apart from the new functionalities for real-time nutrition monitoring and improved mobility compared to desktop applications.

Conclusion
It was evident that the mobile technology could be used as a DI approach in State health sector of LMICs despite the resource limitations. mHealth challenges both the paper based record systems as well as Desktop based data collection. Even though the initial cost of mHealth solutions may be higher, mobile devices have the advantage of a potential DI candidate for the mobile phone being able to use for multiple purposes beyond mere data collection.

Keywords: Disruptive Innovation, mHealth, Child Nutrition Monitoring, LMIC
Session 9: (APAMSI Section) Public health & National Health Strategy

- **Session 9-1** History of Health IT in Japan: Invitation to IMIA's 50th anniversary  
  - Michio Kimura

- **Session 9-2** Climate & Health Innovation for Subsustainable Smart Cities  
  - Adam CHEE

- **Session 9-3** The development and implementation of Stroke risk prediction model in National Health Insurance’s Personal Health record  
  - Jae-Woo Lee, Hyun-sun Lim, Dong-wook Kim, Kyung-Hee Cho

- **Session 9-4** Dialysis Outcomes in India:  
  An online clinical outcomes registry for dialysis outcomes, lessons learned and opportunities for scale up  
  - Oommen J, John K and Vivekanand J

- **Session 9-5** State of Management Information System (MIS) in Tertiary Care Hospitals in Pakistan  
  - Suleman Atique, Abdallah Ahmed Elbakkoush, Syed Muhammad Mursalin, Ting-Wu Chuang, Chien-Yeh Hsu, Shabbir Syed Abdul
**ABSTRACT**

- **Objective**
To record Japan’s history of health IT, also for the purpose of inviting other APAMI members participation to IMIA 50th Anniversary publication and special session at MEDINFO 2017 Xiamen.

- **Methods**
Tokyo University, Chiba University, Hamamatsu University, and Ministry of health had materials. Prof. Kaihara summarized the 1994 situation with issues to be solved.

- **Results**
IT in healthcare in Japan started in 70’s, as an automation of hospital work. It started at some departments, such as pharmacy, laboratory, and accounting, all of which are by standalone computers. Tokyo University Hospital started pharmacy claim messaging in 76, a first case of connections between departments.

In 1980, MEDINFO80 was held in Tokyo, with Prof. Roukins as IMIA president and Prof. Collen as SPC chair. In these years, order communication system was starting to be introduced. Also some trials to record patient charts were found in the conference contents.

In 1985, Chiba University Hospital started recording lab chemical results from the order entry system with some clinical findings. The data can be retrieved now in 30+ year history chart. Also, in 80’s, radiology examination images became available outside of radiology department as PACS. In 1988, first hetero-vendor connection between GE CT and Toshiba PACS was implemented conforming ACR-NEMA standard (now DICOM as version 3).

In 90’s order entry system became popular. Then, Kameda General Hospital, Kochi Medical University are the first runners of electronic medical records.

- **Conclusion**
Following are the issues raised by Prof. Kaihara in 1994, and my ratings now.

  - Exchanging needs and seeds among user, vendor, government (B+)
  - Public recognition that “Soft is mightier than the Hard” (C-)
  - Standardized codes, messages, protocols (B+)
  - Reimbursement premium on information exchange between providers (B-)
  - EMR, instead of papers, films (B+)
  - Medical record given back to patients (C+)

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**Keywords:** History, IT in Healthcare, IMIA 50th anniversary,
Climate & Health Innovation for Substainable Smart Cities

Prof. Dr. Adam CHEE
President, Association for Medical and Bio-Informatics, Singapore (AMBIS)

ABSTRACT

Category
• Public health & National Health Strategy
• APAMI Session

Climate change brings forth environmental consequences affecting clean air, safe drinking water, food supply and secure / safe shelter, all of which are factors affecting (directly and/or indirectly) the physical, social, and psychological health of humans.

Rapid urbanisation with poor urban planning had without doubt, played a key role in exacerbating the problem. However, with the advent of Smart Cities, one can take the opportunity, not only to mitigate direct damages to health caused by climate change but also to reduce the damage (such as lowering emissions of greenhouse gas) by turning “cities as problems” into “cities with as solutions”.

This presentation aims to address how Smart Cities can adopt effective Public Health Informatics with Digital Health(care) as part of their health strategy to ensure health sustainability and effective outcomes.
The development and implementation of Stroke risk prediction model in National Health Insurance’s Personal Health record

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², Department of Policy Research Affair, National Health Insurance Service Ilsan Hospital, Goyang-si, Republic of Korea

ABSTRACT

• Objective
The National Health Insurance Service (NHIS) in Korea which owns the entire national health examination data is providing the Personal Health Record service called My Health Bank in the health information website - Health iN (http://hi.nhis.or.kr/main.do). The purpose of this study is to upload the stroke prediction model based on NHIS data to the disease prediction program of My Health Bank.

• Methods
After constructing the data set come from national general medical examinees of 6,885,789 people (male 3,816,231, female 3,069,558) in 2002 - 2003, it identified when stroke (ICD-10 criteria) was first diagnosed among the inpatient and outpatient until 2013, then developed a 10-year predicted probability and estimated the stroke prediction model using Cox’s proportional hazard model.

• Results
Risk factors in stroke risk model, include the age, the square of the age, BMI, cholesterol, blood pressure, blood glucose level, smoking status and intensity, physical activity, alcohol intake, past history (hypertension, coronary heart disease, stroke) and family history (stroke, coronary heart disease). The AUC values of stroke risk prediction model from the external validation data set were 0.827 in men and 0.822 in women, which showed a high predictive power. The predicted values of Hosmer and Lemeshow’s $\chi^2$ test were 186.19 in man and 111.21 in women showing little difference between observation probability and predicted probability. Using a risk prediction model of stroke, this study calculated the national health examination data automatically read and uploaded it’s results to Health iN website while developed the algorithm to provide a personalized message on the basis of each user’s data. In addition, it developed a lifestyle correction message about the stroke risk factors that required improvements.

• Conclusion
This study developed the stroke risk prediction program based on the nation medical examination results. By doing so, it intended to more effectively give medical users the motivation of health management and to induce changes in their health behaviors.

Keywords: Stroke risk, Risk prediction model, national health data.
Dialysis Outcomes in India: An online clinical outcomes registry for dialysis outcomes, lessons learned and opportunities for scale up

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2. The George Institute for Global Health, Sydney Australia (On behalf of Study coordinating group)
3. The George Institute for Global Health India & James Martin Fellow, Oxford, UK

ABSTRACT

Objective
There is limited systematic data on clinical outcomes and economic impacts of maintenance dialysis for end stage kidney disease (ESKD) in India and other emerging economies. To follow up patients commencing hemodialysis at two North Indian nephrology centers prospectively for 12 months using a cloud based open source electronic data capture tool to study the clinical and economic outcomes.

Methods
A web based electronic data collection and project monitoring tool was developed using the OpenClinica platform. Baseline demographic and clinical outcome data were collected comparable to those recorded by established dialysis registries as well as data on direct, indirect costs and economic impact on the patient and family. (include the setting for the study, the subjects, and the type of statistical analysis; if references are needed, they should be given in the text)

Results
Here we present the technological design and implementation of the online data capture tool for establishment of the dialysis clinical outcomes registry and results of the 6 month interim analysis. A total of 119 patients (82 male, 37 female) have been enrolled thus far, 70 at a public hospital (Chandigarh) and 49 at a private hospital (Delhi). Median age at enrollment was lower at the public hospital compared to the private (37.5 yrs versus 60 yrs). Baseline Median monthly income was USD$90 at the public hospital and USD$377 in the private hospital. Of the 94 patients at the 6 month interim analysis, 18 (19%) have died, 19 (20%) have been transplanted, 47 (50%) remain on dialysis and 10 (11%) patients have discontinued dialysis. Median total monthly expenditure for dialysis was USD$231 in the public hospital and USD$1526 in the private hospital.

Conclusion
Establishing a clinical outcomes registry for those on renal replacement therapy for end stage kidney disease is feasible and using electronic data capture tools allows real-time subject follow up, multicenter participation and centralized monitoring. Our study found that relatively young Indian dialysis patients have high mortality and dialysis discontinuation rates but also a high rate of transplantation. Costs were high relative to income and are likely to impact upon ongoing treatment decisions and survival. The high and ongoing nature of such costs pose particular challenges to how risk protection programs are designed, particularly given the limited capacity to pay of its beneficiaries. Our experiences and the tools developed could be shared within the APAMI partner institutions many of whom face significant burden on the health system due to end stage kidney disease.

Keywords: Web-based data collection, Clinical Registry, Open Source Platforms, Clinical Outcomes Monitoring
STATE OF MANAGEMENT INFORMATION SYSTEM (MIS) IN TERTIARY CARE HOSPITALS IN PAKISTAN

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ABSTRACT

● Objective
Objective of this study is to review the existing situation of data collection, processing, analysis and use of information in major tertiary care hospitals (TCH’s) across Pakistan. Ultimate aim is to design guidelines for an effective hospital management information system (HMIS) compatible with the requirements of the healthcare system.

● Methods
A cross sectional survey was done in different public sector TCH’s of Punjab and Islamabad. The method to collect data involved visits, interviews and distribution of pilot tested questionnaires. Before the questionnaire distribution it was reminded to each respondent regarding the questionnaire and asked about the issues that they might experience. Eight public sector TCH’s were randomly selected and contacted. The data obtained was entered and analyzed by SPSS-17.

● Results
Being the provincial capital and the most populous city of Punjab, 4 hospitals were selected from Lahore. Whereas 2 hospitals were included each from Rawalpindi and Islamabad. It was observed that all the hospitals had HMIS/statistical units, responsible for data collection and analysis. Despite availability of MIS Unit in all the hospitals there is no MIS management committee found in any. In 6 of hospitals more than 100 computers were available for the use of HMIS. Among them, PIMS Islamabad possessed the maximum number of computers i.e. 300. Whereas in the remaining 2 hospitals this is less than 100.

Specifically for HMIS/Statistical Unit the number of computers is 15 or more in 6 hospitals, whereas less than 15 in remaining 2 hospitals. It is found that out of 8, 4 of the surveyed TCH’s had a proper list of indicators on which data is being collected. It is found that supervisors visited the hospitals during the last three months in four hospitals but no such visit is recorded made in other four. Regarding what was discussed during the supervisory visit it was observed that they discussed hospital performance and data reports in 4 hospitals but not in others.

● Conclusion
All the TCH’s visited had an MIS Unit adequately staffed. Most of this staff are statisticians and from IT. Hospital had some kind of data collection and processing systems, and the efficiency and appropriateness varied among hospitals. There is no consistency or standardization of data elements among the hospitals. Each one has developed its own system without due consideration of others. Authorities are unable to make any sense out of this data. In almost all these hospitals there is no MIS Coordination committee as well as proper data backup system, with one exception. In general tremendous interest, motivation and was shown both by Hospital, MIS Units and Health Managers for the improvement of their MIS. It can be concluded that if technically supervised, there is sufficient knowhow and expertise among staff of hospitals for developing a proper MIS. MIS has a lot to offer to improve healthcare services in Pakistan.

Keywords: Tertiary Care Hospitals, Hospital, Management Information System, Pakistan
Session 10: Mobile Health Application

- **Session 10-1** Experience and Preference Factor Analysis for pediatric obesity management mobile app  
  - Jisan Lee, Meihua Piao, Ahjung Byun, Hyeonsuk Lee, Kyung Ryeon Kwak, Jeongeun Kim

- **Session 10-2** Efficacy of Health Management in Rural Area affecting by a Personal Health Records System with Classification Algorithms  
  - Hung-Pin Hou, Heng-Shuen Chen, Ching-Chu Liao, Chin-Yao Chen, Pei-Chia Lo, Mei-Chih Chen, Yu-yuan Yu

- **Session 10-3** Analysis of a mobile electronic medical record usage pattern: User interaction and evolution  
  - Yura Lee, Jeong Hoon Kim, and Jae Ho Lee

- **Session 10-4** Utility of mobile apps in smoking cessation: A literature review  
  - Shwetambara Kekade, Shabbir Syed Abdul, Yu-Chuan Li
Experience and Preference Factor Analysis for pediatric obesity management mobile app

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ABSTRACT

Objective
The obesity rate of elementary school students in Korea (based on body mass index [BMI]) is 20.6% [1]. Smartphone ownership rates are increasing among children, with 72.2% of elementary school students in Korea [2]. For an effective pediatric obesity management, some interventions have utilized mobile technology [3-4]. However, the factors of mobile design for managing pediatric obesity have not yet been fully defined. The present study attempted to clarify the experience and analysis of preference and needs about mobile app for managing pediatric obesity (MAMPO).

Methods
Overweight or Obese high-grade elementary school students were included as subjects. The researcher explained the purpose of the study to the principals and the school nurses of schools in Busan. The nurse-teacher explicated our study's purpose to students then they took the content to their parents. Consented participants then completed a questionnaire comprised of children's experience about smartphone app and preferred method and UI for managing weight. We assessed whether a student wants to participate in making a mobile application for pediatric obesity management. Statistical analysis was performed using the Mann-Whitney U test and Kruskal-Wallis H test.

Table 1: The result of analysis of experience and preference of the overweight and obese elementary school student

<table>
<thead>
<tr>
<th>N=350</th>
<th>MAMPO experience</th>
<th>Partner Preference</th>
<th>Method Preference</th>
<th>Character Preference</th>
<th>App Preference</th>
<th>Mobile app Needs</th>
<th>Intention to use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Grade</td>
<td>Z</td>
<td>-0.776</td>
<td>-0.395</td>
<td>-1.632</td>
<td>-2.811</td>
<td>-2.369</td>
<td>-1.642</td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>0.438</td>
<td>0.693</td>
<td>0.103</td>
<td>0.005*</td>
<td>0.018*</td>
<td>0.101</td>
</tr>
<tr>
<td>Gender</td>
<td>Z</td>
<td>-2.793</td>
<td>-2.546</td>
<td>-2.523</td>
<td>-0.971</td>
<td>-4.932</td>
<td>-1.502</td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>0.005*</td>
<td>0.011*</td>
<td>0.012*</td>
<td>0.331</td>
<td>0.000*</td>
<td>0.133</td>
</tr>
<tr>
<td>BMI</td>
<td>Z</td>
<td>-0.141</td>
<td>-0.346</td>
<td>-0.085</td>
<td>-0.816</td>
<td>-0.168</td>
<td>-0.196</td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>0.888</td>
<td>0.730</td>
<td>0.932</td>
<td>0.414</td>
<td>0.867</td>
<td>0.845</td>
</tr>
<tr>
<td>School Level</td>
<td>Z²</td>
<td>3.696</td>
<td>5.180</td>
<td>1.431</td>
<td>10.758</td>
<td>1.198</td>
<td>8.884</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>0.296</td>
<td>0.159</td>
<td>0.698</td>
<td>0.013*</td>
<td>0.753</td>
<td>0.031*</td>
</tr>
</tbody>
</table>

*: p < 0.05
Results
We recruited 423 overweight and obese students in 11 elementary schools and 311 students had their own smartphones. The response rate is 82.7% (n=350). There are 199 overweight students (56.9%) / 151 obese students (43.1%) and 185 Girls (52.9%) / 165 Boys (47.1%). The participants consisted of 184 fifth-grade (52.6%) / sixth-grade (47.4%) and four school levels (A=9.4%, B=38.4%, C=46.3%, D=6.0%). Students who want to participate in designing the mobile application for pediatric obesity are 184 (52.5%). Gender mostly influenced in mobile app experience, partner preference, weight control method preference, character preference, mobile app preference, needs of app, and intention to use. Moreover, the results revealed that the student’s grade and school level showed greater difference in needs of app, preferred character, and preferred App (Table 1).

Conclusion
The purpose of this study is to analyze the elementary school students’ experience and preference for MAMPO. As a result, gender mostly influenced in experience, preference, needs, and intention to use of MAMPO. The main strengths of this study are that we recruited 372 overweight or obese students in 11 elementary schools and revealed their preferred factors and needs of managing weight by smartphone. However, there are two limitations about this study. First, this study was performed only in Busan. Second, we included the data of whom agreed to participate in our study. There is a possibility only positive data were included. In future studies, overweight or obese student’s parents can be included to compare with their children’s experience and preference. Furthermore, we recommend designing a mobile service that contains factors which elementary school student prefer.

Keywords: Pediatric Obesity, Mobile Applications, Body Mass Index, Surveys and Questionnaires
Efficacy of Health Management in Rural Area affecting by a Personal Health Records System with Classification Algorithms

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ABSTRACT

As healthcare services of the aging society become more complicated, Health management with comprehensive personal information become more and more important. In Taiwan the high prevalence of diabetes mellitus and multiple complications is a major health management issue related to escalating medical cost and complicated problems causing morbidity and mortality.

- Objectives
Because the difficulty of recruiting healthcare professional at rural area, a personal health records (PHR) system in Puli Christian Hospital was designed and launched in 2014 to assist case managers in their health management work for achieving better care quality.

- Methods
In this study, we focused on the analysis of diabetic cases enrolled in the PHR system using classification algorithms to retrieve patients with abnormal condition. The system may remind the case managers to perform specific intervention according to guideline for standard operation procedure.

- Results
The results showed significant difference of the HbA1c changes among patients who were enrolled by the health management PHR system or not during two years periods from 2014 to 2015. The patient managed by health management information system received crucial intervention activities continuously followed by frequent exploration with classification algorithms in their PHR. Besides, another benefit from the information system was to reduce paper work and save work loading.

- Conclusion
In this study health management using a PHR system with classification algorithms could effectively control chronic diseases and provide comprehensive health management. Especially in rural area intelligent health management system could bridge the gap of insufficient healthcare professionals.

Keywords: personal health record, health management system, case management, data mining
Analysis of a mobile electronic medical record usage pattern: User interaction and evolution

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ABSTRACT

\textbf{Objective}

72% of doctors in the United States already own a smartphone. The high penetration of smartphone could have thinking about bed side tool in hospital. A mobile electronic medical record (EMR), called as mAMIS (Mobile Asan Medical Information System), was developed at Asan Medical Center, November 2010 and distributed to 900 hospital staffs. Analysis of access logs and service logs was done. We will analysis the log data of the mAMIS usage pattern, to figure out user interaction and the direction of evolution.

\textbf{Methods}

mAMIS is a mobile EMR viewer which provides electronic medical records via smartphone. The major services of mAMIS are including patients list (in-patient, emergency department, consult), detailed clinical information (vital signs, blood sugar levels, alert information), order list, laboratory results, radiologic results, medication orders and drug information. Currently, 3,859 clinician and health care providers are using mAMIS. The logs for the selected services were collected as described below. The mAMIS logs were collected from December 2010, when the app was first released, to December 2015.

\textbf{Results}

63% of users were nurse (2,333), followed by 30% of doctors (1,102) and others (pharmacists, health care assistants) (Fig.1-a). In doctor group, more than half of the users were trainees (59%, 649/1,102). For daily log from March 2012, total count of users and log-in were kept increasing, and for the daily usage, the mean user count was 438.3 and mean log-in count was 1044.9. The service usage pattern of doctors and nurses are shown in figure 3. In total, 5,233,592 logs and 1,561,216 logs were checked in nurse group and doctor group. In Both group, patient lists were frequently used. In nurse group, services for order information and nurse EMR were frequently used. In doctor group, services for patient exams and their results were frequently used. 7-8AM and 4-6PM, same times of doctor’s rounds, were highly accessed times. And in nurse group, two peaks were shown around 12 pm and 20 pm, one or two hours before hand-over time of nurses. And those peaks were corresponded to the peaks of out-hospital usage.

\textbf{Conclusion}

A mobile EMR has been used successfully at Asan Medical Center until now. As the patterns of usage were correlated with the workflows of different working group, doctors and nurses, it represents that mAMIS is working its unique role for efficient workflow.

Keywords: Smartphone application, mobile electronic medical record, usability
Utility of mobile apps in smoking cessation: A literature review

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ABSTRACT

Objective
Smoking is one of the major causes of preventable death globally. A number of mobile applications are currently available to promote health by quitting smoking. The purpose of the study was to determine the behavioral changes and the benefits of mobile applications in smoking cessation.

Methods
We searched the keyword “mobile apps for smoking cessation” in the following databases: Pubmed, Sage, Scopus and Science Direct. A total of 348 articles were found. We included those articles which were published in last five years and described the mobile applications for smoking cessation. The comparative studies and review articles were excluded.

Results
After screening of titles, 48 articles were selected, from which we chose 11 articles following abstract screening. The duplicate articles were removed and finally 7 articles were included in the study. Three articles stated that the mobile app was beneficial in aiding to smoking cessation, whereas two articles mentioned about the insignificance of the apps in quitting smoking; one article stated that the app had not yet been tested and one article mentioned about ongoing clinical trial.

Conclusion
Smoking, being a cause of a number of diseases, numerous apps have been developed in recent years to encourage its withdrawal. Our study shows that mobile apps are beneficial for behavior changes and eventually quitting smoking to some extent. The apps possess different features such as motivation, inspiration, avoidance and distraction with an approach to smoking cessation. Although, most of the apps are found to be user friendly, major issues arise due to the lack of personal interest and motivation to quit smoking. A game app has been used for distraction, but it faced the constraint of user frustration. Another reason for the non-beneficial nature of apps is the small number of individuals or small duration of study. Feasibility of smoking apps depends upon a number of factors such as its ease to use, individual urge to quit, the duration of use, motivation and inspiration from others and so on. However, our study faces the limitations of small number of articles describing the apps for smoking cessation. Future studies and clinical trials on a large scale are suggested for further implications.

Keywords: mobile apps, smoking cessation, quit smoking
Session 11: Artificial Intelligence in Medical Informatics

- **Session 11-1** Evaluating the effectiveness of distributional hypothesis and chunk tagging schemes: a case of HMM for clinical named entity extraction
  - Wangjin Yi, Jinwook Choi

- **Session 11-2** Coordinated Markov Modeling of Cancer Metastasis from Multiple Primary Sites
  - Hyunggu Jung, Anthony Law, Esther Wu, Mark E. Whipple

- **Session 11-3** Structuralization of Variance Text Records in Clinical Pathway
  - Takanori Yamashita, Yoshifumi Wakata, Hidehisa Soejima, Naoki Nakashima, and Sachio Hirokawa

- **Session 11-4** Identify Factors Affecting Successful Ageing in Elderly Diabetics in Shiraz Using Data Mining Approach
  - F. Izanloo, M. Nasiri, A. Aslani, M. Hajipour, A. Pakdaman, H. Ghaem, M. Shafiee
Evaluating the effectiveness of distributional hypothesis and chunk tagging schemes: a case of HMM for clinical named entity extraction

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², Department of Biomedical Engineering, College of Medicine, Seoul National University, South Korea

ABSTRACT

Objective
This study presents a validation process that helps understand the effect of distributional structure and entity boundary information in information extraction by implementing a specialized topology in HMM (hidden Markov model). This study is done for the purpose of verification of some configurations (i.e., distributional structure, tagging scheme) considered natural in clinical name entity extraction domain. The distributional structure is a form of the distributional hypothesis which suggests that words are characterized by their neighbor words; in other words, words sharing similar neighbors tend to be classified similarly. Representing contextual information of an entity, the distributional structure is a feature type which is generally used in machine-learning based named entity recognition model. Also, BIO tagging scheme, which marks the beginning of an entity boundary, is commonly used to represent chunks of an entity in a text. This paper empirically studies the reason why distributional structure improves the efficiency of information extraction, in addition, evaluates the effectiveness of different tagging schemes.

Methods
This study evaluated the performance of multiple topologies of hidden Markov models. Sequence labeling model is a general choice for a named entity recognition task. Even though conditional random fields, which is one of sequence labeling models, is empirically proven state-of-the-art method, we chose hidden Markov model because the parameters of the model are probability matrices and these parameters are interpretable for a human. So it was easy to be observed how the distributional structure influences the model. And also, it is easy to implement. Observation in both training and test instance was set as sequences of unigram symbols. The topologies of HMMs are basically designed by following tagging schemes such as IO, BIO, and BIEO. IO scheme encodes a boundary of a target entity by a sequence of a single state (i.e., ‘I’) and uses ‘O’ to represent background information (outside of target entities). BIO tagging scheme particularly assigns ‘B’ to the beginning of an entity. BIEO is derived from, which adds ‘E’ tag to represent the ending of an entity. The topologies are expanded by adding ‘prefix’ and ‘suffix’ states for the preceding one and the following one of entity state respectively. Under the setting of using unigram symbol, we wish that the prefix and suffix state provide context information which is a distribution of neighbor word and cannot be implemented in an HMM clique.

In our designed HMM topologies (Fig. 1), transitions between states are partially connected. The transition from background to both target entity and suffix state is suppressed, also, the transition from target entity to both prefix and background is suppressed. The named entity recognition experiment was performed on three named entity recognition task data set; A) i2b2 2010 clinical event identification data set. The data set consists of 394 electronic discharge summaries and progress notes which are used for the training set in i2b2 2010 NER challenge. The notes are obtained from multiple hospitals in the United States. The target entities are annotated for medical problems, tests, and treatments. B) Electronic clinical discharge summaries obtained from Seoul National University Hospital (SNUH) in South Korea. The data set consists of 200 discharge summaries of rheumatic patients who discharged in a period (2013~2014) from the hospital. The annotated information is for medical symptoms/signs, tests, diagnosis/disorders, medications, procedures, visit information (hospital, department or verbal (action) expressions). C. Seminar Announcement information extraction data set from Carnegie Mellon university (CMU) electronic board. This data set is used for validation of our model in a general NER task. It consists of 485 documents and the annotation includes location, speaker, starting time (stime), and ending time (etime).

Results
The datasets were split into training and testing parts (3:1 for i2b2 2010 and SNUH, and 1:1 for CMU). HMMs were trained by supervised learning. HMMs were built for each target entity and tagging schemes ‘IO’, ‘BIO’, ‘BIEO’, and ‘BIOE+prefix/suffix states’, and the learned models were evaluated on the three datasets.
Table 1 shows the evaluation result (F1-score). According to the result, ‘Prefix’ and ‘Suffix’ states effectively improves the performances in every case. In particularly, the prefix/suffix states improve Recall performance. Given the test data that includes an amount of previously unseen words, the inference power of the ‘BIEO+prefix/suffix’ model was augmented by the prefix/suffix states.

To verify the reason of the model’s performance improvement by the ‘prefix’ and ‘suffix’ states, we observed the inside of the Viterbi lattice for ‘Speaker’ entity where unseen words are most prevalent. We synthesized a possible snippet of an observation, ‘lecture who: Arnold’ ‘Arnold’ is the previously unseen word in test time, and ‘who:’ is a symbol frequently preceding ‘Speaker’ mention. In IO tagging scheme, the symbol, ‘who:’, was estimated as a background symbol, and it makes the model predicts the symbol, ‘Arnold’, as a background symbol.

In addition, ‘B’ state representing the beginning of an entity chunk augmented the emission probability of symbols which are likely to be emitted from target state. To verify the reason of the model’s performance improvement through the tagging schemes, we observed the emission probabilities of words related to the ‘Location’ and ‘Speaker’ states. The emission probability distribution of randomly selected words in each model was augmented when the additional states (i.e., ‘B’, and ‘E’) are added.

- **Conclusion**

The question posed by this study was how the distributional structure improves the prediction of a named entity recognition in clinical texts. With specialized states providing information of the distributional structure and boundary information, we showed improvements in named entity recognition performance on two clinical document datasets and one general information extraction data. The distributional structure scales up the probability of informative words and makes transitions to correct predictions to be more favorable in the state transducer. At the same time, fine-grained target states enlarge the emission probabilities of words that are members of the target entity. Given that the hypothesis is natural to humans, many researchers utilize the structure as a baseline feature in statistical language processing without quantifying its effectiveness. Hence, we would, based on the findings of this study, like to assert that the effectiveness of the structure in HMM was proven empirically.

![Figure 1](image-url) HMM topologies in this study. (a): IO, (b): BIO, (c): BIEO, (d): BIEO+prefix/suffix. Background: non-target state. Start and Finish states are omitted in this figure.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>F1-scores of HMM topologies on the test sets.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>i2b2 2010</strong></td>
<td>Problem</td>
</tr>
<tr>
<td><strong>SNUH</strong></td>
<td>Symptom/sign</td>
</tr>
<tr>
<td><strong>Topology</strong></td>
<td>Procedure</td>
</tr>
<tr>
<td><strong>CMU</strong></td>
<td>Location</td>
</tr>
</tbody>
</table>

**Keywords**: Name entity recognition, Clinical event extraction, Text processing, Hidden Markov model
Coordinated Markov Modeling of Cancer Metastasis from Multiple Primary Sites

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ABSTRACT

Objective
Planning effective treatment of cancer of the head and neck requires predicting the probability of microscopic tumor spread to regional lymph nodes. Previous studies demonstrated that Markov chain models are feasible methods to predict tumor spread in the lymphatic system from individual primary tumor sites in the head and neck. However, little is still known about how to utilize data from multiple primary sites with overlapping lymphatic drainage to improve model performance. In this study, we investigated whether a Markov chain model that was based upon lymphatic drainage pathways could predict the probability of metastasis to individual nodal groups. Further, we tested if a Markov model that uses parameters obtained by training with data from two different primary sites performed better than a model trained with data from a single primary site.

Methods
We created a two-dimensional Markov chain model where the row of the model represents the metastatic progression along the lymphatic pathway and the column indicates the T-stages for the primary tumor location. To estimate the parameters of the model, we used two data sets as training sets: one from the records of 50 patients with non-treated, non-recurrent squamous cell carcinoma (SCCA) of the oral tongue and 10 patients with SCCA of the buccal mucosa, which presented to the University of Washington (UW) head and neck tumor board over a 3.5-year period. We ran the model with all possible parameters with a step size of 0.1 to identify the upper and lower bound of the parameters that fit with the training sets. We then determined the parameters when the output of the model was closest to the training sets after running the model again for any parameters with a step size of 0.05 within the range. For validating the model, we compared the closeness (i.e., cosine similarity) between the output of the model and a test set derived from the Cancer Genome Atlas (TCGA), which included 81 patients with SCCA of the oral tongue and 9 patients with SCCA of the buccal mucosa. For each of the two primary sites, we compared the performance between the Markov model trained with data from the primary site only to the performance of the model that was trained using data from both primary sites. For comparison, we also measured the cosine similarity between the training and test sets.

Results
The cosine similarity between the output of the Markov chain model and the test set was greater than the cosine similarity between the training and test sets (see Table 1). Also, the output of the model using the parameters trained by combined data sets from two different primary sites (i.e., buccal mucosa and oral tongue) showed better prediction than models trained using a single data set.

Conclusion
We validated the Markov chain model for predicting tumor spread using the TCGA data with the estimated parameters from different primary sites. The results of our study indicated that our Markov chain model may accomplish better performance when utilizing multiple data sets from different primary sites than a model trained with data from a single primary site.

<table>
<thead>
<tr>
<th>Case for buccal mucosa</th>
<th>Cosine similarity with TCGA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buccal mucosa data from UW</td>
<td>0.279</td>
</tr>
<tr>
<td>Model output trained with buccal mucosa data</td>
<td>0.584</td>
</tr>
<tr>
<td>Model output trained with combined data</td>
<td>0.587</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Case for oral tongue</th>
<th>Cosine similarity with TCGA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral tongue data from UW</td>
<td>0.889</td>
</tr>
<tr>
<td>Model output trained with oral tongue data</td>
<td>0.914</td>
</tr>
<tr>
<td>Model output trained with combined data</td>
<td>0.967</td>
</tr>
</tbody>
</table>

Keywords: Markov chain, Oral cancer, Metastasis
Structuralization of Variance Text Records in Clinical Pathway

Takanori Yamashita¹, Yoshifumi Wakata¹, Hidehisa Soejima², Naoki Nakashima¹, and Sachio Hirokawa³

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2. Saiseikai Kumamoto Hospital, Kumamoto, JAPAN
3. Research Institute for Information Technology, Kyushu University, Fukuoka, JAPAN

ABSTRACT

- **Objective**
  Electronic medical data include structured numerical data and unstructured text data. The medical text data utilization has not been enough so that it takes time and effort to need natural language processing and text mining. The purpose of the present paper is structuralization of variance text records in clinical pathway. Clinical pathway has the daily goal and status, medical treatment of inpatient on temporal as the outcome and unstructured text data such as medical record and summary is structured efficiently as well as a structured numerical data such as laboratory data. However, if cannot be achieved the outcome or occur some problems, it is recorded by the text of various expressions about the patient status and the future plan by doctor or nurse. When those data are structured or standardized, the variance input operation improve the efficiency.

- **Methods**
  The present paper analyzed about 10,000 of variance text records of fever, which recorded in April 2014 - April 2016 at Saiseikai Kumamoto Hospital. First, it performed morphological analysis to those data with the medical dictionary of 70,000 word, then it was applied N-gram(N=2~5) to those words. All the words of each morpheme word and morpheme 2~5grams as attributes were applied hierarchical clustering by Cluto, then it drew sparse matrix with row dendrogram of the word and column dendrogram of document. The combination of the attributes of the row and column is a strong portion is visualized emphasized in sparse matrix. The number of clusters in rows specified 10.

- **Result**
  There were many attributes overlapped semantically, therefore it gathered similar attributes in the sparse matrix. It was extracted feature sentences ("follow-up", "cooling", "analgesic", "check infection") based distributions of the word group in sparse matrix. The sentence about "follow-up" was most often appeared. There were described the plan of starting and continuation or the site about "cooling", administration and its effect about analgesic, and related to pneumonia or urinary tract infection about "check infection".

- **Conclusion**
  We have analyzed to medical text records and summary by text mining for the purpose of medical care process improvement, however clinical interpretation was difficult by the only morpheme word. Although some of the Japanese-specific issues that is difficult to separate word, it appeared similar words or sentences as a group in the sparse matrix by using all the words of morpheme N-gram. We consider that has been progressing method for interpretation. This time the target was a variance record of fever. Then, we plan to classify extracted words for each case, and expand the target to other variance records (e.g. pain control, dietary intake, blood pressure).

**Keywords**: clinical pathway, text mining, N-gram.
Identify Factors Affecting Successful Ageing in Elderly Diabetics in Shiraz Using Data Mining Approach

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ABSTRACT

Objective
In recent decades, world population rapidly became old. In low and middle-income countries population change is more rapid. In Iran, older people above 60 years contains 8.2% of the whole country’s population, and furthermore, it’s predicted that it will reach 10% by 2020 which shows the speed of aging in this country. Diabetes can have an effect on successful aging, but there is not enough information about the relation between diabetes and successful aging. In this study, we use data mining approaches to extract important factors about successful aging in diabetics in Shiraz.

Methods
In this study, information of 592 older people (aged ≥ 60 years) with diabetes between April 2014 and April 2015 are collected from health centers of Shiraz and then we used the APRIORI algorithm for analyzing them. The method of collecting information was a questionnaire contains 99 features from these domains: Physical health from Bartle questionnaire, demographic information, important diseases, quality of life, life satisfaction from Diner questionnaire, social health from Keyes questionnaire, spiritual health from Alison questionnaire. We used association rule to analyze the relationship between features and identify important features influence successful aging.

Results
Results of analysis of the relationship between every single domain and successful aging show that every domain has a relation with successful aging. The association rule algorithm applied on all factors that show 32 rules achieved 7% of support and a confidence of 50%-51%. In the last model, the majority of rules was about religious health. According to the results, the most important factor influenced successful aging was spiritual health while religious health was more important than existential health. After these, social health and factors like a feeling of valuable for society, being able to make some valuable product for society and quality of life (pain, sleep disorder and the food must not eat due to diabetes) in older people with diabetes were more important than other factors. Finally, after all of these, diabetes, liver disease, kidney disease and CVA had more impact on successful aging than other chronic diseases.

Conclusion
In this analysis, religious health was the most important factor, after that social health and quality of life were important. These factors had subdomains that priority of them determined. Results of this study consistent with findings of other researchers about effective factors on successful aging. Current study with analyzing of all factors provided the possibility of identifying more important factors.

Keywords: aging, successful aging, diabetes, data mining
Online Medical Appointment System

A comparison of community-based tele-rehabilitation, face-to-face, and usual care for low-income elderly women in Korea

Hyoid Bone Tracking using Tracking-Learning-Detection in Videofluoroscopy Swallowing Study

Characterizing hidden rules linking symptoms and acupoint selection using an artificial neural network model

Deep Belief Network based Classification Prediction Model of Pathology Stage in Patients with Prostate Cancer

Developing novel algorithms of approximate entity extraction for laboratory test names in clinical documents based on q-gram

Development of new extravasation alert system by optical hemoglobin sensor in drip infusion therapy

Improving of Medical Supply Purchasing Process by Using Barcode Technology in Thai University Hospital

AURORA: Analytic code managing and distributing Unit bridging Research Organizations and Associated users

Exploring the possibility of identifying adverse-drug-events from nursing records

A method of compressing whole slide images (WSI) with multi-focus plane using blur estimation

Suggestion of a Phased Classification Method of Requirements for a Registry by the types of Cancer and the Definitions of Items using Electronic Medical Records

Development of Patient Portal for Exchange Personal Health Record

FHIR for IHE LAW Profile

Design of middleware solution for the vendor neutral archive system

Design and Implementation of SMART guide system based on integrated data modeling

Design and Development of a Medical Information Support System
ABSTRACT

• **Objective**
  Business process reengineering represents an important opportunity for business to reduce cost and increase quality at proper time and speed. The purpose of process redesign is to identify possibilities for improving the design of medical appointment systems: from "as is" to "to be." The aims of this process redesign are to increase healthcare quality, efficiency, flexibility and decrease cost.

• **Method**
  The proposed medical appointment system is designed for small or medium size medical centres (clinics) with a reception assisting the user to administer data sets. Make / modify appointment is the chosen target process for this project. I improve the design process by using the Business Process Modelling and Notation (BPMN). I analyse the strengths and weaknesses using several heuristic design principles and the devil's quadrangle model from Dumas (2013).

• **Result and Conclusion**
  I've improved the design process by introducing an online medical appointment system. It has a highly efficient set of management tools to synchronise, computerise and systematically record data assisted by the use of Internet websites. The medical appointment system based on BPMN describes the process of patients making medical appointments using both traditional method and online system.
  
  There are at least eight principles identified in this target process redesign: Control relocation, Outsourcing, Integration, Parallelism, Activity automation, Integral technology, Interfacing, Centralization, Empowerment. Three principles out of the eight are chosen as examples from the first three groups of principles, as summarised in Table 1:

  • Control relocation - Patients take control over which doctor and the time for the appointment. It improves flexibility for the patient as they can make an appointment online without restricting to business hours. It also improved patient satisfaction. However, there's a high probability of patient misusing the system.
  
  • Parallelism - Activities can be carried out in parallel especially when greater speed is required during the busy business hour. Overall, parallelism leads to improved performance, reduction of waiting times, reduce throughput time and better use of capacity.
  
  • Activity automation/ Integral technology - Online medical appointment technology is deployed to alleviate physical constraints in a business process. It reduces the time that the receptionist spends on electronic work. The online system provides a better quality of service. Activities can be executed faster, increase communication speed, increase information availability, reduce duplicated data entry, reduce human error and offer a more predictable result. However, the cost of implementation, training, and maintenance efforts related to technology can be high. Workers' reluctance to adopt new technology may decrease the quality of the business process. Another risk is that the Internet can be unresponsive, resulting in a failure to make an appointment.
  
  I've analysed the three redesign principles on each of the four performance dimensions of Devil's Quadrangle. The dimension of time, quality and flexibility will improve dramatically. The biggest drawback is increasing in cost. However, utilising other redesign principles identified in this medical appointment system, the possibility of improving the Devil's Quadrangle may occur.

**Table 1** Characteristics of the business process operation heuristics

<table>
<thead>
<tr>
<th>Principle</th>
<th>Time</th>
<th>Cost</th>
<th>Quality</th>
<th>Flexibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control relocation</td>
<td>Neutral</td>
<td>Negative</td>
<td>Positive</td>
<td>Positive</td>
</tr>
<tr>
<td>Parallelism</td>
<td>Positive</td>
<td>Negative</td>
<td>Neutral</td>
<td>Negative</td>
</tr>
<tr>
<td>Activity automation</td>
<td>Positive</td>
<td>Negative</td>
<td>Positive</td>
<td>Negative</td>
</tr>
<tr>
<td>Integral technology</td>
<td>Positive</td>
<td>Negative</td>
<td>Positive</td>
<td>Positive</td>
</tr>
</tbody>
</table>
A comparison of community-based tele-rehabilitation, face-to-face, and usual care for low-income elderly women in Korea

Hanna Choi¹, Jeongeun Kim²
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2. College of Nursing, Seoul National University, Research institute of nursing science, Seoul, Korea

ABSTRACT

Objective
Nearly all low-income older women have a chronic disease; they are more likely to face them than average elderly people. However, these concerns rarely receive proper care or further advanced rehabilitation. Recently, telerehabilitation has been recommended as a possible solution to access barriers with low cost, functionality, and social surroundings. The objective of this study was to explore how community-based technology with theraband can improve cognitive and physical function, compared to face-to-face or usual care.

Methods
Based on a quasi-experimental nonequivalent pre-test and post-test research design, 61 low-income elderly community-dwelling women participated in three groups: the experimental group, which included community-based tele rehabilitation with theraband (n=22); control group 1 with face-to-face theraband rehabilitation (n=18), and control group 2 with usual care and free gymnastics (n=21). Participants were recruited from communities in Seoul and Kwangju, Republic of Korea. The intervention occurred twice per week, with each lasting 40 minutes for a period of 12 weeks. The degree of cognitive variables such as falls efficacy, exercise efficacy, and vitality was measured using structured questionnaires. Performance-based measures of physical function data, SPPB (Short Physical Performance Battery: balance score, gait speed score, and standing from a chair) were collected from December 2014 to March 2015. Statistical analyses included a one-way ANOVA and a χ² test.

Results
The results were as follows: falls efficacy, exercise efficacy, and vitality between groups were significantly different (F=8.03, p<.001). Cognitive variables of the experimental group were found to be significantly higher than that of control group 2 (p<.001). However, there was no difference between control group 1 and the experimental group. The three variables of control group 1 were significantly higher than those of control group 2 (p<.001). Secondly, there was no difference between the total SPPB for monitoring physical functioning score of the experimental group and control group 1; however, the SPPB total score of the experimental group was significantly higher than that of the control group 2 (F=5.45, p=.007). The SPPB total score of control group 1 was significantly higher than that of control group 2 (p<.001). Thirdly, SPPB gait speed measured of the experimental group was higher than that of the control groups (p<.001); no difference between control group 1 and 2 was observed.

Conclusion
This study shows that telerehabilitation with theraband improves cognitive and physical performance. Community-based telerehabilitation with theraband was effective and feasible in a class with face-to-face intervention in low-income women. Therefore, findings indicate that telerehabilitation be used to encourage for better assist elderly women with low-income.

Keywords: Telerehabilitation, low income, elderly, women
Hyoid Bone Tracking using Tracking-Learning-Detection in Videofluoroscopy Swallowing Study

Dongheon Lee¹, Jung Chan Lee²,³,⁴, Byung Mo Oh⁵, Hyoun-Joong Kong⁶,⁷ and Hee Chan Kim²,³,⁴

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⁷, Department of Biomedical Engineering, Chungnam National University Hospital, Daejeon, Korea

ABSTRACT

We present a new approach for tracking the hyoid bone in Videofluoroscopy Swallowing Study (VFSS). In the current approach, it is difficult to automatically localize the cervical vertebrae from VFSS images because of occlusion due to a marker used to display the relative position of the cervical vertebrae region. Moreover, traditional image processing approaches such as template matching or optical flow methods are not robust for tracking the hyoid bone in video frame images. In this study, an Active Shape Model (ASM)-based fitting algorithm is proposed to detect C2, C4 points and address the aforementioned issue of occlusion. Then, the Tracking-Learning-Detection (TLD) algorithm is applied to automatically track the hyoid bone region in the images. Our approach is evaluated for the VFSS dataset of four dysphagia patient cases; the obtained results show a total mean error of 13.3±9.05 pixels in comparing manual trajectory of hyoid bone. Therefore, our proposed method is robust for detecting and tracking the hyoid bone automatically.

- **Objective**
  Development of a tracking algorithm for the movement of the hyoid bone in VFSS.

- **Methods**
  The proposed method consists of two steps. First, an ASM[1] for the detection of cervical vertebrae, specifically C2 and C4, which are used for calibrating hyoid bone coordination, is applied to the preprocessed initial frame (Figure 1). Second, the

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**Figure 1** Cervical vertebrae localized using an ASM

**Figure 2** The hyoid bone detected using the TLD algorithm
TLD algorithm[2] was applied to track the hyoid bone (Figure 2). The method is validated using the obtained VFSS dataset from four dysphagia patient cases by comparing the coordination errors of the hyoid bone, which were calculated using the Root Mean Square Error (RMSE) between the coordinate of the hyoid bone in the proposed method and the reference coordinate.

**Results**
The results obtained from the evaluation of our proposed method had a total mean error of 13.3±9.05 pixels in calculating the hyoid bone trajectory from the VFSS images; the size of these images was 480×480 pixels and the frame rate was 30fps. (Table 1)

**Conclusion**
This study demonstrated the use of ASM for detecting C2, C4 regardless occlusion between the cervical vertebrae and the marker and TLD algorithm for tracking hyoid bone. Through our obtained results, our proposed method is feasible for detecting and tracking the hyoid bone automatically.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Errors in tracking the hyoid bone for the four test subject cases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Patient #1</td>
</tr>
<tr>
<td>Mean±S.D (pixel)</td>
<td>8.92±4.78</td>
</tr>
<tr>
<td>Total Mean±S.D (pixel)</td>
<td></td>
</tr>
</tbody>
</table>

**Keywords**: Dysphagia, Hyoid Bone, Video Processing, Active Shape Model, Tracking-Learning-Detection
Characterizing hidden rules linking symptoms and acupoint selection using an artificial neural network model

Won-Mo Jung¹, In-Soo Park¹, Bo-Hyoung Jang², Younbyoung Chae³

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² Department of Preventive Medicine, College of Korean Medicine, Kyung Hee University, Seoul, Republic of Korea

ABSTRACT

The Abstract must be submitted in Microsoft Office Words and is limited to 3000 characters. If it is necessary, supporting figures can be presented as part of the text and total content is limited to one page including supporting figures.

Objectives
To understand the principle underlying selection of appropriate acupoints, it is important to understand how medical doctors diagnose and treat diseases. We explored the pattern recognition process pertaining to symptoms and diseases that in informs acupuncture treatment in a clinical setting.

Methods
In total, 232 clinical records of acupuncture treatment were collected using the “Charting Language” program. Using an artificial neural network (ANN), we trained associations between symptom information and selected acupoints for the treatment. We chose 11 hidden nodes with the highest average precision score through 10-fold cross-validation.

Results
Our ANN model could predict the selected acupoints based on symptom and disease information with an average precision score of 0.865 (precision: 0.911; recall: 0.811). We visualized the relationships between symptom information and selected acupoints based on learned treatment pattern of hidden nodes. Two distinctive patterns were observed: 1) hidden node mainly involved in the regional control effects of acupoints involved in the treatment of musculoskeletal pain. 2) hidden node mainly involved in the remote control effects of acupoints for more systemic symptoms.

Conclusion
Our ANN may be a useful tool for diagnostic classification or pattern recognition and for prediction and modeling of acupuncture treatment based on clinical data obtained in a real-world setting. The relationship between symptoms and selected acupoints could be systematically characterized through knowledge discovery processes.

Keywords: Acupuncture, indication, neural network, pattern identification, prediction
Deep Belief Network based Classification Prediction Model of Pathology Stage in Patients with Prostate Cancer.

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ABSTRACT

• Objective
Prediction model for prostate cancer of pathology staging is estimating the likelihood that the cancer has spread before treatment. Although important for determining the most suitable treatment for patients, pathology staging continues to present significant challenges to clinicians. Clinical test results such as the pre-treatment PSA (Prostate-Specific Antigen), Gleason score in tissue biopsies, and the clinical T stage can be used by clinicians to predict the pathology stage of prostate cancer. However, not most patient will return abnormal results in most of tests. This significantly influenced the capacity to effectively treatment of prostate cancer. Therefore, deep learning based pathology stage of prediction is required to the treatment of prostate cancer.

• Methods
We proposed deep belief network based pathology stage classification prediction model. Proposed classification prediction model aim at classify the OCD (Organ-Confined Disease; pT2+) and NOCD (Non Organ-Confined Disease; pT3+ or N+). The study data comprised the data of 467 male patients extracted from SPCDB (Smart Prostate Cancer Data Base). Among 467 patients with OCD is 235 patients, NOCD is 232 patients. The DBN model input following variables: PSA, Gleason score, clinical t stage. DBN consist of two RBM (Restricted Boltzmann machine) layer, and learning to use use a back propagation algorithm.

• Results
The experiment divided into learning dataset (70%, OCD: 328 patients; NOCD: 161 patients) and validation dataset (30%, OCD: 141 patients; NOCD: 71 patients) to measure performance. Experiential result, proposed DBN model accuracy (82.00%) was larger than the Partin table (66.43%), artificial neural network (81.43%) and logistic regression (80.71%).

• Conclusion
The proposed DBN model was superior to the Partin tables in terms of predicting the risk of prostate cancer. Compared to the validation of the Partin tables, the DBN model resulted in a larger accurate prediction of the pathologic stage of prostate cancer.
Developing novel algorithms of approximate entity extraction for laboratory test names in clinical documents based on q-gram

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ABSTRACT

Objective
In clinical documents, Entities are often expressed in a short term. For example, "Neutrophils" is written as "neuts". We developed a novel approximate entity extraction algorithm that can extract this kind of expression in clinical documents. We suggested space effective, less time-consuming algorithm at the same time.

Methods
We expressed q-grams on two dimensions. (x-axis : the number of q-grams of a word, y-axis : the number of matching q-grams). In counter filtering, words that have LB at least are treated as similar words. \( LB = \max(|word|,|query|)-q+1-q*\tau, \) \( \tau \) is edit distance threshold. So we can think that word that has matching grams more than \( y=LB \) can be candidate set. We set this methodology as the baseline. And then we developed model following steps: Method 1: words on the line are components of a set that Edit distance is 1. For example, if a query word is "neutrophils", there can be "neutrophil", "neut" etc. These words are treated as exemplary words as short term in clinical notes. So the points that are closer to the line are similar to the query. Method 2: Different thresholds are applied to each point upon to their L. In figure 1, Each triangle has the same area. So words that are far from the point of query word are applied strict \( \text{d(threshold)} \) than nearby words. A Big triangle is integral space of small triangles so the points within this area are treated as similar to the query word. Method 3: We added a parameter to make the big triangle area distorted to exclude some useless expressions. This model doesn’t iterate over Inverted index of q-gram, instead, just remember numbers that the number of q-grams(x-axis) and matching q-grams(y-axis), then calculate Euclidean distance. So it is space effective, is able to achieve \( O(1) \). We extracted candidate words from 300 documents of i2b2 2014 that consists of 25,823 tokens with repetition removal. Query words consists of "Alanine", "cholesterol", "Microalbumin", "troponin", "Globulin", "Neutrophil", "Lymphocyte", "Monocyte", "Eosinophil", "Basophil", "glucose".

Results
Nevertheless extracting additional short terms in addition to query terms, proposed model 2, 3 could generate smaller size of candidate set compared to baseline within every \( \tau \) dramatically.

Conclusion
In this study, we proposed a novel model to extract similar words in clinical documents utilizing Euclidean distance.

Keywords: Information retrieval, computing methodologies, similar entity extraction, q-grams, abbreviation
Development of new extravasation alert system by optical hemoglobin sensor in drip infusion therapy

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ABSTRACT

Introduction
Drip infusion is the most popular medical treatment. Automatic infusion pump system has the flow rate control or jagging detection mechanism for medical incident prevention, however, it is reported that medical incidents are often caused in drip infusion therapy. The cause of the incident is the extravasation from blood vessel, and it is impossible to detect by the current system. The aim of this work is development of the extravasation detection system and monitoring system for nursing support in drip infusion therapy. We examined the application as the new extravasation alert system.

System configuration
This system is composed of two photo-reflector units, a spectroscopic sensor and data logger system “NI-Compact DAQ”. Two photo reflector units are put on the vessel, and it detects blood hemoglobin optically. On the other hand, a spectroscopic sensor is put on the skin around the infusion position, it scan the maximum wavelength from 400nm to 900nm. Application software was developed by “NI-LabVIEW”.

System evaluation
Each photo-reflector was placed on blood vessel at the upstream and downstream site of the needle injection position (Fig.1). We measured the initial value of the reflected light intensity on both sides before infusion. After drip infusion starting, the rate of change of the reflected light intensity was measured. Additionally, peripheral blood was drawn from the downstream site continuously. We analyzed the signal, and evaluated correlation between transcutaneous optical hemoglobin method and the SLS-hemoglobin method.

Results
The optical hemoglobin method and the conventional method showed correlation, but optical hemoglobin method was not suitable for absolute quantification of hemoglobin concentration. The intensity of reflected light was changed significantly between the upstream and downstream site. The rate of change of the reflected light intensity showed a correlation to blood dilution by drip infusion.

Conclusion
The optical hemoglobin method is not suitable for absolute quantification of hemoglobin concentration. However, this method is suitable for relative quantitation of hemoglobin, it is considered to be applicable to new extravasation alert system for medical safety in drip infusion therapy.

Keywords: Drip infusion, extravasation, medical incident prevention, nursing support
Improving of Medical Supply Purchasing Process by Using Barcode Technology in Thai University Hospital

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ABSTRACT
Srinagarind Hospital, a 1000 beds university hospital implemented new procurement software solutions in June 2015, the hospital had already implemented Hospital Information System (HIS) since December 2014. Data was cleaned and new item codes was set and used (>17,000 medical supply items). The new purchasing process took more time to finish due to longer item code names. We conducted a pilot project of barcode systems implementation in our operating theater to evaluate the benefit and value of this technology in purchasing process.

• Objectives
To compare using of barcode technology in the purchasing process of medical supplies

• Methods
We conducted a comparison experiment between manual data input and barcode assisted system during purchasing process of 40 medical supply items in operating theater unit. We assessed the errors, processes reduction and time reduction in purchasing order processes.

• Results
data input error was found 3 times by manual data input and 0 by barcode methods. Process step was reduced from 7 to 3 steps after barcode system was implemented. Mean total process time was 36.94 seconds/step by manual data input and 6.49 seconds/step by barcode systems.

• Conclusion
barcode application can reduce data input error, medical supplies purchasing process and total process time.

Keywords: Purchasing, barcode, operating theater
AURORA: Analytic code managing and distributing Unit bridging Research Organizations and Associated users

ABSTRACT

We need to distribute an analytic code to the data partners to perform a study using the Distributed Research Network (DRN). Although we have successfully performed many analyses by using email to communicate and distribute the analytic codes, however we need a more sophisticated managing tool for them. We develop a managing and distributing tool for the analysis codes between the researcher and data partners and named Analytic code managing and distributing Unit bridging Research Organizations and Associated users (AURORA). With the AURORA, a researcher can easily send their study protocol and analytic codes to multiple data partners and check the status of the study progress.

Objectives

Distributed research network (DRN) has been emerging as an alternative mean for maintaining confidentiality among analysis using information from multiple institutions. To perform an analysis with many data partner, we need to send the analysis codes to many data partners. Although we have successfully performed many analyses by using email to communicate and distribute the analytic codes, however we need a more sophisticated managing tool for them. We tried to develop a managing and distributing tool for the analysis codes between the researcher and data partners.

Methods

Design of the system

We named the system as Analytic code managing and distributing Unit bridging Research Organizations and Associated users (AURORA). Through the system, a researcher can send a research protocol and analytic codes to multiple data partners via SMTP. Each administrator of the data partner can determine to approve study or not. For the approved study, the analysis is performed in the organization. The decision, comments from the administrator, or the results of the analysis are automatically provided to the researcher. Delivery of messages between researcher and administrator of each data partners is performed by e-mail (e.g., sending code, notifying the change of status).

Distribution and production of the web interface

Using Java Database Connectivity (JDBC) API, we let the system be able to access the database and record the log. The system send all of the events that occur during the process of the study by e-mail to the researchers and the administrators of the organizations, to enable real-time monitoring of the research.

Results

Only authorized user can access the system. The system has the following functions: uploading and downloading for protocol, analytic code and result files; mailing for alarm and link; status update for job and error; member administration.

Conclusion: With the AURORA, a researcher can easily send their study protocol and analytic codes to multiple data partners even without information who is in charge of the system. Each institution can confirm the study protocol and perform the analysis by the received analytic code. Eventually, each administrator of data partner can send the results from the analysis to the original researcher through the AURORA. Since only the result of the analysis is requested and transmitted, the personal information is thoroughly protected, and the anonymity is maintained.
Exploring the possibility of identifying adverse-drug-events from nursing records

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ABSTRACT

Objective
OBJECTIVE: The purpose of this study is to explore whether the drug contraindications and adverse-drug-events data can be extracted from the nursing records.

Methods
Two nurses analyzed the drug information available from KFDA [1] of ten randomly selected drugs [2] for the contraindications and adverse events. Then, eight nurses were asked to check where these 334 extracted contraindications and adverse events can be identified either in nursing records, medical records or lab reports.

Results
As shown in Table 1, nursing records have more information on the contradictions and adverse events in ‘Psychiatric’, ‘Cardiovascular’, ‘Respiratory’, ‘Body as a whole’, ‘Application site’, ‘Neurological’, ‘Skin and appendages’ and ‘Gastrointestinal’ categories compared to the medical records or lab reports. Medical records have more information on the factors in ‘Vision’, ‘Endocrine’, ‘Infections’, and ‘Personal’ categories than the nursing records and lab reports do. Lab reports have more information on the factors in ‘Musculoskeletal’, ‘Metabolic and nutritional’, ‘Liver and biliary’ and ‘Blood’ categories than the nursing and medical records do.

Conclusion
This study showed that the possibility of using nursing records as a source for detecting the early signals for the adverse drug events, especially psychiatric, neurological, cardiovascular, and general symptoms.

This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (NRF-2015R1A2A2A01008207).

Table 1 Types of records where contraindications and adverse-events of ten drugs identified by categories

<table>
<thead>
<tr>
<th>Category</th>
<th>N of Sx</th>
<th>Nursing records</th>
<th>Medical records</th>
<th>Lab report</th>
<th>Category</th>
<th>N of Sx</th>
<th>Nursing records</th>
<th>Medical records</th>
<th>Lab report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immune</td>
<td>2</td>
<td>2(100)</td>
<td>2(100)</td>
<td>0( 0)</td>
<td>Gastrointestinal</td>
<td>26</td>
<td>20(76.9)</td>
<td>9(34.6)</td>
<td>4(15.4)</td>
</tr>
<tr>
<td>Hearing and vestibular</td>
<td>3</td>
<td>3(100)</td>
<td>3(100)</td>
<td>0( 0)</td>
<td>Vision</td>
<td>8</td>
<td>5(62.5)</td>
<td>7(87.5)</td>
<td>0( 0)</td>
</tr>
<tr>
<td>Psychiatric</td>
<td>7</td>
<td>7(100)</td>
<td>2(28.6)</td>
<td>0( 0)</td>
<td>Urinary tract</td>
<td>12</td>
<td>6(50.0)</td>
<td>3(25.0)</td>
<td>6(50.0)</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>16</td>
<td>16(100)</td>
<td>0( 0)</td>
<td>1(6.25)</td>
<td>Endocrine</td>
<td>9</td>
<td>4(44.4)</td>
<td>6(66.7)</td>
<td>5(55.6)</td>
</tr>
<tr>
<td>Respiratory</td>
<td>13</td>
<td>13(100)</td>
<td>1( 7.7)</td>
<td>3(23.1)</td>
<td>Musculoskeletal</td>
<td>10</td>
<td>4(40.0)</td>
<td>4(40.0)</td>
<td>6(60.0)</td>
</tr>
<tr>
<td>Body as a whole</td>
<td>8</td>
<td>8(100)</td>
<td>0( 0)</td>
<td>0( 0)</td>
<td>Metabolic and nutritional</td>
<td>22</td>
<td>5(22.7)</td>
<td>3(13.6)</td>
<td>19(86.4)</td>
</tr>
<tr>
<td>Application site</td>
<td>3</td>
<td>3(100)</td>
<td>0( 0)</td>
<td>0( 0)</td>
<td>Infections</td>
<td>20</td>
<td>4(20.0)</td>
<td>20(100)</td>
<td>17(85.0)</td>
</tr>
<tr>
<td>Neurological</td>
<td>37</td>
<td>36(97.3)</td>
<td>5(13.5)</td>
<td>1( 2.7)</td>
<td>Personal</td>
<td>71</td>
<td>14(19.7)</td>
<td>67(94.4)</td>
<td>9(12.7)</td>
</tr>
<tr>
<td>Skin and appendages</td>
<td>27</td>
<td>24(88.9)</td>
<td>5(18.5)</td>
<td>0( 0)</td>
<td>Liver and biliary</td>
<td>10</td>
<td>1(10.0)</td>
<td>1(10.0)</td>
<td>10(100)</td>
</tr>
<tr>
<td>Drug</td>
<td>6</td>
<td>5(83.3)</td>
<td>6(100)</td>
<td>0( 0)</td>
<td>Blood</td>
<td>24</td>
<td>2( 8.3)</td>
<td>4(16.7)</td>
<td>24(100)</td>
</tr>
</tbody>
</table>

Keywords: adverse drug event, drug surveillance, electronic medical record, electronic nursing record.
A method of compressing whole slide images (WSI) with multi-focus plane using blur estimation

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ABSTRACT

When scanning a lab specimen for digital pathology, some region of the specimen may come out blurry when its curved surface gets out of focus. As this hinders clear visualization of the area of interest, some scanners are designed to perform multiple scans, adjusting focal lengths, which results in creation of many images. Among the multiple images, some would eventually show the region of interest vividly. However, such a method is time-consuming and ends up with large data size. As high-volume data leads to high cost of storage and transmission, we propose a new method to improve the issue.

This paper explains how to compress whole slide images (WSI) by creating virtual images to reduce image size without compromising on image quality: compare different slide images of a specimen created by adjusting focus to identify the sharpest image for each region of the image on a given 2D block, then estimate similar blurs with the rest of the image to create a virtual image. Processing and saving only the difference between the estimated virtual image and the original image results in substantial decrease in data size, without affecting its quality. The presented method is expected to allow effective data size reduction for long-term storage, as well as significant saving in data transmission cost.

Keywords: Digital Pathology, WSI, Compression, Blur Estimation, Multi Focus Plane
Suggestion of a Phased Classification Method of Requirements for a Registry by the types of Cancer and the Definitions of Items using Electronic Medical Records

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ABSTRACT

Objective
Although medical records are well computerized in these days, the utilization of medical information data is low. This is one of reasons that general hospitals build up research registry for meaningful use of the electronic medical records (EMR). Due to the fact that existing requirements of registry by cancer type and methods of the definitions of item varies by hospitals, it is necessary to organize classification standard.

Method
This study suggests a phased classification method of requirements for a registry by the kind of cancer and the definitions of items. First, this study classifies items by category, centering around the flows of the treatment of the patients, and next, classifies items by division, mainly focusing on the treatment methods. Finally, items by section are classified mainly by the treatment history. Items by category and division are classifications based on the basic process of the treatment of cancer patients, so they can be commonly applied.

Result
Unlike to the category and division commonly applied for registry by cancer types, items by section showed deferent treatment method in the process of application. So different composition was applied to them.

Conclusion
This study suggests phased standard of item classification and if it applys to construct registry, the study will contribute to building a construction process of the standard registry by cancer types.

Keywords: Registry, electronic medical records (EMR), cancer, classification
Development of Patient Portal for Exchange Personal Health Record

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ABSTRACT

Objective
A paradigm shift in medical services, from being provider (medical organization)-centric to client (patient)-centric, coupled with aging population that led to more chronic diseases and higher interest in health results in the increasing need for collecting, sharing, and exchanging the patient’s personal health record. This study is aimed at providing a platform that can meet such need: by implementing a portal which collects personal health and medical records and provides them to patients according to Healthcare standards.

Methods
A portal was designed to collect patients’ personal health records according to the criteria defined by Meaningful Use regulations. Terms and code systems for each item were mapped with industry standards such as SNOMED CT, and were created in C-CDA, a standard document format, to allow exchange of health records data with different organizations.

Results
We developed a system that collects and saves patients’ comprehensive medical records (e.g., clinical studies, imaging studies, and results of examinations) as well as a web portal that displays and prints the saved health records of patients. The web portal was designed to enable patients to access in the mobile environment as well.

Conclusion
The outcome of the study achieved Meaningful Use Stage 2 certification. The developed system has been implemented and in use in various imaging centers in the U.S. It is our expectation that the portal can be used for building more convenient and useful personal health management systems (e.g., ubiquitous healthcare systems) based on further advanced mobile environments and technologies, when patient health data collection systems compliant with standards of each medical institution are deployed in full swing.

Keywords: Personal Health Record, Health Data Exchange, Clinical Terminology, Patient Empowerment
ABSTRACT

With recent advancement in ICT (Information & Communication Technology), an IVD (In-Vitro Diagnosis) analyzer is expected to be able to interface with many other devices and services such as smart phones, tablets, Cloud services, and so on, which puts a great burden on product development. Traditionally, an interfacing capability of an IVD analyzer was limited to LIS (Lab Information Systems), for which IHE published the LAW profile based on HL7 V2 message standard, where most of the data that can be generated by an IVD analyzer are defined. While the interfacing technology based on HL7 V2 works with LIS, it is not well suited to mobile devices and Cloud services.

HL7 FHIR (Fast Healthcare Interoperability Resources) is a new standard candidate based on up-to-date web standards such as REST and OAUTH that is being developed in a way that all existing HL7 standards including V2, V3, and CDA, and focuses on developers for easy implementation. In this study, we redefine IHE LAW profile in terms of HL7 FHIR by converting V2 messages to FHIR and apply the new profile to an IVD analyzer so that it can easily interface with emerging devices and services as well as the existing LIS.

- **Objectives**
  We redefine IHE LAW profile in terms of HL7 FHIR.

- **Methods**
  1. Review the HL7 V2 messages in IHE LAW Profile
     The HL7 V2 messages in LAW Profile use 16 segments which are not the same as defined in HL7 V2. Several segments restrict some fields and their associated dataset according to the use cases defined in LAW Profile, which we must take into consideration.
  2. Select FHIR base resources
     HL7 V2 message segments and FHIR base resources are defined and categorized according to their usage. For example, ORC segment of HL7 V2 and Order resource of FHIR are defined to contain or explain order information. We select the base resources of FHIR from this point of view. Also we check the mapping table between HL7 V2 segments and FHIR resources on the FHIR official website before the selection process.
  3. FHIR resource profiling
     There may be some pieces of information in LAW V2 messages that cannot be expressed by FHIR base resources. In such a case, we create additional elements as "extension" to appropriate base resources and also put restrictions on the elements in base resources that will not be used.
  4. FHIR messaging
     A conventional transaction in LAW profile is based on transmission of information from the actor that has information. We follow the guidance for messaging in the FHIR website. All of the resources for a transaction are wrapped in a Bundle resource and the type element value of this Bundle resource should be set as "message". Moreover this Bundle resource should contain MessageHeader resource as first entry resource. Both of the two actors in the LAW Profile should perform a server and a client role illustrated below.
**Results**
We were able to redefine 17 of HL7 V2 segments in the LAW profile using 10 FHIR resources, namely, MessageHeader, OperationDefinition, Specimen, Patient, Encounter, Bundle, Order, OrderResponse, Observation, and Substance. Further, we defined a total of 34 extension elements for Specimen, Order, OrderResponse, and Observation resources. For verification of these conversion, we developed an emulator for an implementation of LAW profile for Samsung PT10 device that had passed an IHE Connectathon. Under various testing scenarios, it worked well and, hence, partly verified the correctness of our implementation.

**Conclusion**
We converted HL7 V2-based transactions in IHE LAW profile to ones based on FHIR. We also verified the correctness of conversion using a simulator. Although a more rigorous verification such as Connectathon-style testing must be required, this study provides an ample evidence of the effectiveness of FHIR-based implementations for interface development of IVD analyzers.

**Keywords**: Standards, FHIR, IHE LAW profile, IVD
Design of middleware solution for the vendor neutral archive system

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ABSTRACT

• Objective
Vendor Neutral Archive (VNA) solutions are increasingly being adopted for integrated management of various medical images and contents. The introduction of a VNA requires integration across medical information systems based on contents, rather than mere physical integration. This necessitates an efficient data relay process. The aim of this study is to design a middleware that classifies main relay processing functions needed for VNA and that enables processing of large data contents.

• Methods
A middleware was designed for routing and prefetching, among main functions of VNA. A Message-Oriented Middleware (MOM) was designed to which Advanced Message Queuing Protocol (AMQP) is applicable, instead of using a database in a queue-based system.

• Results
Construction of a middleware with a message broker resulted in the increased total throughput and a system that enables quantitative performance monitoring when using routing and prefetching.

• Conclusion
For a VNA to function as a long-term archive for large-scale data, the delay in data processing should be minimized and the total throughput should be maximized, by carefully designing a back-end architecture. A message-based middleware used for such an architecture can increase the total throughput as well as allow a high-availability, fault-tolerant structure.

Keywords: PACS, VNA, Middleware, DICOM, MOM
Design and Implementation of SMART guide system based on integrated data modeling

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ABSTRACT

Objective
The purpose of this study is to design, implementation, and evaluation of SMART guide system that utilizes PDP/LCDs and a hospital information system (HIS) to address the difficulties and insufficiency that outpatients meet in finding hospital facilities, recognizing each examination’s guide and schedule, and accessing personalized medical and administrative information. Those should can manage independent control based on each examination process and subject without any constraint.

Methods
The present study was conducted in a fully digitized tertiary university hospital in South Korea. We developed outpatient SMART guide system that consists of data controller to manage to present display contents and time on receiver, it can be also covered about cycle, end lag time, waiting time, guide script etc., and a kind of display device, LCD/PDP based guide application, a guide server which includes the integrated master based on patient flow and data process in every patient examination, and interfaces with the HIS. Applying UX user interface, End users who play role on master manager easily without IT staffs.

Results
We confirmed that SMART guide system can be applied effectively to visiting outpatient who have an examination. We completed to apply about 300 examinations, also it includes each process and events. After doing a pilot test, we implemented 1,500 LCD/PDP which related to examinations at the same time. The satisfaction rating of the system was high, showing its utility as a patient-centered hospital service.

Conclusion
The design of SMART guide system offers reduction delay time of patient medical treatment, obtains higher score in customer service satisfaction, and improve response time effectively according to medical condition and procedure. There is the improvement of hospital information system in ubiquitous environment.

Keywords: SMART guide system, HIS (Hospital information system), ubiquitous environment, Outpatient process, a patient-centered hospital service.
Design and Development of a Medical Information Support System

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Beijing, China

ABSTRACT

With the development and application of Internet, information research institutes are confronted with both opportunities and challenges. Establishing the information support system based on Web has become a trend.

- Objectives
To develop a medical information support system based on the needs of medical information research institute, to realize the comprehensive integration, effective utilization and knowledge service of medical information resources.

- Methods
Based on the information classification principle, the medical information accumulated by the information research institute has been divided into journal articles, research reports, books, dissertations, conference information, network news, laws and regulations, standards, experts and scholars, organizations, professional vocabulary and other 12 kinds of types. Using metadata storage, full-text retrieval, data mining, web crawler technology, the medical information support system has been established by adopting the J2EE technology based on the Browser/Server architecture. Windows 2008 Server (64 bits), JDK1.7, Tomcat7.0 and MySql5.5 were employed as the developmental platform to realize the system functions. Users can access the system through the browser, using a dedicated account.

- Results
The medical information support system can exercise overall management. Internet information capture. Periodical information collection, classification, storage and release of the main sites of Internet biological medicine. Resource processing and indexing. The processing of medical information resources, indexing, storage and other operations. Information storage management. Add, deletion, and modification the information stored in the database. Subject classified navigation. Organization, navigation and browse the information stored in the database according to the set of subjects. Information query and retrieval. The information stored in the database can be general query and full-text retrieval. Visual mining analysis. Construction of medical information network, based on keywords, experts, relevant literature to provide knowledge discovery. Statistical analysis of data. Through multi-dimensional statistical analysis, the sources and utilization of the information can be analyzed and displayed in a variety of graphics. Integrated management of the system. Including data synchronization, interaction, backup and recovery, also includes security authentication mechanism for information dissemination to provide security guarantees.

- Conclusion
We have successfully put the medical information support system into use since April 2014, after 2 years of operation, it has accumulated nearly 10 thousand data records. The system is characterized by the friendly interface, diversified retrieval methods, rapid response and complete output. As an attempt of the information research institute, the medical information support system significantly promoted the institute's information construction, improved the intelligence research quality and efficiency, and supported the academy's innovation and decision-making in the area of medicine.

Keywords: Medical Informatics; Information Retrieval; Information System
• Exploring factors affecting the time to fall from admission using EHR data
• The development of eHR domain content in HKSAR
• A Fast Microbial Detection Algorithm based on High-Throughput Sequencing Data
• Patient Engagement Function Usage Trends in a Hospital-tethered Mobile Personal Health Records
• User requirement analysis for hyperlipidemia management application
• Identification of Strategies to Promote Positive Mental Health among the Adolescents using a Mobile App
• A Design of Smartphone App for Children's Weight Control with Their Parents
• Prescribing Error Reducing After the Implementation of Computerized Physician Order Entry (CPOE) in Thai University Hospital
• Computerized Physician Order Entry(CPOE) Improved Financial Outcome in Thai University Hospital
• An Investigation Report of Citizen’s attitudes toward the handling of Electronical Medical and Medicine Information.
• A Research Study on the Design of Secure HIS that Based on International Standards for General Hospitals : with a focus on ISO 17090, ISO 22600 and ISO 27799
• Non-smoking Webtoon opinion mining, a non-smoking awareness through the Analysis of posting comments
• Childhood Vaccination Ontology for Social Data Analysis
• Development of Medical Informatics Principles for Data Repository in Different Healthcare IT Platforms in Singapore
• The mediating effect of depression on sleep disorder and fatigue among reproductive aged women with Psoriasis
• Reliability and Validity of the Persian Version of the Decisional Conflict Scale in Selecting Mode of Child Delivery
• Using Simulation to assess user needs for the Point of Care (POC) Robot development
ABSTRACT

Objective
The aim of this study was to explore factors affecting length of fall free days from admission using electronic health record (EHR) data.

Methods
This was a retrospective observational study of 71 fallers who were admitted to neurology, neurosurgery, hematology and medical oncology wards in a tertiary-care university hospital during the period from January 2015 to May 2016. A faller is defined as a patient with nursing narratives such as ‘Fall’, ‘Slip and Fall’, ‘Fall off the bed’, ‘Fling oneself to the floor’, ‘Fall down during a move’ and ‘Slip down during a move’ in nursing notes. The multiple regression and cox’s proportional hazards regression analyses were used to identify factors affecting a time period between admission and fall event. Sex, age, Hendrich-fall risk score and patient severity score were included as independent variables in analyses.

Results
There were 48 male (67.6%) and 23 female (32.4%) fallers with a mean age 64.8 and 64.9 years, respectively. The average Hendrich-fall risk score and patient severity score at admission were 5.6 and 24.0, respectively. The average time to fall from admission was 17.4 days. Figure 1 shows the Kaplan-Meier survival curve depicting the time to fall from admission of the 71 fallers. The multiple regression model (p=.0483) and cox’s proportional hazards regression model (p=.0292) were statistically significant. Table 1 shows the estimates of regression coefficients for the two models. Hendrich-fall risk score and patient severity score were statistically significant variables to predict the length of time between admission and fall event in the models. The higher Hendrich-fall risk score is, the earlier patient fell and the higher patient severity score, the later patient fell. Even though sex and age were not statistically significant, the older and male tend to fall earlier than the younger and female patients.

Conclusion
This study is a pilot study to explore the relationship the time to fall from admission with four key factors of fall. We will extend the study by including control groups and more risk factors to develop a fall prediction model.

Figure 1 Kaplan-Meier survival curve of falls

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Multiple regression analysis</th>
<th>Cox’s PH regression analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate SE Pr&gt;t</td>
<td>Parameter Estimate SE Pr&gt;Chisq Hazard Ratio</td>
</tr>
<tr>
<td>Sex0(female)</td>
<td>3.35389367 4.43748356 0.4525</td>
<td>-0.21570 0.27995 0.4410 0.806</td>
</tr>
<tr>
<td>Age</td>
<td>-0.24585262 0.15643199 0.1210</td>
<td>0.00994 0.00941 0.2912 1.010</td>
</tr>
<tr>
<td>Fall-risk score at admission</td>
<td>-1.83359790 0.84149623 0.0330</td>
<td>0.15509 0.06155 0.0118 1.168</td>
</tr>
<tr>
<td>Severity score at admission</td>
<td>0.60216930 0.31834254 0.0631</td>
<td>-0.05719 0.02470 0.0206 0.944</td>
</tr>
</tbody>
</table>

Keywords: fall, EHR data, nursing narratives, survivor analysis
The development of eHR domain content in HKSAR

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ABSTRACT

The Electronic Health Record Sharing System (eHRSS) is a territory-wide platform that allows sharing of electronic womb-to-tomb health records between public and private healthcare providers (HCP) with healthcare recipients’ consent. eHRSS was launched on March 13 2016, with the aims to improve the quality of healthcare delivery by enhancing the continuity of care, improving the integration of different healthcare services for individual patients, and promoting the public-private collaboration.

Objectives

This paper aimed to describe the process of developing the data content of the first stage eHRSS.

Methods

The stage 1 eHR sharable scope and the data content of each domain were developed by undergoing the following journey:

The initial set of eHR content standards were defined with reference to local or international standards e.g. ASTM E1384 Content & Structure of Electronic Health Record and E369 Continuity of Care Record (CCR), HL7 standards, and Hospital Authority’s (HA) data for electronic patient record (ePR). Multi-level standards compliance strategy was formulated to cater for different levels of computer adoption at various HCPs; i.e. Level 1, free-text or PDF document; Level 2, structured data with local value and Level 3, structured data with standard value.

Domain groups (DG) were set up to oversee the standards of data sharing for specific domains, such as, drug, laboratory. Consultation was sought from expert advisory group for domains that have no DG. Meanwhile, gap analysis with HA, Clinical Management System (CMS) On-ramp and CMS Adaptation Modules was performed to ensure interoperability. Briefing sessions were held and comment was sought from local health care providers on the data standards. Also, the display format of the eHR data content in the eHR Viewer was proposed with ongoing enhancement.

Finally, the data content and information standards were endorsed by Coordinating Group on eHR Content & Information Standards. The related standards documents were published to http://www.ehealth.gov.hk for reference.

The defined data standards provided a framework of data to be shared in eHRSS. It facilitated the testing of compliance standards and ensured data quality uploaded to eHRSS.

Results

There were 15 domains data standards developed in the phase 1 eHRSS (figure 1). 1,458 records covered with 10 domains were successfully uploaded in the first week of eHRSS launched. As more and more participant joined eHRSS, the number of uploaded records was increased to 13,011,152 which covered with all the 15 domains in the 4th week of eHRSS launched.

Conclusion

eHRSS enables two-way sharing of eHR contributed by both public and private sectors. The eHR Information Standards Office will review and update the sharable scope as appropriate and more domains standards will be developed in the later stage of eHRSS.

<table>
<thead>
<tr>
<th>Domain</th>
<th>Level of compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level 1</td>
</tr>
<tr>
<td>Healthcare recipient index</td>
<td></td>
</tr>
<tr>
<td>Encounter</td>
<td>✔</td>
</tr>
<tr>
<td>Referral</td>
<td>✔</td>
</tr>
<tr>
<td>Clinical note/summary</td>
<td>✔</td>
</tr>
<tr>
<td>Adverse drug reaction</td>
<td>✔</td>
</tr>
<tr>
<td>Allergy</td>
<td>✔</td>
</tr>
<tr>
<td>Problem</td>
<td>✔</td>
</tr>
<tr>
<td>Procedure</td>
<td>✔</td>
</tr>
<tr>
<td>Birth Record</td>
<td>✔</td>
</tr>
<tr>
<td>Dispensing record</td>
<td>✔</td>
</tr>
<tr>
<td>Prescribing record</td>
<td>✔</td>
</tr>
<tr>
<td>Immunization</td>
<td>✔</td>
</tr>
<tr>
<td>Laboratory</td>
<td>✔</td>
</tr>
<tr>
<td>Radiology examination</td>
<td>✔</td>
</tr>
<tr>
<td>Others investigations</td>
<td>✔</td>
</tr>
</tbody>
</table>
A Fast Microbial Detection Algorithm based on High-Throughput Sequencing Data

LI Jiangyu, MAO Yiqing, WANG Xiaolei, ZHAO Dongsheng

Institute of Health Service and Medical Information, Academy of Military Medical Sciences Beijing, China

ABSTRACT

*Objective*
According to the 'output while sequencing' characteristic, design a localized rapid microbial detection algorithm. The algorithm analyzes the sequencing data while sequencing, which can improve the speed of pathogenic microbial detection.

*Method*
A ‘analysis while sequencing’ method is used to analyze the sequencing data while sequencing, the method is using the detection algorithm to analyze the sequencing data generated by the sequencer periodically. In each analysis, the reference microbial genomes are grouped. For each group the algorithm extracts sequencing reads mapped well to the microbial genomes and then filters the human genome data in the reads extracted, then the algorithm assembles the reads left and aligns the assembled contigs to the microbial genomes. The algorithm flow ends if the microbial species are detected from the comparison results. Otherwise the algorithm continues with the next group of reference microbial genomes. If the algorithm still cannot find out the microbial species when all reference microbial genomes are used, then it filters out the human sequencing reads in the rest of the sequencing data and assembles the reads left. If the assembled contigs cannot map to any reference microbial genomes, these contigs are detected as genome segments of unknown pathogenic microorganisms.

*Result*
First, the new detection algorithm was used to analyze the simulated data and real sequencing data respectively, and RINS is used for comparison. For the simulated data, the new algorithm achieves speedup of 10 compared with RINS when the microorganisms in the sample have ref-genomes, the analysis results are consistently and the new algorithm gets longer contigs. The new algorithm achieves an average speedup of 9 when the microorganisms in the sample don't have ref-genomes, and it obtains a more complete original sequence. For the real data, the new algorithm achieves an average speedup of 3 compared with RINS, and the detection results of the two algorithms are the same. When verifying the Sequencing-by-side method, a reliable result can be obtained with a certain scale of sequencing data. Along with the increase of sequencing data, the number of contigs obtained by the algorithm is reducing and the length of contigs is increasing.

*Conclusion*
The 'analysis while sequencing' methods implemented in this paper can improve pathogen detection speed, and have good application prospects.

Keywords: high throughput sequencing; microorganism detecting; sequencing assembly; algorithm
Patient Engagement Function Usage Trends in a Hospital-tethered Mobile Personal Health Records

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ABSTRACT

Objective
Patient engagement functions (PEFs) is an important factor of continuous use of mobile personal record (mPHRs). A hospital-tethered mPHR which was actively used in Korea since December, 2011 was recently updated to provide more PEFs to patients. By analyzing usage trends of PEFs, we tried to find which functions were used frequently or seldom to guide next upgrade of the mPHR.

Methods
PEFs were defined as that of patients’ active action needed for their health and disease management. Functions of health data management entry, medication entry, allergy entry, phone call, diary entry for three diseases, my health summary download, and questionnaire entry for cancers and inflammatory bowel diseases were included. Phone call, my health summary download, diary entry, questionnaire entry were newly added functions to the upgraded mPHR. Six months’ log data of PEFs and log data of sign-up, users, and access to the mPHR were gathered and tendency of their usage were analyzed.

Results
During the study periods, total sign-up, users, and access were 20947, 169621, and 336113 (115.1/day, 932.0/day, 1846.8/day) and they showed increase in use. Health data entry was the most used PEF (total: 10870, daily mean: 59.7) then followed by Diary entry (2270, 12.5), Medication entry (1774, 9.7), My health summary download (1262, 6.9), Questionnaires (1248, 6.9), Phone call (566, 3.1), and Allergy entry (43, 0.2). Within the health data entry, blood sugar test was the most used (5246, 28.8), then flowered by Blood pressure and heart rate (3466, 19.6), Body mass index (1503, 8.3), 10 years’ Cardiovascular risk (354, 1.9), and Metabolic syndrome (301, 1.7). Except Allergy entry menu, all PEFs usages were increased as time passed. But usages of only three PEFs—Questionnaires, Diary entry, and My health summary download– were increased when divided by users logged-in.

Conclusion
The mPHR usage was increased after upgrade. The daily usages of three of four newly added PEF functions were increased but those of previously existed PEFs and Phone call were slightly decreased. More in-depth studies of PEFs usage trends are needed for improving patient engagement including previously existed PEFs usage trends.

Keywords: Personal health record; Mobile health; Patient engagement; Patient centeredness
User requirement analysis for hyperlipidemia management application

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ABSTRACT

• Objective
The objectives of this study are to survey user requirement for tailored information and feedback from the app on self-monitoring of diet, exercise, smoking cessation, medication and weight control for hyperlipidemia management app.

• Methods
Paper-based survey was conducted on 30 patients who were diagnosed as hyperlipidemia. Questionnaires contained 7 items on demographic information, 10 items on tailored information, and 22 items on self-monitoring with feedback. We asked patients to rate how much they think they need tailored information on the importance of and how to manage each life style. For self-monitoring, we asked patients to rate how much they think they need displaying daily activity, displaying activity trend, reminder for data input, reminder for lifestyle activity as feedback from the app, and goal setting function using 5-point rating scale (from 1 = the least to 5 = the most). We allowed patients to give any suggestion with open-ended question. Rating scores were analyzed by descriptive statistics using means and SDs.

• Results
Among 30 patients, 22 patients were male and 8 were female. Their mean age was 52.87 years (Min. 29 years, Max. 70 years). All patients were smartphone users. For tailored information, the patients rated information on the importance and management methods of life style component higher than 4.0 except for the information on smoking cessation management method. For self-monitoring, they rated goal setting function relatively high (3.90 – 4.43) and reminding data input as a feedback on self-monitoring relatively low (3.57-4.07) (Table 1). Three patient suggested a function to compute the likelihood of developing hyperlipidemia complication.

• Conclusion
Most patients think they need tailored information for lifestyle management. Highly rated functions were goal setting. However, patients do not think they need remind alarms for their behaviors. We will develop hyperlipidemia management app reflecting user requirements.

Table 1 Rating score for tailored information and self-monitoring of hyperlipidemia management app

<table>
<thead>
<tr>
<th>Tailored information</th>
<th>Feedback on self-monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Importance</td>
</tr>
<tr>
<td>Diet</td>
<td>4.47</td>
</tr>
<tr>
<td>Exercise</td>
<td>4.53</td>
</tr>
<tr>
<td>Smoking</td>
<td>4.13</td>
</tr>
<tr>
<td>Medication</td>
<td>4.10</td>
</tr>
<tr>
<td>Weight control</td>
<td>4.40</td>
</tr>
</tbody>
</table>

Keywords: Mobile health, Hypercholesterolemia, Health behavior, Needs Assessment
Identification of Strategies to Promote Positive Mental Health among the Adolescents using a Mobile App

Ji-Hyun Lee, Hyeoun-Ae Park

ABSTRACT

Objective
The aim of this study is to identify strategies for a mobile app to promote positive mental health in the adolescents.

Methods
First, social emotional learning competencies as a framework of educational contents to promote the positive mental health in the adolescents were identified by reviewing the clinical practice guidelines published by the NICE and the CASEL [1], and related literature. Second, skill sets to develop theses competencies were identified by reviewing literatures and validated by two mental health nurse-specialists. Third, strategies to realize these skills were identified by reviewing the literatures on the mental health apps and studying functions of the mental health apps. The appropriateness and preference of these strategies were surveyed with three school health teachers and 13 middle school students. Finally, competencies, skill sets and strategies were linked and the linkage was validated with three nursing informatics experts.

Results
Table 1 displays five competencies, eight skill sets, and five strategies identified for the app and their relationships. Two mental health nurse-specialists agreed eight skill sets are enough to achieve the goal of the app. School health nurses and students answered five strategies are appropriate to develop eight skills. School health nurses preferred self-monitoring and tailored education strategies. However, students preferred gamification and social media strategies. Finally, nursing informatics approved the strategies to be implemented on the app to achieve the skill sets identified for the competencies required for positive mental health promotions in adolescents.

Conclusion
A mobile mental health app to promote positive mental health in adolescents will be developed based on the strategies identified in this study. This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIP) (No. 2010-0028631).

Table 1  Competencies, skill sets and strategies for a mobile mental health app

<table>
<thead>
<tr>
<th>Competencies</th>
<th>Skills sets</th>
<th>Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Recognizing and naming one’s emotions</td>
<td>Self-monitoring</td>
</tr>
<tr>
<td>Self-awareness</td>
<td>Understanding the reasons and circumstances for feeling</td>
<td>O</td>
</tr>
<tr>
<td>Self-management</td>
<td>Managing stress</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Mobilizing positive motivation</td>
<td>X</td>
</tr>
<tr>
<td>Social awareness</td>
<td>Recognizing others’ emotions</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Appreciating diversity</td>
<td>X</td>
</tr>
<tr>
<td>Relationship skills</td>
<td>Help-seeking</td>
<td>X</td>
</tr>
<tr>
<td>Responsible decision making</td>
<td>Engaging in self-reflection</td>
<td>O</td>
</tr>
</tbody>
</table>

Keywords: Mental health, Health Promotion, Mobile Apps, Adolescents
A Design of Smartphone App for Children’s Weight Control with Their Parents

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ABSTRACT

Objective
Pediatric obesity concerns healthcare professionals around the world due to its increasing harmful effects. Overweight or obese children are prone to various chronic diseases and also influenced psychologically and socially [1]. According to previous studies, parents had positive influence on children when cared well with proper diet and physical activity [2]. Along with lack of will, lives of elementary school students in Korea are centered around school work and private education that it is difficult for them to control weight and stay healthy [3]. Currently, smartphone application (app) has been emerged as an alternative means to healthcare industry and it is possible to apply personalized intervention to obese children in a cost-effective way. In this study, we depicted a smartphone app design so as to actually realize it.

Methods
In order to design an app, we used the LUCID framework [4]. It helps the developers to create the product they envisioned. Its first step is to envision. We wanted to create an app that helps elementary school students to control their weight with their parents’ guiding and stay healthy by practicing good acts of staying healthy. The second step is Discovery Stage. So as to find out the users’ needs, we conducted focus group interview and a survey. Based on the results, the third step, design foundation, has been done.

Results
Figure 1 shows the prototype of the app design based on the results of focus group interview and survey. The content itself contains the ideas about habit loop by Charles Duhigg [5]. This habit loop consists of three steps: cue, routine, and reward. By applying this means, it helps children to build a habit of practicing healthy lifestyle.

Conclusion
An app design for children’s weight control with their parents has been depicted and this would be applied to real users after implementation. With further study, the effect of this app would be confirmed and this could be used as a new method for elementary school students’ new means to control their weight with their parents.

Figure 1 The prototype of the app design

Keywords: Pediatric Obesity, Smartphone App Design, Parents, Elementary School, Weight Control
Prescribing Error Reducing After the Implementation of Computerized Physician Order Entry (CPOE) in Thai University Hospital

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ABSTRACT

Introduction
Srinagarind Hospital, a 1000 beds university hospital had implemented new Hospital Information System (HIS) since December 2014. New Computerized Physician Order Entry (CPOE) is a hospital management and information system for preventing or minimizing unwanted events that may cause harm to the patients called medication errors. This system may decrease prescribing error and improve patient safety since physicians can send medication order directly to the pharmacy service department instead of using paper-base prescription with hand writing. Moreover, the commercial MIMS drug information was incorporated to the CPOE and the physician can select the medication in hospital formulary from drop down list in the software; meanwhile, drug-drug interaction, drug duplication and drug allergic history can be displayed and allow the physician to make final decision. CPOE has been a major institutional change at Srinagarind Hospital to minimize the prescribing errors and may enhance patient safety and efficiency of the treatment. As the system has been implemented since December 2014, therefore, the monitoring of reported medication error and the constructive feedback should be performed to assess the effectiveness of this strategy.

Objectives
To explore the outcome of CPOE implementation on the incidence of prescribing error.

Methods
This retrospective descriptive study was performed at Srinagarind Hospital, a 1000-bed teaching hospital, Khon Kaen University, Thailand in July 2016. The data about prescribing errors were obtained from the hospital’s voluntary paper-based reporting system for medication errors which were already assessed by pharmacist in pharmacy service department before CPOE implementation (2014) and after CPOE implementation (2015). The report included incident date and time, report date, location, medical service, type of error, medication involved, severity and the name of person who notified and/or reported. The incidence of medication error was calculated as the number of event divided by 1000 prescriptions and used as service indicator. Then, the outcome of COPE was assessed by comparing these service indicators between pre and post implementation.

Results
Prior to CPOE implementation, the incidences of prescribing error were ranged between 5.14-6.50 and 3.35-12.98 events/1000 prescriptions in outpatients and inpatients, respectively. A year after the CPOE implementation, the incidence of prescribing error was decreased to 0.22 and 0.30 events/1000 prescriptions in outpatients and inpatients, respectively, and meant that the incidences of prescribing errors were reduced approximately 99.9% in both outpatient and inpatient.

Conclusion
CPOE system could reduce prescription error and may improve the patient safety. Undoubtedly patient safety is the core benefit of CPOE implementation.

Keywords: CPOE, Prescribing error, University hospital
ABSTRACT

Introduction
Thailand has three major health insurance schemes that together provide access to health coverage for all of its citizens. The Civil Servant Medical Benefit Scheme (CSMBS) provides health care to government employees. The Social Security Scheme (SSS) is a compulsory insurance program for employees of private businesses. The largest insurance program is the Universal Coverage (UC) scheme. In the past, paper prescriptions by doctors were entered into the pharmacy information system by a pharmacist. This human-dependent process unavoidably led to prescription errors and reimbursement errors. The former increased patient risks while the latter initiated financial risks. Srinagarind Hospital, a 1000 beds university hospital implemented new Hospital Information System (HIS) since December 2014. New Computerized Physician Order Entry (CPOE) is designed to reduce both types of errors. Doctors can order through CPOE, with embedded Clinical Decision Support System. CPOE will automatically allocate medications by primary health insurance and payer agreement. Data set up is based on drug type, encounter, agreement type, and payer’s office. Each patient can be entitled to medicines from various insurance schemes per one visit. After verification by financial office, data will be populated and sent out to the claim office of the applicable payers. That information will be validated by payer’s format and rules and sent back to the hospital for correction. Once verified, the reimbursement process will complete.

Objectives
To explore the financial benefits of CPOE in reducing claim denial and increasing reimbursement amount in CSMBS scheme.

Methods
Outpatient reimbursement data of 24 months before and 12 months after the new CPOE implementation were analyzed. Claims denied and error data were collected from file acknowledgment by the payers. The claim denial is identified by the incomplete claim data, i.e. patient information, encounter information, product category, drug code, compatibility of drug code to hospital drug catalogue, reason for using non-essential drug, and prescriber information. Percent of claim denial is defined by the ratio of number of denied claims to the number of total claim transactions multiply by 100. Two financial outcomes to be observed are percent of change in annual reimbursement amount and percent of change in annual reimbursement amount per visit. Results: Prior to CPOE implementation, 27.5 percent of reimbursements in CSMBS scheme were rejected. While some can be claimed after several corrections, there were many reimbursements left unclaimed. A year after the CPOE implementation, those figures reduced to 4.57 percent. Annual reimbursement amount increased by 40.5 percent while annual reimbursement amount per visit increased by 8.5 percent.

Conclusion:
Undoubtedly patient safety is the core benefit of CPOE implementation, however, it also evidently helped decrease claiming errors and significantly improved financial outcome. Data set up was very important in preventing such errors and led to zero claim denial.

Keywords: CPOE, University hospital, Financial, Reimbursement
An Investigation Report of Citizen's attitudes toward the handling of Electronical Medical and Medicine Information.

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\textsuperscript{1} Medical Information System Development Center, (Tokyo, JAPAN)
\textsuperscript{2} The University of Tokyo Hospital, (Tokyo, JAPAN)

\section*{ABSTRACT}

\textbf{Objective}

If adequate PHRs are realized, it will be beneficial for health management by accumulation and management of lifelong health care information for every citizen. To control own information is one of basic concept of privacy, but to control own health information is difficult for general people because of lack of enough knowledge for medical sciences. So we consider that PHRs should have supportive functions for privacy protection and data security. For determining the requirements for adequate PHRs, we planned to clarify the acceptability of PHRs by ordinary citizen and also their attitudes toward data security, privacy, and secondary use for public benefit.

\textbf{Methods}

We have carried out Web questionnaire 4 times about the citizen's attitudes toward the handling of their medical information. The results of the survey were investigated for age and health conditions of the respondents, and also analyzed using cross tabulation. We also analyzed results of opinion polls of users of PHRs already operated in other countries such as the Blue Button in the U.S., and compared the results with those of our results.

\textbf{Results}

We asked about the necessity for PHRs, 82.4\% of the respondents (N=2266) answered "Yes". Those who answered "No" (N= 399) were then asked why they think there is no need for PHRs. 66.9\% of the respondents chose "I think we do not need anything more than the current system that maternity notebooks and medicine notebooks on paper", 65.4\% chose "I am afraid about the high cost", and 59.9\% chose "I am afraid about the security issues such as information leaks". Regarding the subject that should services PHRs, the questionnaire allowed multiple choices, which resulted in "National governments" was chosen most often: 41.8\%, then "Local governments": 32.9\%, "Medical institutions": 32.0\%, "Private sector enterprises controlled by national governments": 16.9\%, "Private sector enterprises controlled by local governments": 11.5\%. We asked about necessity for cloud service which is aimed for electronical medicine notebooks for management of drug information by oneself for lifetime span, 86.9\% chose "Yes, if it is free", 4.7\% chose "Yes, even if there is a charge". We asked about usage of smartphone application of standalone digitalized medicine notebooks, "It's being used at present": 1.9\%, "It was used in the past": 2.5\%. Same tendency was confirmed in case of paper based maternal handbook and electronical one.

\textbf{Conclusion}

The surveys revealed that most citizens desire adequate PHRs, on the other hand, the survey also showed that citizens feel vague anxiety about security issues. Many citizens seem to recognize the necessity of PHRs and lifetime electronical medicine notebooks, on the other hand the rate of usage of electronical medicine notebooks and electronical maternal handbooks was quite low. We suppose the paper-based medicine notebook and the paper-based maternal notebook have already quite important role in managing medication and pregnant-delivery-childcare, and citizens notice the disadvantage of paper based records, but the function of present electronical medicine notebooks and electronical maternal handbooks is incomplete and lack of the long time availability, and we conclude it is still necessary of further exploitation of PHRs and should be supported by public sectors for achieving long time availability.

\textbf{Keywords}: Privacy, PHR, Web Questionnaire Survey, Electronical Medicine Notebook, Electronical Maternal Notebook
A Research Study on the Design of Secure HIS that Based on International Standards for General Hospitals: with a focus on ISO 17090, ISO 22600 and ISO 27799

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ABSTRACT

Objective
Hospitals are able to provide increasingly diverse services by implementing HIS (Hospital Information System). But HIS does not based on a information management standard and therefore has an insufficient level of security at all stages of processes ranging from data creation to verification. Therefore a HIS that applies ISO 17090, ISO 22600 and ISO 27799 standards was designed in this research study to support the implementation of secure healthcare services.

Methods
To design a secure HIS, the authentication certificate policies and security requirement specifications based on the PKI (Public Key Infrastructure) ISO 17090 standard were analyzed. Additional security requirement specifications were deduced by analyzing the SSO (Single Sign-On) / EAM (Enterprise Access Management) ISO 22600 standard recommended for healthcare providers, which were reflected into the secure HIS designed in this research study.

Results
It was confirmed to be possible to verify users with their electronic signatures when storing record archive documents and orders for the long term by implementing PKI and that the abuse of permissions by users can be prevented by implementing SSO/EAM. Also the Interim HIS designed in this research study that implements a redesigned minimized hardware profile and software stack that is both medical record and also order oriented, a secure and convenient healthcare service that manages the creation, storage, utilization and verification processes using electronic signatures can be provided.

Conclusion
The Interim HIS designed in this research study applied international standards to the previous information management system that did not based on any standards. The scope of patient oriented healthcare IT services can be expanded by based on these standards, which will enable the implementation of secure system based on increased security protocols.

Keywords: HIS, ISO, PKO, SSO/EAM, healthcare security
Non-smoking Webtoon opinion mining, a non-smoking awareness through the Analysis of posting comments

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ABSTRACT

Objective

Smoking in adolescence critically damages adolescents’ physically undeveloped body and also causes genetic damage. Starting to smoke at young age is known to highly likely to continue throughout adult period. As a solution, online and offline smoking cessation campaigns are being implemented at national level.

Among those campaigns in 2014, a webtoon called “Tale of Cigarette” received positive reviews from viewers, publishing a total of 12 episodes in NAVER webtoon. The cartoon amusingly portrayed a friendly character attempting to quit smoking, urging the viewers to directly participate in smoking cessation campaign and enlightening them of the benefits of smoking cessation.

Recently, commercial public brand webtoons have been developed through a variety of fields’ advertisement platforms, but methods to evaluate their effects are insufficient. So far, the only way to evaluate the effect of brand webtoons is limited to ratings, comments, and page views.

Methods

Therefore, the proposed research analyzed smoking cessation advertising brand webtoon’s comments using opinion mining method. The objective was to analyze the association between frequent morpheme and morpheme, and to analyze sentiment embedded in user comments.

For the research objective, all opinion mining related domestic and international prior researches were referenced to design preprocessing operation and association analysis to account for collected comments. Then, analysis results were compared to prior adolescence smoking cessation research results.

Results

A total of 107,264 participants rated the webtoon “Tale of Cigarette” as 9.91, and preprocessing results showed that after preprocessing the initial 20,560 comments, a total of 18,117 comments were refined.

Frequent morpheme analysis results showed that the word ‘Cigarette’ was most frequent, and other words such as ‘Smoking Cessation’, ‘Human’, ‘Smoker’, ‘Dad’, ‘Please’, ‘Smoking’ followed the ranking order. Comments were converted through transaction for association analysis. Support, confidence and lift were applied to the transaction data to check for association patterns, and results showed high lifts between the word ‘Cigarette’ and words ‘Smoking’, ‘Tax’, ‘Street’, ‘Smell’, and ‘Smoke’. Sentiment analysis results showed that negative sentiment in the early episodes changed into positive sentiment as the episodes progressed.

Conclusion

In conclusion, in order to successfully advertise smoking cessation through brand webtoon, it was important to first gain as much viewer attention as possible, and then to appeal the importance of the webtoon’s story. Also, it was important to convince the users understand the harmful effects of smoking and to ultimately make them quit through repeatedly publishing attractive smoking cessation related topics.

Analyzing readers’ opinion through opinion mining of webtoon comments is envisioned to provide clear indicators when deciding the course of advertisement. Also, this will enhance the quality of analysis when handling atypical data such as user comments, and is expected to be applied in other practical web sites as well.
Childhood Vaccination Ontology for Social Data Analysis

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ABSTRACT

Objective
The aim of the study is to develop a childhood vaccination ontology as a framework for collecting and analyzing social data to understand parents’ sentiment, attitude, experience and knowledge about childhood vaccination. This ontology will be used to develop vaccination policies and interventions before, during and after vaccination.

Methods
The ontology was developed using the revised ‘Ontology Development 101’ methodology. We determined the domain and scope of the ontology as factors affecting patients’ decision making process for childhood vaccination ranging from individual factors to environmental factors. Then we collected terms describing factors affecting childhood vaccination from national immunization guideline of Korea, literatures related vaccination and postings of parents’ sentiment, attitude, experience and knowledge about childhood vaccination on social media. We extracted concepts from the terms and classified the concepts hierarchically. We defined the properties and value sets of the concept, and the relation among the concepts.

Results
In total, 1760 terms were extracted. Out of these terms, 638 concepts were extracted. They are concepts for 7 super classes, 207 subclasses, 146 attributes and 278 value sets. The Figure 1 presents 7 super classes of the childhood vaccination ontology and the relationship among the super classes before, during and after vaccination. Personal factors, structural and sociocultural factor, informational factor, and environmental factor affect the vaccination intention of the parents. The vaccination intention affects the vaccination behavior and the vaccination behavior affects the experience of the parents.

Conclusion
Childhood vaccination ontology developed in this study will be used as a framework to understand parents’ decision making about childhood vaccination and parents’ sentiment, attitude, experience and knowledge about childhood vaccination before, during, and after vaccination using social media data. The result of the social media data analysis using the ontology can be used for development of vaccination policies and interventions.

Figure 1. 7 super classes of the childhood vaccination ontology.

Keywords: Childhood vaccination, Ontology, Social media analysis
Development of Medical Informatics Principles for Data Repository in Different Healthcare IT Platforms in Singapore

ABSTRACT

Since the movement into paperless systems in healthcare management, a myriad of different systems and platforms has emerged. Although most of the systems boast to have the capability to handle the requirements of the healthcare institution, different systems are still being used by different healthcare institutions to serve their own purpose. In Singapore, the healthcare environment is divided into 6 clusters based on the regional healthcare systems. These 6 clusters employ different vendors for their electronic medical records and the national electronic health record for each Singapore citizen employs a different system as well. Community services and other voluntary organisations likewise have their own platforms to service their needs. All this different platforms have caused widespread confusion as to what data should reside in which systems. It has also been a great challenge to integrate and rationalise all these data to ensure that there is smooth data transfer to enable continuity of care and patient safety.

Through various engagements with different stakeholders to understand their workflow, needs and identifying gaps in the data flow, we attempt to produce a set of informatics guidelines and principles to allow healthcare providers as well as non-healthcare providers a clear understanding as to the definition of different data repository into different IT platforms.

This guideline is based on 6 informatics focus as documented below.

**3U-Informatics Focus**

- Maintain the health continuum record with purpose for all providers, through a longitudinal health record from birth to end of life.
- Transform the care team clarity, accountability and effectiveness to ensure optimal co-management and co-ownership.
- Facilitate joint governance of information/data domains, with the care recipient and patient at the centre.
- Know your population and patient group better to personalize and achieve the best care outcomes.
- Support delivery of care and strengthen model of care through facilitating adaptive e-clinical process flow and personalized e-collaboration.
- Support future medicine through ensuring precision informatics is in place and has effective practical application.

Keywords: aaaaa
The mediating effect of depression on sleep disorder and fatigue among reproductive aged women with Psoriasis

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ABSTRACT

• Objective
The purpose of the study was to investigate the mediating effect of sleep disorder in the relationship between depression and fatigue among Korean reproductive aged women with Psoriasis.

• Methods
The data were collected from Korean Nurse’s Health Study (KNHS). Female nurses of reproductive age 20 to 45 years old were included. The KNHS was conducted between March 2013 and December 2015 as a web-based questionnaire survey. The total number of nurses of reproductive who participated in KNHS Module 1 was 20,922. Of these, 20,463 had no Psoriasis and 495 were clinically diagnosed with Psoriasis; 171 of the latter group were diagnosed within one year prior to the survey. One of the main variables, fatigue, was measured using Chalder et al (1993)’s questionnaires. Depression was measured with the Patient Health Questionnaire (PHQ) 9, a self-reported, brief depression assessment tool developed to determine depression levels based on the DMS-IV. In order to measure the sleep disorder degree, Jenkins Sleep Questionnaire (Jenkins, Stanton, Niemcryk, & Rose, 1988) were used. Data were analyzed a hierarchical-multiple regression analysis as suggested by Baron & Kenny with Sobel test for mediating effect, and were analyzed t-test, ANOVA, Pearson correlation coefficients according to statistical purpose.

• Results
There were differences in depression, sleep disorder according to age, marital status, shift work and other variables had no significant differences. First step, There were correlation between depression, sleep disorder, and fatigue. There was a positive relationship between sleep disorder and depression ($\beta = .663$, $p<.000$) and Second, a positive relationship between sleep disorder and fatigue ($\beta = .484$, $p<.000$). Third step, a positive relationship between sleep disorder, depression, and fatigue. So, there was a partial mediating effect of sleep disorder. As a result of Sobel test, depression significantly gave mediation effect on the relation between sleep disorder and fatigue ($Z=6.097$, $p<.000$).

• Conclusion
These results suggest that there is a need to develop tailored program for reproductive aged women with psoriasis to decrease fatigue considering simultaneous management of depression and sleep disorder.

Keywords: Psoriasis, Depression, Fatigue, Sleep, Women
Reliability and Validity of the Persian Version of the Decisional Conflict Scale in Selecting Mode of Child Delivery

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ABSTRACT

Objective
Women’s estimates of the risks and benefits of modes of delivery vary, and many pregnant women unnecessarily choose for a caesarean delivery. Because some delivery options have undesirable outcomes, pregnant women may experience uncertainty and decisional conflict when facing delivery mode choices. A valid tool is needed to identify decisional conflicts and their contributing factors when facing delivery choices. The Decisional Conflict Scale (DCS) is a 16-item, self-administered questionnaire consisting of 5 subscales developed to assess peoples’ decisional conflict. The low literacy version of the DCS tool contains a subset of 10 items from the full DCS in “yes, no, unsure” response format. The aim of the present study is to investigate the reliability and validity of the Persian language version of the full and low literacy version of the DCS.

Methods
The DCS was translated from English to Persian and then back translated by two English language experts. The translated version was used with 212 pregnant women in Mashhad, Iran. The scale was statistically assessed for reliability and construct validity including factor analysis and the Cronbach alpha coefficient.

Results
212 women with an average age of 26.7 (SD=7) years, and median gestational age of 29 weeks, who received prenatal care from public centers and private offices, were sampled. Factorial analysis identified four factors (or subscales) in pregnant women preferring cesarean section, corresponding to: feeling informed (feeling clear about values included in this factor); being supported; being uncertain; and perceived effective decision making. Three subscales, in the group selecting vaginal delivery (being uncertain; and effective decision making were in one) were extracted. We also analysed the low literacy version of the DCS tool and found 2 subscales, feeling informed, and being supported. The reliability coefficients of the DCS tool were 0.87 and 0.82 in the two versions, respectively. The Persian versions of the DCS were not clustered in the same way as the original version of the DCS.

Conclusions
The Persian version of the DCS had good construct validity and internal consistency. This version of the DCS was not clustered in the same way as the original DCS version. Two subscales, feeling informed and feeling clear about values, may not reflect distinct factors in pregnant women deciding on mode of delivery (all versions).

Keywords: decisional conflict, decision making; child delivery mode; validity; reliability
Using Simulation to assess user needs for the Point of Care (POC) Robot development

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\textbf{ABSTRACT}

\textbf{Objective}

The adoption of telehealth technologies eliminates location as a barrier to accessing quality treatment and care. This opens up new opportunities for healthcare providers to engage with patients and other professions across distances in real-time.

Point of care (POC) means healthcare providers deliver health services to patients at the time of care. In this sense, we are currently developing the POC robot as a tool for teleconsultation and interdisciplinary education. Thus, the purpose of this simulation was to assess needs of the POC robot and to define the essential elements and functions of robot prior to robot system development.

\textbf{Methods}

We went through the following steps in order to derive specific user requirements and barriers in real medical environment. Firstly, target medical fields were selected and basic domains of the POC robot were defined. Secondly, we used contextual inquiry methodology that combines interviews and field observations to gain significant information concerning the user’s context, the equipment in use, and the place of work (Beyer, H., et al., 1997). Thirdly, we organized scenes, and mapped expected functionality of the POC robot to each scene. Fourthly, a simulated patient was defined and medical records of the patient were described. Lastly, clinicians reviewed scenarios and completed final scenarios for the simulation. A total of 9 researchers (two clinicians, four nurses, and three system developers) involved to conduct the simulation. Three nurses and three clinicians participated as observers to evaluate the robot. The simulation took place in a simulation center with an emergency department, an operation room, and general wards. All the simulations were filmed.

\textbf{Results}

We selected department of neurology, dermatology and pathology as target medical fields according to demands of health professionals of the study hospital. Three major functionalities tested in the simulation: 1) image acquisition using a super wide angle camera and a high resolution camera, 2) image transmission and display, 3) remote control of robot arms, 4) mobility of the robot. A developed scenario was consisted four part, and each part had 3 to 4 scenes. A simulated patient was female of 52, and she admitted an emergency department for headache and memory impairment. Four research assistants took roles as two clinicians, a nurse, and a family caregiver. Observers reported that the POC robot is highly acceptable. Also, they derived some errors such as space conflict, communication errors, and safety issues.

\textbf{Conclusion}

We found that it was feasible to use the POC robot for teleconsultation. While there are challenges, incorporating this technology into healthcare services will enhance communication and teamwork skills across distances, and will facilitate teamwork. Repeated simulations will be needed to evaluate improved performances.

\textbf{Keywords} Teleconsultation, Point of Care, Telepresence robot, Bedside robot
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