最后报告
ITU-D第2研究组

第14-3/2号课题
用于电子卫生的信息和通信技术/ICT

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第 14-3/2 号课题

用于电子卫生的信息和通信技术/ICT

ITU-D 研究组

作为电信发展局知识共享和能力建设议程的后盾，ITU-D 研究组支持各国实现其发展目标。通过推动为减贫和经济社会发展进行 ICT 知识的创建、共享和运用，ITU-D 研究组鼓励为成员国创作条件，利用知识更有效地实现其发展目标。

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信息交换和知识共享中枢

共同关心议题的共享是通过面对面会议、电子论坛和远程与会，在鼓励公开讨论和信息交流的气氛中实现的。

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第 2 研究组

第 2 研究组由 WTDC-10 受命研究涉及信息通信基础设施和技术发展、应急通信和适应气候变化等领域的九项课题。着重为在规划、发展、实施、运营、维护和持续提供电信服务过程中能够优化用户得到的服务价值，并能最合适、最成功地提供服务的方法和方式。该工作包括将具体工作重点放在宽带网络、移动无线电通信和农村与边远地区的电信/ICT、发展中国家对频谱管理的需要、ICT 在缓解气候变化对发展中国家的影响中的使用、用于减轻自然灾害和赈灾的电信/ICT、合规性和互操作性测试及电子应用，特别强调通过电信/ICT 手段支持的应用。该项工作还研究探讨信息通信技术的实施，同时兼顾 ITU-T 和 ITU-R 开展研究的成果以及发展中国家的优先事宜。

第 2 研究组与 ITU-R 第 1 研究组一道共同负责涉及第 9 号决议（WTDC-10，修订版）问题的研究 – 各国，特别是发展中国家对频谱管理的参与。

本报告是由来自不同主管部门和组织的众多志愿人员编写的。文中提到了某些公司或产品，但这并不意味着它们得到了国际电联的认可或推崇。文中表述的仅为作者的意见，与国际电联无关。

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第 14-3/2 号课题
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1 引言

1.1 情况说明

电子卫生是当今卫生领域发展最为迅速的领域。电子卫生是一种采用信息通信技术代替面对面医患接触的综合性医疗卫生提供系统，其中包括诸多应用，如远程医疗、电子病例、远程就诊、农村医疗中心和城市医院间的会诊等。电子卫生以数字方式提供服务，用于医生、护士、其它医护人员和病人在当地（您的工作地）和远程地点（远程工作地）之间进行的临床、教育和行政管理医疗信息传输、存储和检索。目前，某些发展中国家的移动电话数量已超过固定电话，因此，移动通信网可被视为更加诱人的电子卫生服务平台。

电子卫生的一个关键构成要素是，范围更广的产品和服务宽带生态系统，该系统可提供电子卫生和各项创新业务。在此系统内，“物联网”的概念是指成万物均具备智能且相互连通 – 这一点可直接通过高效、低成本计算能力实现。这将成为智能电子产品的核心特征，可用于测量、管理、控制商用电子产品和医疗设备的性能。个人传感装置实现联网之后，可通过对活动水平、心率以及葡萄糖的测量，向专业医护人员传递个人健康信息。

世界卫生组织[1]已特别针对资源匮乏的群体，起草了一份医疗方案和电子卫生设备纲要。这类群体中的多数人均因无法享用医疗技术服务而遭受着不必要的病痛折磨。此外，美洲开发银行[2]的一份报告审视了移动卫生的潜在应用问题，尤其注重拉丁美洲的潜在机遇。

例如：

– 智能电话可通过采集、存储和发送与公民健康相关的信息，推动电子卫生的发展。随着患者数据采集量的上升，卫生从业者已开始强调数据安全和数据保护的重要性，从而让患者对其病历的安全性充满信心。ITU-T 2012 年的技术跟踪报告[3] 为隐私、安全与保障制定了若干原则，作为电子卫生领域标准和互操作性的指导原则。

– 低成本节能型计算可延长电池寿命，从而提高电子卫生监测的可靠性和成本效益，它可以降低新电子卫生产品和服务提供商的门槛，使发展中国家的医疗服务提供商从种类繁多的创新业务中获益。另外，从降低总体能耗的角度亦可获得更多益处– 这不仅降低了成本，同时还减轻了地方与国家电网的压力，减少了提供现代电子卫生解决方案所需的电量。

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1 http://who.int/ehealth/resources/compendium2012/en/index.html

2 http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=1861959

3 http://www.outgrid.eu/public/outgrid/download/homepage/T230100001700O1PDFE.pdf

电子卫生对在发展中国家提供医疗服务至关重要，这些国家极度缺医少药，护理人员不足，巨大的医疗卫生服务需求无法得到满足。某些发展中国家已成功实施了小型电子卫生试点项目，并正在考虑制定电子卫生总体计划（世界卫生组织通过其 2005 年 5 月的 WHA58.28 号决议提出建议），希望将试点工作更推进一步。人们特别希望通过该项工作缩小城市和农村地区之间的医疗服务差别，并特别关注发展中国家的情况，其中包括小岛屿发展中国家、内陆国家和经济转型国家。在本报告中，上述国家将被统称为“发展中国家”。

1.2 第 14-3/2 号课题的研究工作

第 14-3/2 号课题侧重于：

– 采取必要步骤，帮助政策制定机构、监管机构、电信运营商、捐助方和用户了解信息和电信技术在改善发展中国家医疗卫生提供方面所起的作用；

– 鼓励发展中国家的电信部门与卫生部门开展合作、相互支持，使双方都能最有效地利用有限资源实施电子卫生服务；

– 继续在发展中国家推广信息和电信技术在电子卫生领域应用的经验和最佳做法。

– 鼓励发展中国与发达国家在移动电子卫生解决方案和服务方面开展合作；

– 促进与 ITU-T 共同制定有关电子卫生应用的标准，特别要制定有关发展中国家如何使用此类标准的导则；

– 引入并传播国际电联针对发展中国家的、有关电子卫生的技术标准。

本课题最初由 1998 年世界电信发展大会（WTDC-98）批准，后经 WTDC-02、WTDC-06 和 WTDC-10 修订。

1.3 第 14-3/2 号课题的任务

第 14-3/2 号课题的宗旨是就电子卫生的有效做法、政策及标准向国际电联各成员国提供战略信息和指导，以提高卫生水平。其目标包括：

– 及时提供优质证据和信息，帮助国内外政治与决策机构完善电子卫生服务的政策、做法以及管理；

– 培育国内外政治与决策机构以及私营部门投资和推进电子卫生领域发展的意识，并请其做出承诺；

– 收集、分析和传播包括研究成果在内的相关电子卫生知识，为利用 ICT 提高卫生水平做出重大贡献；和

– 通过发布有关电子卫生的重要研究课题报告及实际成果，为政府和决策机构提供参考。

1.4 第 14-3/2 号课题的研究方法

第 14-3/2 号课题的输入意见来源如下：

– 审议第 14-3/2 号课题成员开展的研究；

– 开展调查；

– 成员国、部门成员和电子卫生应用专家的输入意见等。

在第 2 研究组内，第 14-3/2 号课题的输入成果将可通过 ITU-D 网站获取。

如上文纲要所述，本课题的战略目标就是推动电信/ICT 与卫生领域，发达国家与发展中国家，以及发展中国家之间的协作。电子卫生应用电信/ICT 使用方面的经验，亦将使发达国家的设备供应商和业务提供商受益。

在继续探讨之前，有必要对发展中国家的概念加以澄清。

1.5 发展中国家的定义

发展中国家[4]，又称欠发达国家，是指生活水平低、工业基础不发达且与其它国家相比人类发展指数（HDI）较低的国家。然而，在联合国系统内“发达”与“发展中”国家或地区的提法并无既定规范。联合国（UN）通常的做法是将亚洲的日本、北美的美国、大洋洲的澳大利亚和新西兰以及欧洲视为“发达”国家或地区。在国际贸易统计数据中，南部非洲关税同盟也被视作发达地区，以色列被视为发达国家。前南斯拉夫分裂形成的新国家被视为发展中国家；东欧以及独联体的欧洲国家既未包括在发达国家之中，也未被纳入发展中国家之列。

国际货币基金组织（IMF）采用了一种灵活的分类系统，其考虑的因素包括 (1) 人均收入水平，(2) 出口的多元化—石油出口国尽管人均 GDP 很高，但由于石油出口约占其出口总量的 70%，因此不能被归入发达之列，和 (3) 与世界金融体系的融合程度。

世界银行将各国分为四个收入集团，并在每年 7 月 1 日对这些国家加以确定。截至 2011 年 7 月 1 日，按国民总收入（GNI）对各经济体做出了如下归类：

– 人均 GNI 小于等于 1,026 美元的低收入国家；

– 人均 GNI 在 1,026 至 4,036 美元的中低收入国家；

– 人均 GNI 在 4,036 至 12,476 美元的中高收入国家；和

– GNI 高于 12,476 美元的高收入国家。

世界银行将所有中低收入国家均归入发展中国家，但指出“使用此术语是为了方便；并不意味着该集团中的所有经济体都处于相似的发展阶段，或其它经济体已达到理想状态或发展阶段的末期。依照收入分类并不一定能够反映出发展状况。”

鉴于为发展中国家提供支持这一概念是第 14-3/2 号课题及其初步和/或最后报告的核心内容，因此上述信息非常重要，必须铭记在心。

[4] 文稿第 1.5-7 节：M. Jordanova1、L. Androuchko2，1 保加利亚，保加利亚科学院，空间研究技术学院，副报告人 2；日内瓦国际大学，瑞士 Dominic 基金会，第 14-3/2 号课题–医疗保健中的电信业务--报告人；

1.6 一些重要方面

在探讨电子卫生实施时，始终要考虑这些方面，它们既可能成为阻碍电子卫生发展与广泛应用的拌脚石也可能成为其塑造因素。

1.6.1 对发展中国家重大金融和医疗卫生问题的总结

– 疾病负担 – 与发达地区不同；

– 人口 – 与发达地区相比更为年轻且增速更快；

– 医疗服务 – 由于医学院校和专家数量不足，造成效率低下 [1]；

– 医疗保康支出 – 仅是发达国家的几分之一

1.6.2 数字鸿沟

数字鸿沟是那些计划或正努力为发展中国家提供电子卫生服务的人们所面临的严重问题之一。

何为电子鸿沟？该术语于二十世纪 90 年代提出[2]，指能够获取并有能力使用信息通信技术的群体与不具备此能力的群体间存在的差距。

造成此鸿沟的因素很多 – 贫穷首当其冲，此外还包括教育、文盲数量、年龄、姓别、文化、与 ICT 的接触、地理位置、基础设施、连通性、带宽和电信成本。数字鸿沟不仅出现在发达国家与发展中国家之间，也存在于各国国内。

数字鸿沟已被视作在发展中国家和发达国家农村地区开展电子卫生服务的障碍。有关数字鸿沟的讨论旷日已久，人们期望随着基础设施和连通性的提高，更多带宽可供使用，技术和通信成本的持续下降，以及移动电话使用的更加普及，数字鸿沟将被缩小。目前，这些愿望在大多数发展中国家，都取得了不同程度的进展。

M. Mars [3]撰文指出，过去 10 年间发展中国家与发达国家间的数字鸿沟并未缩小，因此提出了数字鸿沟是否会缩小这一课题。理论上，鸿沟的弥合是必然，但实际上随着技术不断进步，实现的机会很渺茫。专家就发展中国家与发达国家间数字鸿沟何时消失所得出的结论，并不令人振奋。

因此，在发展中国家开展电子卫生工作必须对数字鸿沟、数字鸿沟的影响及其驱动因素有切实了解，并在其指导下进行。

1.6.3 盲目模仿

以往 20 年，医疗卫生业目睹了成千上万远程医疗和电子卫生项目的失败。即便非常成熟且在发达国家开展顺利的方案，在发展中地区也会出现水土不服，导致失败。

显然，盲目模仿并非广泛开展电子卫生工作的最佳方式。发达国家广泛采用的方案并非总是发展中国家真正需要或梦寐以求的方法！

1.6.4 当地文化和传统

对当地传统和文化特性缺乏尊重甚至是无知地视而不见，可能会让精心筹备的电子卫生商业项目付诸东流。

所有电子卫生举措均得到发展中地区文化的认可，是一项必要前提。

1.7 发展中国家电子卫生概览：调查

发展中国家电子卫生的落实现状如何？每年出版的论文、报告和介绍成千上万，分别阐述了某区域、国家或社区在电子卫生应用方面的情况。前几年开展的最为全面的一项调查是“世界卫生组织（WHO）全球电子卫生观察站”项目，它总结了 2005 和 2009 年开展的两项调查的成果。

自 2009 年以来，电子卫生的实施、验收和相关知识发生了变化。因此，第 14-3/2 号课题的合作伙伴决定于 2013 年初开展一项具有明确针对性的调查。该调查采用了互联网问卷调查表的形式，可通过以下网址获取：www.surveymonkey.com/s/KSZTVMT。该问卷调查表侧重于调查：

- 发展地区的电子卫生工作，
- 发展中国家代表认为以及是否相信国际电联，特别是第 14-3/2 号课题，能够为其所在地区的电子卫生落实与推广做出贡献。

此项调查联系了国际电联的牵头人，并请其提供相关国家的信息。

调查文件在起草过程中与第 14-3/2 号课题下电子卫生方面的专业人员开展了合作，并得到了心理学家和道德专家的支持。

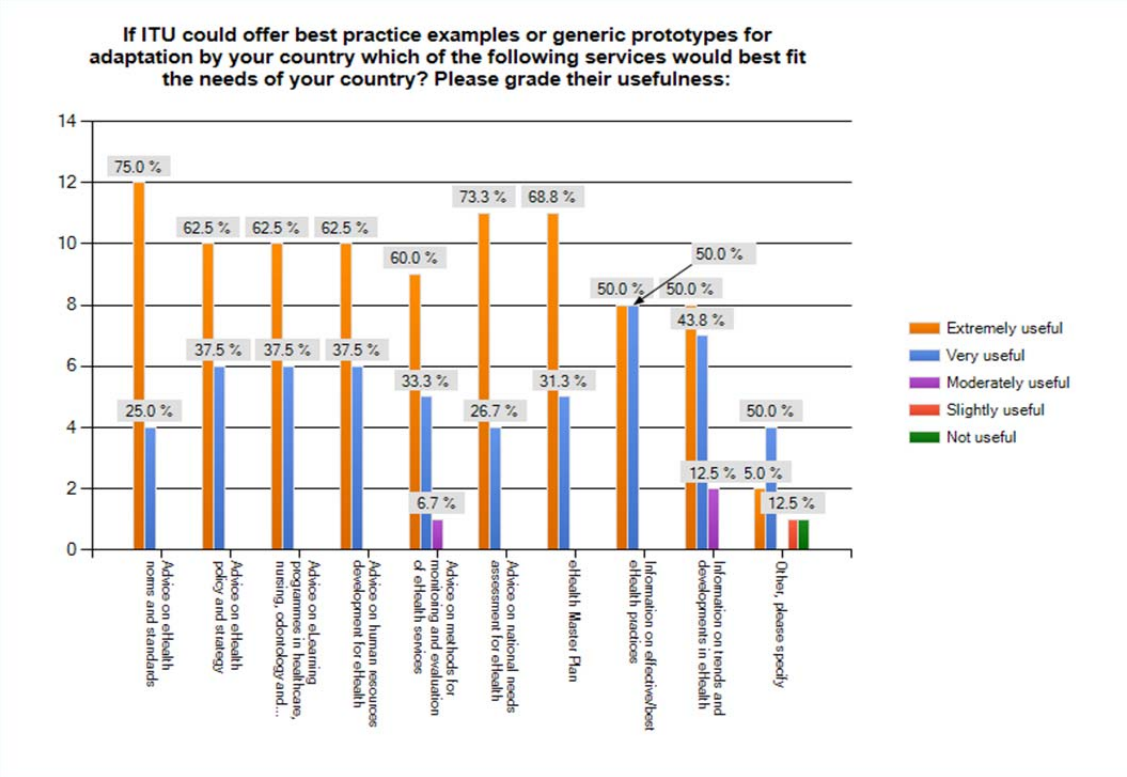
目前已有 20 多个国家做出了回复，数据收集工作仍将继续。调查结果显示：

- 47%的应答者指出，存在国家电子卫生战略缺失的现象；
- 制定有此类战略的国家，在 90%的情况下仅部分实施了此战略；
- 目前开发的最佳电子卫生工具和服务包括，国家药品注册机制、医院信息系统，卫生专业人员与机构目录。被视为几乎“没有开发”的项目包括：远程精神病治疗、远程放射治疗、家庭远程监控和慢性病监测。

调查还发现了术语确定问题。结果显示，如果国际电联能够为发展中国家提供建议和/或最佳做法示例，或通用的适应做法原型，则以下服务将能够很好的满足上述国家的需求：

- 有关电子卫生规范和标准的建议；
- 电子卫生总体计划；
- 有关电子卫生人力资源开发的建议；
- 有关医疗卫生、护理、齿科和临床心理学网上培训计划的建议；
- 有关电子卫生政策和战略的建议；
- 有关电子卫生服务监督和评估方法的建议；
- 关于有效/最佳电子卫生做法的信息；
- 关于电子卫生趋势与发展的信息（图 1）；
- 在 2013 年中之前，一直可在网上找到该调查。第 14-3/2 号课题尽力从尽可能多的发展中国家收集回复。

图1: 2013年调查示例



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2 在发展中国家开展电子卫生工作的部分指导原则

2.1 向电子卫生标准化迈进

[5]当今，以有效、价格可承受的方式提供医疗卫生服务，是发达国家和发展中国家都必须面对的挑战。信息和电信业有机会在全球医疗卫生方面大展身手。毋庸置疑，推广电子卫生业务必将惠及各国，尤其是发展中国家。这些国家资源匮乏，无法采用传统手段，通过增加医务人员和医院数量来改善医疗卫生系统。

通过国际电联的努力，有关发展中国家远程医疗的课题在 1994 年 3 月召开的首届世界电信发展大会上被提出，并进行了第一次讨论。该届大会批准了有关远程医疗的第 6 号课题（1998 年重新将其改为第 14 号课题），同时将其指配给了国际电联发展部门第 2 研究组。根据本届大会的决定，国际电联开展了大量相关活动，研究电子卫生可能给发展中国家医疗卫生业带来的益处，展示电子卫生/远程医疗试点项目在选定国家的应用成果。

首届世界发展中国家远程医疗专题研讨会于 1997 年 6 月 30 日至 7 月 4 日在葡萄牙召开。该专题研讨会是国际电联提出的举措，由葡萄牙电信主管部门委托葡萄牙通信研究院（ICP）承办。此次会议共有超过 57 个国家参加，开创了该国电信专家与本国医生共同会商大计的先河。此次专题研讨会首次为发展中国家熟悉远程医疗提供了机遇，使其能与卫生和电信领域的专家一起探讨，共同寻找各自国家使用远程医疗的可能性和实际应用方式。

世界卫生组织在 2005 年 5 月召开的世界卫生全会第 58 届会议上正式认可了电子卫生，并通过了为世界卫生组织制定电子卫生战略的 WHA 第 58.28 号决议。

正如任何创新设想一样，这一举措也是障碍重重，其中既包括发达国家医务人员不愿采用新的医疗方式，也有发展中国家医疗专业人员和主管部门缺乏对电子卫生知识的了解。

困扰发达国家和发展中国家的另一重大障碍是–电子卫生的标准化，该问题极为复杂。尽管已在这一领域投入了大量的财力与人力，但结果却不令人满意，特别是对发展中国家的利益而言。这些国家要求要在考虑到固定和移动网络的条件下满足其需求。包括移动卫生在内的卫生和电子卫生 ICT 解决方案已取得了长足进步，尤其是在过去十年。但是，这些方案仍通常是孤立的小规模应用，无法与其它卫生系统通信和/或实现跨地区、跨技术的信息共享。

发展中国家小规模系统升级的壁垒，有碍为更多患者及看护提供商提供支持。决策者未必能够评估实际卫生状况，因而无法全面规划、做出响应和制定政策。

国际电联标准化部门负责协调多媒体系统的技术标准化和电子卫生应用的能力。该部门刚刚发布了一份展望电子卫生未来的新技术跟踪报告[6]。该报告认为电子卫生的发展需要制定更多普遍性的电子卫生互操作标准以及克服技术基础设施壁垒的战略，同时还要满足隐私、安全及其它法律要求。电子卫生应用中使用了大量针对视频编码、安全性、多媒体传输及语言等的通用标准。其中有许多标准均是由 ITU-T 制定。目前 ITU-T 第 16 和 17 研究组和其它

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[5] 供稿：L. Androuchko1、I. Nakajima2、M. Jordanova3，1 日内瓦国际大学，Dominic 基金会，瑞士，报告人，第 14-3/2 号课题–医疗保健中的电信业务 2 东海大学，医学院，日本，副报告人；3 空间研究技术学院，保加利亚科学院，保加利亚，副报告人

[6] www.itu.int/en/ITU-T/techwatch/Pages/ehealth-standards.aspx

一些外部标准化机构正在着手解决这些问题及其它一些问题。电子卫生的国际标准需是基于现有的“成熟且稳定的技术”而非仅着眼于未来的先进技术。

2010 年在墨西哥瓜达拉哈拉召开的国际电联全权代表大会通过了一项新决议，即关于“用于电子卫生的电信/信息通信技术应用”的第 183 号决议，呼吁国际电联优先考虑扩展其工作中针对电子卫生的电信/ICT 举措，并在国际电联标准化、发展和无线电通信部门之间协调与电子卫生相关的活动，特别提高对电信/ICT 电子卫生标准的认识，将其纳入主要工作，开展电信/ICT 电子卫生标准制定的能力建设，并酌情向国际电联理事会报告研究结果。

除第 183 号决议之外，在瓜达拉哈拉召开的国际电联全权代表大会批准了《2012-2015 年战略规划》，其中 ITU-T 的一项战略目标是“弥合标准化差距：努力向发展中国家提供支持和帮助，弥合标准化、信息通信网络基础设施和应用以及相关能力建设培训资料方面的差距，并考虑到发展中国家电信环境的特点。”这关系到适用于发展中国家现有网络的电子卫生技术标准。

世界电信发展大会（2010 年，海得拉巴）也批准了第 65 号决议“利用信息通信技术进一步普及医疗卫生服务”，该决议指出“…主要与国际电联无线电通信部门和国际电联电信标准化部门合作，继续推进制定在发展中国家环境中使用的电子卫生网络解决方案和医疗器械互连的电信标准”。

下文的案例研究展示了印度在制定国家电子卫生标准方面取得的经验，同时为发展中国家在现有国际标准基础之上制定自身的国家标准指出了一些教训并提出了建议。

2.2 电子卫生标准化-发展中国家的经验

2.2.1 简介

[7]为发展中国家农村人口提供最低限度的、可接受的基本医疗卫生服务，是一项长期的挑战。在众多因素之中，有限的资源和医疗专家分布不均对此造成了重大影响。印度也不例外，而分布在广袤地域内的十亿人口，更给按照承诺的既定水准提供医疗卫生服务增加了难度。采用卫生信息技术始终可选方案之一，但其是否能够提升医疗卫生服务交付流程的效率尚有待观察。公共和私营领域目前有大量医疗卫生机构仍在各自为战，医生或医院之间缺乏交流，还在以独立实体的形式运营。在此方案中，人们感到有必要在全国采用一种可满足不同群体要求并能为患者带来价值的标准卫生信息系统。

如今，许多私营和公有医院均采用了电子病历医院信息系统（HIS）。国家政府开展的卫生管理信息系统项目正在试验电子访问装置。印度目前正在远程医疗和电子卫生领域内大步前进。随着远程医疗在该国不断推广，印度的决策者坚信，有关远程医疗的推荐标准和指导原则不仅必须到位且还应不断调整，在考虑到飞速变化背景的情况下，提高可实现的医疗卫生标准。鉴于这些趋势和对国际方案的观察，特别是因专有系统增长而造成大多数发达国家出现卫生信息交换困难的情况下，信息技术部（DIT）实施了为印度(1)的医疗卫生信息技术基础设施（ITIH）定义框架的举措。与此同时，由一个高层委员会和一个技术工作组，针对印度[2]远程医疗的做法提出了一系列标准和导则。经过漫长的努力，这些工作与其它活动

[7] 文稿：Baljit Singh Bedi，印度政府通信和 IT 部（MCIT）下属协会高级计算发展中心（CDAC），卫生信息化顾问。参见文件：RGQ14.3.2-INF-0024。

一起，共同为发展印度的信息网络提出了可供考虑的重要标准建议。作为定义 ITIH 的前期探索，现已就定义该国的卫生信息标准，向业内各主管利益攸关方进行了咨询，以期实现定义可接受的电子医疗档案（HER）这一基本目标。建议的框架力求涵盖临床标准、数据元素、健康标识、基本数据集、法律框架和消息标准。

该举措在用户的推动下得以进一步深入。在远程医疗任务组的支持下，印度联邦卫生和家庭福利部成立了远程医疗标准分组。该分组的成员来自不同的政府和私营公司/机构，以为远程医疗制定普遍可接受的标准和导则的形式推广这一举措。该分组提交的本文件是针对适用于印度的远程医疗标准和导则，同时就未来的实施步骤提出了建议。此项工作充分利用了 DIT 早期举措中的输入意见。包括电子卫生在内的一系列全国医疗卫生 IT 服务标准化举措，均从此项开拓性工作中汲取了大量营养。这其中就包括印度的国家级 APEX 政府制定机构--国家知识委员会，为向印度卫生信息网络开发（I-HIND）建言献策而成立工作组的举措。此外，卫生与家庭部任务组的分组还从 EMR 领域上报的各项工作中获取了大量信息。随着信息技术在不同医疗卫生领域的进一步普及，预计这些标准化举措还需要长时间的磨合，方能在提升印度综合医疗卫生提供水平方面得心应手。希望此项进程中汲取的教训，能够为其它开展类似活动的发展中国家提供借鉴。

2.2.2 启动国家标准化进程

如今，世界各国都已感受到信息通信技术（ICT）在经济和社会等各行各业的普及所产生的影响。尽管起步较慢，但发展中国家已开始体会到 ICT 在医疗卫生服务成本、水平和可用性方面带来的益处。对这些国家而言，这不失为一个良机，可在推广 ICT 应用的同时学习发达国家的经验，跨越式地启动行业标准化进程，享受与之相伴的诸多利益。对象印度这样，远程医疗服务已经形成多种不同网络的国家，迫在眉睫的需求是完善各项标准与导则，促进以统一科学的方式开展远程医疗实践。负责 IT 和卫生的两家政府机构，是主抓和推进此项目的核心机构。在印度，通信与 IT 部首先采取了该项举措，随后又将指挥捧交给了此举措的主要用户 – 卫生和家庭福利部。这一领域采取的、同样适用于其它发展中国家的部分其它重要步骤包括：

a) 成立专家工作组并制定其职责范围

此为该项工作的第一步，涉及对相关专业领域专家的仔细遴选。这些专家应选自相关的专业和行业协会、学术届、政府部门官员、卫生信息化领域的研发机构、主要用户机构和医院管理部门的决策者、知名 IT 专业人士、医疗卫生应用/服务供应商、原设备制造商和医生等。这些专家应参加可能问题的讨论，收集可用于审核技术标准是否与国情相适应的要求。

必须保留一项相关条款，以便能在需要时邀请法律等方面的专业人士参与。该工作组在既定标准范围内履行其全部职责之前，必须积极确定各项重要标准和愿景。

b) 定义各项标准- 核心目标

至关重要的是，任何机构在开展此项工作之前，必须就定义电子卫生及相关 HMIS 标准，设定明晰的目标。这其中或包括：

– 提升全民享有高水平医护服务的水平；

– 推进电子卫生和 HMIS 的发展；

– 寻找并支持保护个人健康数据隐私和保密性的机制，以及其它安全和法律问题；

– 拓展电子卫生使用在科学、法律和道德方面的国际合作；

– 为国内外 IT 支撑业务的互操作性和可升级性制定框架；

– 为包括厂家、用户、大众在内的各利益攸关方带来利益。

c) 定义导则和标准的框架

– 此框架特别针对远程医疗实践；

– 互操作性：支持远程医疗网络接口互连，实时共享不同参与系统的应用或实现若干应用间的无缝连接；

– 兼容性：不同厂商间的系统或同一系统不同版本间相互连接的能力；

– 可升级性：远程医疗设备/系统能够通过升级增加更多功能，并能通过模块化选项增加新功能；

– 便携性：某系统的一项应用生成的数据可轻松地携带到不同平台。

指导框架需确保：

– 涵盖所有利益攸关方；

– 所提建议不偏向任何厂家。

d) 临床规程和导则

该专家工作组还需研究所需的临床规程和导则。远程医疗实践的临床规程包括初步计划程序、实际会诊程序和远程医疗设备操作程序（例如，电信传输规范）。视频传输图像质量的临床技术标准将详细规范专家所需的技术标准，例如皮肤科医生为能正确诊断而要求的高图像清晰度和颜色。

e) 职责范围

为使专家组能够启动评议工作，必须慎重选择能够最好完成手中任务的职责范围。远程医疗/电子卫生专家工作组职责范围的示例如下：

1 全面评议可用的国际标准，选择与该国要求最相符的标准加以推荐。

2 了解应协同工作的不同网络/设备间互操作性的方方面面。

3 制定尽可能实际的，现有医疗信息系统与必要标准相匹配的要求。

4 制定已用技术的可升级性规定及其升级能力规定。

5 推荐标准 EMR 结构。

6 考虑标准数据信息与 ISDN、PSTN、VSAT、无线和 IP 等该国不同可用通信技术间的兼容性。

7 以高成本效益的方式标准化远程医疗视频会议及其适用性的要求。

8 比对远程医疗系统的兼容性，明确地标准化放射学、心脏病学、病理学等各医疗领域的要求。

9 标准化并格式化病例的发送方法，包括医疗数据数字化、加密和保密等方面。

10 推荐 ECG、X 光扫描仪等标准医疗诊断工具，包括提出对视频会议摄像系统的要求。

11 提出有关强制/可选远程医疗系统外围设备的建议。

12 推荐隐私和安全标准。

13 推荐法律框架。

此外，有必要为该工作组提交建议确定阶段性目标。为寻求意见以强化评议工作，设立并维护一个活动网络亦或非常有益。为达成最终共识，邀请大量利益攸关方参加研讨会，介绍、争论并最终确定相关建议，永远不失为一项有意义的做法。

2.2.3 审核主要技术标准

– 指导医疗卫生 IT 生态系统的成长

无论是国内还是国际，都为监管/指导医疗卫生 IT 生态系统的成长付出了巨大努力。这些努力是医疗卫生信息表述和系统间传输进程标准化的迫切需求所引发的。发展中国家要提出电子卫生和医院管理信息系统（HMIS），则首先要研究现有国际情况、该领域内已经成立的各个组织、目前采用的各项标准，以及各国对这些标准的接受和使用情况。许多此类标准开发组织（SDO）和特殊利益集团（SIG）活跃在标准化进程领域，致力于解决卫生数据共享、数据结构、访问管理、医疗卫生的临床与业务流程标准化、安全性和隐私等问题。下文简要提及了发展中国家必须研究和考虑采用的主要相关电子卫生和 HMIS 标准，并列出了相应倡导机构的名称。这些标准适用于农村和也同样适用于城市。

– HER 和数据互换/交换标准

- ISO/TS 18308-针对电子医疗档案结构的要求

  本标准是 215 技术委员会为国际标准化组织（ISO）制定卫生信息化领域的标准而开发的。该标准给出了 HER 的定义和原则特性，并提供了要求规范。

- CEN/TC 251 EN 13606(EHRcom)

  CEN/TC 251 EN 13606（EHRcom）是欧洲标准化委员会（CEN）技术委员会（TC）制定的标准，由五部分构成。此标准制定了结构、内容、通信规范以及 EHR 通信的安全政策，用以实现 EHR 信息交换过程的句法间互操作性。

- 医疗数字影像和通信（DICOM）

  医疗数字影像和通信（DICOM）是 ACR 和美国电器制造商协会提出的行业标准，用于促进数字形态医疗图像的交换与处理。不同厂商的图像采集设备（如计算机 X 射线断层术），图像档案、硬拷贝设备和诊断图像工作站能够与公共信息基础设施连通，并与其它信息系统集成（如，图片存档和通信服务（PACS）、HIS/RIS）。当前的版本为 DICOM PS 3.0-2009。

– 第 7 级卫生水平（HL7）标准

作为临床环境下的 ANSI 信息传送标准，HL7 用于不同远程医疗系统间的临床信息互换。HL7 是指第 7 级卫生水平；术语“第 7 级”是指国际标准化组织（ISO）开放互联系统（OSI）的最高水平。不同的版本中包括 HL7 2.x、HL7v3 和 HL7 CDA。HL7v2.x 定义了以消息形式发送/接收医疗卫生事件以及查询的互操作规范。当前版本 HL7v3 是基于面向对象的理念并就类别和对象做出了规范。HL7 临床文件构架（CDA）是一种文件标识标准，规范了用于交换的‘临床文件’的句法结构。

– 护理记录的连续性（CCR）-ASTM 标准

护理记录的连续性（CCR）是一项由 ASTM 国际、马萨诸塞州医学协会（MMS）、卫生信息管理系统协会（HIMSS）和美国家庭医师学会（AAFP）共同开发的标准，旨在当患者从一家医疗护理机构转移至另一机构时，对填写护理记录摘要所需的最基本数据集（MDS）加以规范。此标准的目的在于尽量减少差错，避免因医疗信息不足造成的治疗延误，提升全民总体医疗卫生服务水平。

– CEN/TC 251 EN 13940

本标准是国际标准化组织（ISO）215 技术委员会制定的标准，其名为“支持持续护理的卫生信息化系统概念”（CONTsys）。此标准为患者护理过程中的医疗活动制定了概念与流程。

– 临床标准

临床数据表现方式的标准或码集，是一种对健康信息的系统性表现形式。卫生行业应用了大量临床标准，对与疾病、程序、临床观测、药品、护理程序、消耗品、外科手术等相关的信息进行编码，在标准化程序中的地位十分重要。大多数国家已根据其要求和使用特性采用了不同编码集。就发展中国家的电子卫生、HMIS 标准化活动而言，需要审慎分析并采用临床标准。这对实现有助于提高患者安全的全国性卫生信息系统间的互操作非常关键。临床标准共分为三个主要类别，其中包括：

- 疾病编码
- 程序编码
- 临床观测编码

一些主要且广为使用的编码系统列出如下：

– 国际疾病分类（ICD）

为方便死亡率与发病率统计数据的采集、处理、分类和展现，世界卫生组织（WHO）开发了国际疾病分类（ICD）编码系统。ICD-10 是目前被接受的版本并为多国所用。

– 国际疾病分类 -第 10 版- 程序编码系统（ICD-10-PCS）

程序编码是将所执行程序的医学术语翻译为代码。

– 临床医学术语系统命名法（SNOMED-CT）

临床医学术语系统命名法（SNOMED-CT）是国际卫生术语标准开发组织（IHTSDO）制定的一份全面的临床术语集，收纳了有关诊断、治疗和医疗卫生规程方面的编码。

– 当前的程序术语（CPT）

当前的程序术语（CPT）是由美国医学会（AMA）制定的。

– 一体化医学语言系统（UMLS）

UMLS 由美国国家医学图书馆设计并维护，在现有编码术语之间建立的映射结构。对可能使用相同信息模型但模型内编码集不同的组织而言，这是实现互操作的一种有效系统。

– 视频会议标准

此为电子卫生/远程医疗的一个重要方面。幸运的是下文列出了目前已被全球广为接受的，国际电信联盟（ITU）为不同连接模式视频会议的互操作制定的标准。

- ITU-T H.32x 标准

– 标准化组织

重要的是要注意到，欧洲标准化委员会（CEN）、美国试验与材料协会（ASTM）、国际标准化组织（ISO）、世界卫生组织（WHO）、国际电信联盟（ITU）、美国国家标准学会（ANSI）和卫生信息组织管理系统协会（HIMSS）等已就电子卫生、HMIS 和卫生信息化其它分支领域标准的各个方面开展了工作。多年以来，这些组织开发出了一系列重要的具体标准。所有开始推广标准化的发展中国家均可从考察是否适宜采用这些现成标准中获益。与此同时，某些近期发布的报告，如国际电联就此主题发布的报告（3），亦可能有助于就相关问题得出一个宏观印象。

2.2.4 医院管理信息系统（HMIS）的标准

HMIS 标准化的一个重要方面涉及电子医疗病历（EMR）、电子健康病历（EHR）、数据互换/交换标准和临床标准。第 3.2 节详述了更多所涉问题和相关标准的内容。在 HMIS 中应用标准的基本优势在于支持 HMIS 应用与其它应用通信，并可为不同的 HMIS 生成统一的患者医疗病例。从 HMIS 角度来看，标准化进程普遍同样适用于大小医院。但是，两类医院的主要差别源自医院的功能与规模。此外，还需考虑标准的应用环境。小型医院可能拥有一或两类系统，例如患者登记和实验室信息管理系统。在这种环境下，遵循 HL7 等单一系统便已够用，而对于拥有包括图片存档和通信服务（PACS）、HMIS、实验室管理系统和放射科各类系统在内的大型医院而言，该情况会复杂化。此类环境除需遵守多个标准，还要遵守 IHE 特征。IHE 特征定义了不同标准之间的互操作特征，让流程变得更为平顺。

HMIS 和电子卫生服务

将电子卫生服务与医院的 HMIS 相结合，将大幅提升与专科医院进行电子卫生互动的效率。随着电子卫生/远程医疗的深入，部分专科医院已把它作为前提条件，要求厂家在安装 HMIS 时将其作为功能之一。印度喀拉拉邦成功运营的远程医疗网内的此项功能为偏远地区的癌症患者带来了附加值。除网上会诊预约之外，经 HMIS 批准，HMIS DICOM 数据库中的患者 EMR 可同时供两处医院使用并将在会诊后更新。

HMIS 的云计算解决方案

云计算是另一种模式，发展中国家应谨重考虑是否将其应用于医院的 HMIS。更好的交流与协作是采用云模式的最大益处。这一模式允许该解决方案在全国实现统一覆盖，并大幅削减了拥有成本。此外，该方案还将为现有业务引入互操作标准。为医院各层面提供 HMIS 服务的公共云，具备为发展中国家的卫生服务提供方案带来革命性变化的潜质。印度的某些邦目前已先行一步，决定在其辖下的部分医院应用云计算解决方案。

2.2.5 涉及监管、法律框架及合规机制的各个方面

鉴于电子卫生服务涉及各种法律和法学问题，因此了解若干法律问题十分重要。不同国家的司法管辖流程不尽相同，因此使用电子卫生业务在各国产生的法律影响必然存在差异。印度并没有建立管理电子卫生行业发展的法律框架。随着时间的推移，为确保各利益攸关方能够形成合力，让选择将电子卫生解决方案纳入其医疗卫生体系的发展中国家实现其国家目标，需要努力建立这样的法律框架。

由印度远程医疗任务组支持成立的远程医疗标准分组，在提交其报告前对这些问题中的一部分进行了详细审议。目前印度医学信息协会（IAMI）和印度远程医疗协会（TSI）这两家该领域内的专业协会，也在思考这方面的问题。现有的印度法律无法完全解决当前的问题。本文简要介绍了该分组所提建议中在这方面需要解决的问题。

数据保存政策

电子形式的医疗数据应与纸质医疗病历的保存期一致，甚至更长。需要建立适当的备份系统，用于挽回因病毒/火灾或其它不幸事故造成的数据损失。

患者隐私/机密和安全标准

患者的隐私和机密必须始终得到保障。这些标准与其它标准互相关联并跨越了多种类型。因此，必须考虑到患者的各种法律权益，其中涉及认证、访问控制和传输安全等。用户应能够强制实现匿名数据传输。此类匿名传输数据自身无法完全识别实际患者。必须采取适当的安全规定，防止有意无意侵害患者隐私的行为。各级别的电子卫生信息加解密技术便属于需要采用的标准。

患者同意

远程医疗用户应意识到传输/共享患者数据中的隐私问题。最好应在涉及患者身份数据传输的远程医疗互动开始前，在患者知情的情况下征得其同意。

服务质量

为确保服务质量，整个互动过程中的各实体必须保证数据无差错且互动顺利而完整。

数据所有权

患者和/或法定监护人应为医疗数据有效、唯一的合法所有者。诊所、会诊人员和专家是这些数据的监护人，因此必须采取一切预防措施，对私密信息和身份信息等加以保护。

争端解决

有关远程医疗手段权益的一系列法律问题亦存在不确定性，需对争端解决的条款加以明确规范。

2.2.6 合规机制和挑战

建立让利益攸关方遵守既定标准的机制，几乎是采取此做法的所有国家都必须面对的最为重大的挑战之一。应当从两个方面来看待遵守电子卫生服务标准的问题：医疗卫生信息的表达和传输。信息的表达包括信息的结构及其能表达内容的类型。此外，还包括医疗卫生信息使用的临床术语标准化。传输问题包括如何根据系统特性遵守适用的标准。例如，卫生管

理信息系统（HMIS）信息传输可能使用 HL7 标准，而放射应用和医疗设备可能会采用 NEMA 的 DICOM 标准。监管导则将帮助当今的医疗卫生 IT 产业逐步遵守这些标准。但这一进程将提出新的挑战，例如遵守特定标准和扩大遵守标准的范围均会增加工作量和产品的成本。

无论是国内还是国际标准化组织出面，迈出第一步，即让利益攸关方就可接受的标准达成共识本身都将是一个漫长的过程。标准制定的包容性要求虑及各利益攸关方的利益，再加上对厂商中立性的要求，将使这一过程变得艰难而耗时。第一步结束之后，让可接受的推荐标准成为强制标准的进程，将在当地主要管理系统的基础上，因国家而异。

总体而言，发展中国家在启动系统标准化进程时，会得益于两项起步优势。首先，它们不会受到过多传统系统竞争的羁绊。换言之，他们具备新秀的后发优势。其次，它们将可从师发达国家及少数先行一步的发展中国家，从这些国家的经验中受益。同时，这些国家还不得不面对双重挑战，即知识型人才的匮乏以及用长期回报率（ROI）优化短期财务负担的需求。

无需说明的是，提高认识与突出活动重点的最初步骤均需领导有方。领导需将不同利益攸关方群体团结在共同目标的麾下。领导需了解相关国家的运作机制，并据此与决策者制定行动方案。首先，建立全国专家委员会/工作组需要权能机构的授权/同意方能使其建议具有份量。本文简要介绍了印度方案在此方面汲取的教训。

经验教训以及向其它发展中国家提出的建议

IT 和软件业过去二十年间的迅猛发展，在印度引起了人们对 IT 支撑服务的深厚兴趣。其应用已开始增长并进入医疗卫生行业。农村人口比例巨大，临床医疗人员不足且地域分布广泛，让应用远程医疗的可能性进入了人们的视野。负责技术的部委，如利用卫星实现连通的空间部以及通信和 IT 部（MCIT）均是大量远程医疗网络的主要推动者。此阶段，MCIT 在 2002 年左右成立了提供远程医疗标准建议的技术工作组，并同时开展了一项研究，旨在就标准化的卫生 IT 基础设施框架提出建议。众多来自公共和私营部门（包括政府、IT 与医学学术界）的利益攸关方在研讨会上对此建议进行了精雕细琢之后，两份建议于 2003 年 5 月推出。

有关将建议转化为强制性规定的问题引发了激烈的辩论。首先，尽管信息通信部提出了这一举措，但鉴于该课题主要涉及卫生部，因此人们认识到所有立法活动均必须由卫生部依据其业务规则开展尝试。实践证实，此项活动非常耗时。在另一种替代方案中，相关建议于 2003 年 9 月被公布在通信和 IT 部网站的显著位置。由于相关建议经历了千锤百炼，又与顶级专家和大多数主要利益攸关方进行了磋商，因此这些文件已成为业务及利益攸关方效仿的指导原则。一些邦的政府部门将这些导则纳入其基本要求，但对医疗机构计算机化的表述并不确定。此方法在印度推广电子卫生的早期起到了广泛宣传、培育意识和规范行为的效果，可作为其它发展中国家的参考示例。但毋庸置疑，要将建议变为公共与私营部门均须遵守的强制性要求，尚需依照各国主导方法的要求，实施相关立法。

相关国家部委支持开展的某些宣传活动，可调动利益攸关方采纳被接受标准的积极性。例如，印度通信和 IT 部曾支持该国的某科学社团为 DICOM 和 HL7 开发软件包。DICOM 是经放射学协会认可的、医疗领域的主要图像和消息标准之一。HL7 是医疗领域的主要消息、信息传输和管理标准之一。此标准被广泛应用于医疗信息和信息系统。由于这些标准的复杂性和实施的艰巨性，目前业界仅有极少数应用支持上述标准。但是，预计在不久的将来，对此类技术的需求将有大幅提升。DICOM 和 HL7 类别库将确保能够方便地将 DICOM 和 HL7 融入任何应用，且相关标准将得到遵守。医疗设备制造商还可通过这些库使其生产的医疗设备遵从 DICOM 和 HL7 标准。

设备提供商间流传着这样一个错误概念，即由于遵循标准会减少其产品的专有功能，因此会降低产品的市场份额。所以，我们必须培育遵守标准的重要性意识并指出遵守标准将来可能创造出的机会，以此澄清这一错误概念。

此外，主管医疗卫生 IT 转型的监管机构可为依据导则实现合规性而采用某些机制。应当出台监管导则文件，阐述如何根据电子卫生服务的特性使用各类标准。最有效的机制之一是依据医疗卫生服务提供商遵守标准的情况予以奖励。为能够实施奖励，需对遵守标准的情况进行评估。可建立国家电子卫生服务认证基础设施，并通过它为合规的医疗卫生服务提供商颁发认证证书。此机制有助于监管机构未来强制要求相关机构提供经认证的电子卫生服务。

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[2] Report of the Technical Working Group on Telemedicine Standardization: Recommended Guidelines & Standards for Practice of Telemedicine in India, September, 2003; DIT, Ministry of Communication and IT

[3] Standards and eHealth: ITU Technology Watch Report, January 2011

2.3 电子卫生经济学的应用

[8]电子卫生的战略承诺之一是提升医疗卫生的效率，即保证每天 24 小时一周七天向全体公民提供高质量的、不受地域限制的医疗服务，同时降低总体卫生支出（总卫生支出是指公共和私营部门卫生支出的总和）。在过去十年间，各国总卫生支出在国内生产总值（GDP）中的比例不断稳步上升，很快就将达到成本再也无法担负的水平[1] 。发展中国家显然无法确保医疗卫生资金与需求保持同步增长。发展中国家必须另辟蹊径，用较少的资金达到与发达地区公民所享受医疗服务相类似的服务水平。如果它们要想在确保削减总卫生支出的同时又提供相当高水平的医疗卫生服务，则电子卫生不失为最佳的可能选择。

鉴于电子卫生的发展和广泛应用是众多地方政府和世界卫生组织、国际电联、欧洲联盟（EU）等国际组织卫生政策战略的组成部分，因此有关电子卫生应用是否具有高成本效益的争论具有很高的严肃性。这也是电子卫生的成本效益因何对我国亦至关重要的原因。

本文总结了电子卫生经济学领域的最新成果，并回答了“电子卫生是否具备成本效益？”和“如何在实施电子卫生应用前评估其潜在经济影响？”等问题。

2.3.1 电子卫生经济学

电子卫生经济学旨在评估电子卫生举措的长期成本效益，其针对的若干利益攸关方包括公民、患者、上班族、医疗专业人员和其它医疗从业人员、医疗卫生服务提供商组织和付费者。

有关成本效益的初步研究[2]以及部分近期的刊物[3]十分肯定的表示 – 没有证据表明电子卫生是一种高成本效益的医疗卫生服务提供方式。部分作者甚至强调远程会诊的成本高于传统的门诊预约，尽管他们也支持电子卫生生产率损耗较低的假设[4]。

侧重大规模研究的电子卫生经济学最新研究（即，基于大量会诊或多年的经验）所得出的结论与之恰恰相反，例如：

– 2013 年发布的一项日本研究考察了 2002 至 2010 年间日本福岛西会津町居民使用电子卫生的长期效果。作者对比了慢性病（中风、高血压、心力衰竭和糖尿病）远程护理用户与非远程护理用户的医疗支出和护理时间。在应用了包括系统广义矩估计法在内的严格统计方法之后，他们发现远程护理用户所需治疗天数较少，医疗支出比非远程护理用户更低。[5]。

– 另外一项详细的调查揭示了一个为期五年的远程儿科会诊项目取得的成果。作者强调开展 1,499 次会诊的总费用为 955,996 澳元（澳大利亚元）。预计在布里斯班皇家儿童医院为相同数量患者提供门诊服务可能需要耗资 1,553,264 澳元；因此远程儿科会诊服务为医疗服务提供商净节省了约 600,000 澳元[6]。

– 电子卫生提升临床诊断效率最强有力的证明来自对高血压、糖尿病和爱滋病等慢性疾病的家庭监护。另有合理证据表明电子卫生在应急医疗方面不仅能节约成本，其水平也与现场护理并无分别。此外，它还将惠及外科和新生儿重症监护室以及神经外科手术的转诊[7]。

[8] 文稿：Malina Jordanova，保加利亚，保加利亚科学院，空间研究和技术学院

因何有关电子卫生成本效益的观点会存在如此大的差异？其答案在于：

– 有限的数据或分析是基于《远程医疗和电子卫生》和《远程医疗和远程护理期刊》发表的期刊文章。这两份期刊主要刊登来自英语社团的文章；

– 抽样规模小 – 大部分研究是基于患者数低于 100 人的抽样；

– 仅有少数论文对与电子卫生解决方案直接相关的输出成果进行了衡量；

– 只有 26%的研究列出了研究期的长度，而这却是判定长期成本效益的一项基本参数；

– 评估工具简陋，缺乏被广泛认可的方法；

– 需要很长时间方能达到盈亏平衡点；

– 技术和成本不断发生变化。

考察巴西和俄罗斯等“欠发达”国家的长期研究结果时发现，其数据非常有趣且令人信服。

2.3.2 内容、地点和费用

根据西西伯利亚医生在几乎长达十年的电子卫生实践基础上做出的估计，患者为莫斯科高水平专家网上会诊支付的费用约为其亲赴莫斯科让该专家进行诊断费用的四十分之一。该服务的水平并无差别[8]。同一作者[10]还就电子临床服务的投资回报进行了详细分析，指出在历时 2.5 年的初期阶段过后便可开始回收投资。尽管其大部分出版物使用俄文，但对以其它语言发表的文章或翻译版本进行跟踪仍十分有趣。投资回报仅是该国远程医疗项目经济分析的 20 项指标之一。

另一个实例是巴西米纳斯吉拉斯州的远程心脏病诊疗服务。米纳斯吉拉斯州的面积相当于法国，总人口 1900 万，分别居住在 853 个城市。远程心脏病诊疗服务自 2006 年 6 月起便在 82 个偏远、与世隔绝的村庄开始应用。经济可行性评估的初期结果显示，出村治疗总量下降 1.5%带来的结余足以承担其运营成本[10]。

电子卫生应用的明智选择能够普惠各地。一项来自相对“较小”国家意大利的研究指出，2001 年帕尔马地区为患 1 型糖尿病的青少年提供了全天候免费电话热线服务[11]。在 2001 年初到 2006 年末期间开展的一项广泛的调查显示，共有 421 位儿童接受了帮助（平均年龄 10.8 岁，平均病龄 4.5 年）。在这五年间，共记录了 20,075 次呼叫，平均每天 11 次，其中有 52%的呼叫为紧急呼叫。由于此项服务，因糖尿病酮症酸中毒入院的儿童数量从平均每百名儿童每年 10 例下降至每年每百名儿童 3 例。换言之，入院费用下降了 60%[11]。

自 1994 年以来，日本的西会津镇始终坚持提供电子卫生服务。重要的生理参数被传输到远程医疗机构，用于监测已确诊为高血压、脑梗塞、中风、糖尿病的患者以及老年患者。有几篇论文[12-13]分析了该系统的成本效益。这些论文发现电子卫生用户与生活习惯相关的疾病所产生的医疗支出下降了 20.7%。论文作者还指出，长期电子卫生用户的医疗支出要低于短期用户，该成果再次证明如果我们追求成本效益，则有必要将精力放在大规模长时间的研究之上。

研究成果还证明电子卫生应用能够产生成本效益。但我们永远不能忘记这样一个问题：成本效益究竟造福于谁？在保加利亚实施远程心理咨询的成果令人鼓舞。从五年将近 6,000

小时的网上咨询来看，为患者节约了费用是毫无疑问的[14]。网上咨询比面对面咨询的费用要低三至四倍。

2.3.3 如何评估经济影响

必须强调的是，针对电子卫生实施所产生的经济影响，目前尚无被广泛接受和认可的评估方法。最为便捷的方式之一便是计算投资回报（ROI）。ROI 是一种用于评估投资效率或比较不同投资之间效率的性能测量指标。计算 ROI 的方式是，投资效益（回报）除以投资成本；其结果用百分比或比例表示。

判断经济效率的另一种或许更好的方式，特别是针对引入远程会诊和/支持这种最为流行的方式，要考虑到如下因素：

– 转诊病人的数量与转诊的距离、个人和交通成本、交通用车的贬值、税收和保险费用以及通信成本；

– 新增管理成本、技术和会诊人员的成本及通信成本；

– 此外，还要考虑到系统运营的全部成本，贬值和资金成本，然后用此三项之和除以开展活动的数量，便可计算出单位电子卫生活动的成本。

另外，亦可计算出电子卫生活动的效率，该效率的定义为因使用电子卫生而减少的转诊病人与转诊病人总量之比。

通过成本与效益的对比，可以得出令该系统经济可行所需的电子卫生活动数量的最小值（平衡点）并对节余做出评估[15]。

近期，巴西又提出了一种相对简单的经济影响评估方式[16]。该方法源自大量的电子卫生应用 – 5 年期间在 86 个城市开展的 33 000 多次远程会诊以及 850 000 次远程 ECG 分析。作者考虑了 3 个参数 – 转诊患者单位可变成本（RVC）和转诊距离（D）：

$$RVC = a.D \qquad (1)$$

式中“a”表示每公里的交通成本。

必须强调的是，该分析中仅使用可变成本。原因很简单– 电子卫生应用不会将转诊病人全部消除，因此个人费用和贬值等固定成本保持不变，节余仅是基于可变成本。

电子卫生应用节余（S）必选的计算方式如下：

$$S = \eta.RVC = \eta.\ a.D \qquad (2)$$

式中η为电子卫生活动的效率或是指因使用电子卫生而减少的转诊病人与转诊病人总量之比。因此，为使单一电子卫生活动（UAC）具有经济效率，其成本至少要与节余（S）相等或

$$UAC = \eta.\ a.D \qquad (3)$$

依据此简单公式，成本效益所需的最小距离应为：

$$Dmin = UAC / \eta.a \qquad (4)$$

如果按转诊患者数量和距离加权平均得出的，在某县级市/医疗实践区/省级市内的转诊距离大于 Dmin，则应用该系统将给此县级市/医疗实践区/省级市带来节余。根据目前的经验，作者[16]计算得出经济上可行的最小距离为 20 公里，为减少转诊距离在 20 公里以上的

患者数量而引入电子卫生应用，在经济上是可行的。此外，必须指出，随着活动效率的上升或单一活动成本的下降，即便对短距离转诊而言，该系统在经济上也将变得可行。

2.3.4 结论

发展中国家在采用医疗卫生系统和确保全天候提供充分医疗卫生服务方面，仍面临着严重问题。鉴于转诊成本大多与患者交通费用相关，因此在了解（a）与转诊中心之间的距离和（b）一个城市中转诊患者的平均数量的基础上，有可能预先计算出各单一案例采用特定电子卫生应用所产生的经济影响。

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2.4 信息通信技术改善妇女和儿童健康信息及问责制

[9] 由于资金、政治和文化等原因，妇女和儿童的医疗卫生问题经常被忽视。广泛应用 ICT 正是提升妇女和儿童医疗卫生水平的利器。

信息和问责委员会（CoIA）强调了使用电子卫生、创新工具以及互联网服务在帮助改善母婴医疗卫生服务方面的重要性。医疗卫生行业采用 ICT 在近年来呈爆炸式增长，其中部分刺激可归因于此类技术在实现有效计划生育和完善数据采集流程，以提升 CoIA 指标可靠性方面发挥的重要作用。

收音机和电视在 CoIA 国家的高普及率与高使用率—即使是在低收入和孤立的社区—使其成为传播母婴健康保护信息及倡议的有力工具。与此同时，向其它 ICT 技术的不断延伸，如移动蜂窝电话、互联网业务、移动和固定宽带、网络工具和云计算系统，使 CoIA 国家具备了建立国家卫生信息系统（HIS）的能力。为拓展 MNCH 下的移动卫生项目，支持联合国秘书长提出的“每个妇女，每个儿童”全球战略，由 mHealth Alliance 管理的创新工作组启动了一项催化性融资机制，该机制由挪威发展合作署（Norad）出资，世界卫生组织提供技术支持。

迄今为止，推动移动卫生补助金已向 16 项计划或受助方提供了援助—详情见下文表 1：创新工作组运作中的援助项目（2012-2014），这些计划或受助方如今仍在非洲和亚洲的 12 个国家运作。这些计划旨在共同为 150 万母亲和儿童、6,500 所卫生设施和 100,000 名卫生工作人员提供帮助。此外，在两年的援助期内，移动卫生联盟和世界卫生组织将提供相互学习的机会并为升级过程中具有挑战性的领域提供专项技术援助，包括为各类利益攸关方提供适当的证据、开发可持续的业务模式、建立公私合营伙伴关系和实现健康目标。

表1：创新工作组运作中的援助项目（2012 - 2014）

第1轮（2012年1月-2013年12月）的受助方	
南非，Cell-Life – MAMA	Cell-Life 使用 MAMA SMS 业务向母亲们提供有关 HIV 测试、孕期健康和婴儿护理的知识，并向其提供国家爱滋病帮助热线服务。Cell-Life 计划与地方卫生部门和非政府组织（NGO）合作，争取到 2014 年为 38,000 位母亲服务。
尼日利亚，克林顿健康倡议（CHAI）– SMART	CHAI 与尼日利亚联邦卫生部（FMOH）和惠普公司联手推出了“利用 SMS 打印机加速回传婴儿早期 HIV/AIDS 诊断测试结果”项目（SMART），将测试结果的往返时间缩短了约 15 天。至 2014 年，CHAI 拟在全部 6 个地理区域内部署 600 台打印机。
印度，Dimagi – CommCare	通过与天主教救援服务、世界宣明会及 Real Medicine 基金会合作，Dimagi 的开放源代码移动母婴健康案例管理工具目前正由经认证的社会卫生活动专家进行部署，用以向印度的五个邦提供卫生信息和服务。为支持升级，Dimagi 正在推出主动数据管理工具，从而能够策略性地使用为决策收集的数据。
桑给巴尔，D-Tree International – mNUT	D-Tree International 与联合国儿童基金会（UNICEF）和桑给巴尔岛政府共同为该岛的乡村卫生工作人员提供基于移动电话的决策辅助应用，作为其确认、治疗和护理营养严重不良儿童的工具。D-Tree 的目标是到 2014 年能够在桑给巴尔岛的全部 10 个区内推行该系统。

[9] Hani Eskandar，电信发展局第 Q14-3/2 号课题联系人，ITU/BDT/IEE/CYB，瑞士。参见 RGQ14.3.2-C-0022

第1轮（2012年1月-2013年12月）的受助方	
加纳，格莱珉基金会 – MOTECH	格莱珉基金会与加纳卫生服务局合作，通过向妇女提供有关怀孕、育儿方法和看病预约等针对不同时段的信息，以及向护士提供电子病历系统支持，为贫困人口、农村妇女和社区医疗护士带来帮助。格莱珉基金会已与 MTN 加纳建立了公私合作伙伴关系，以便能够持续地推广这些服务。
巴基斯坦，IRD –疫苗覆盖互动式报警	互动式研发（IRD）正在使用互动式告警，即一种电子疫苗登记方式，来提升疫苗覆盖的范围，为巴基斯坦的扩展免疫计划提供支持。互动式告警向信德省的患者和护理人员发送 SMS 提醒信息，为免疫卡提供射频标识牌，并推出一种新型搏彩式的有条件现金转账系统，为 15,000 名婴儿提供转账服务。
卢旺达，卢旺达卫生部的 RapidSMS 和 mUbuzima	卢旺达卫生部正在培训社区卫生工作人员通过移动卫生应用监测和促进母亲与新生儿的健康，找出潜在的风险并在卫生机构在开展产前保健宣传。正在使用的移动卫生应用中，有一种名为“RapidSMS”，用于帮助跟踪怀孕妇女，另一种名为 mUbuzima，用于在社区层面采集和上报 MDG 指标。
喀麦隆、坦桑尼亚、加纳，诺华制药 – 生命短信（SMS for Life）	诺华制药推出的生命短信举措用于跟踪每周药物存量的水平，减少主要抗疟疾药品缺货的现象，目前正在通过升级实现与喀麦隆和坦桑尼亚的所有卫生机构连通。在加纳，生命短信被用于实时显示全国各医院的血液供给情况，从而降低新生儿的死亡率。

第2轮（2013年1月-2014年12月）的受助方	
肯尼亚，Changamka Microhealth – mPowerment	Changamka Microhealth 通过向妇女提供储蓄和医疗保险，参考信息以及预约提醒的移动接入，降低了母亲和儿童医疗保健在金融、交通和知识上的壁垒。目前，Changamka 正在为 Vihiga 区的农村人口服务，其目标是到 2015 年底，在西部肯尼亚再增加三个区。
马拉维，CHAI – 利用 SMS 移动技术帮助母婴	CHAI 正在使用前线 SMS（Frontline SMS）改进患者看护模式，即母婴组（MIP）诊所模式下的病人跟踪能力，防止母亲向婴儿传染 HIV。到 2015 年，前线 SMS 将在*马拉维南部的六个区*为 MIP 诊所的卫生工作人员提供支持。
马里和塞内加尔，国际通信和发展研究所（IICD） – MAMMA	为加强对疟疾的监控，IICD 及其合作伙伴训练社区卫生工作人员使用移动应用来提高其收集本地数据、开展物流协调和诊所间通信的水平。此类应用可使医疗诊所和社区组织在疟疾爆发时更快地做出响应。到 2015 年，IICD 希望能够对马里 Bamako 地区的 200,000 人口以及塞内加尔 Fatick 地区的 100,000 人口实施监控。
坦桑尼亚，与疟疾说再见（Malaria No More） – NightWatch	“与疟疾说再见”组织将与坦桑尼亚的天才之家（House of Talent）共同开发 NightWatch: Mobile 项目。此项目将为 NightWatch 疟疾通信平台增加一个互动的移动组件，用于提升在坦桑尼亚以蚊帐防疟疾的知识与动力。
南非，普拉科特基金会（Praekelt Foundation） – MAMA 南非	普拉科特基金会在南非使用 MAMA SMS 服务，每周为母亲们提供高质量的有关怀孕和婴儿保健方面的本地信息。此项服务将通过扩展，纳入一个具有社交功能的社区门户，实现专家、顾问实时参与的聊天功能，SMS 消息功能与互动提问。MAMA 计划在三年内向一百万母亲和家庭决策者提供这些服务。
移动医疗（Medic Mobile） – Kujua（“To Know”），印度	移动医疗组织与印度发展医学基金会中心合作，共同提高其新软件平台 PatientView 的可扩容性与范围，该平台通过为患者接种疫苗和发送 SMS 提醒，进一步提高了欠服务人口的疫苗接种率。移动医疗组织计划到 2015 年，能为德里、瓦朗加尔，孟买和海得拉巴的 50,000 名患者提供服务。

第2轮（2013年1月-2014年12月）的受助方	
印度，消除农村贫困协会（SERP）– mNDCC	消除农村贫困协会（SERP）正在利用移动营养日间护理中心（mNDCC），加强社区卫生工作者为印度安德拉邦的农村母亲和儿童提供医疗和营养服务的水平。到 2015 年，mNDCC 应用将从目前的 4,200 个 NDCC 村庄扩展到安德拉邦的所有 38,000 个村庄。
马拉维，VillageReach - Chipatala cha pa Foni （“电话医疗中心”）	VillageReach 是一个试点免费电话热线（“Chipatala cha pa Foni”（CCPF）），旨在提升母亲和儿童的健康管理水平，增加农村地区对社区和设施服务的使用。到 2015 年，CCPF 将可供马拉维东南部 3 个区的约 400,000 名妇女和儿童使用。

来源： 移动卫生联盟

此外，实施远程医疗干预、移动卫生服务、应急免费电话和在不同 CoIA 国家使用其它接近实时的通信信道，提高了传统医疗卫生交付系统的服务水平。在偏远的冲突地区和孤立区域，远程医疗为当地医务从业人员开辟了与外界医学专业人士和诊断专家沟通的渠道，在实现大幅节约成本的同时增强了本地医务人员的能力。采用电子卫生和 ICT 创新给利益攸关方带来的益处，不仅涉及世界卫生组织提出的整个持续护理领域，还将惠及全部医疗卫生产业，相关介绍和解释请分别见下文中的图 2，并在“表 2：世界卫生组织持续护理领域内的电子卫生与 ICT 创新”中做了解释。

图2: 在卫生领域，电子卫生应用和ICT使不同利益攸关方受益

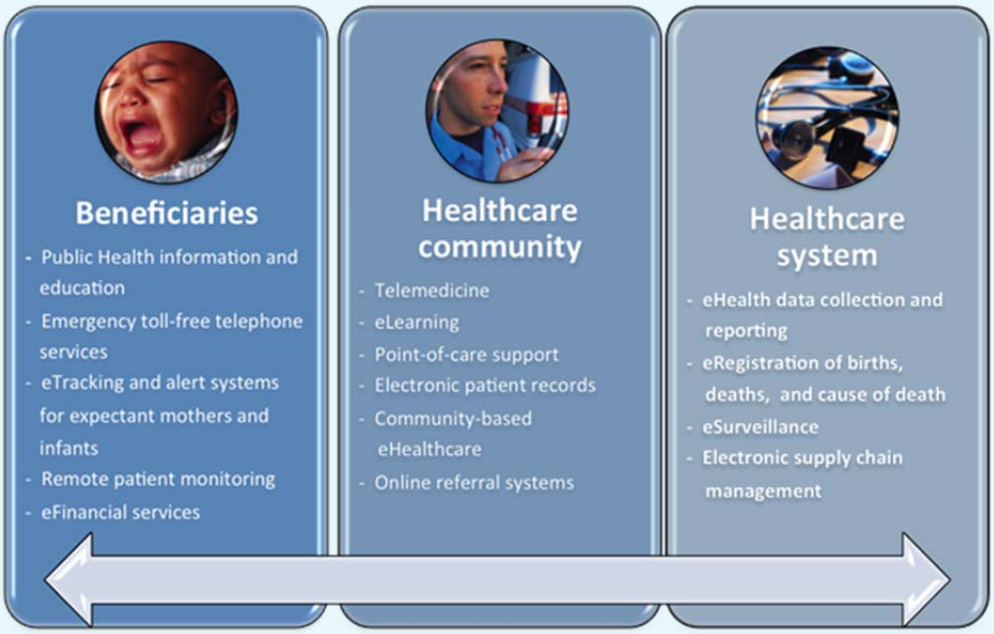


表2: 世界卫生组织持续护理领域内的电子卫生与ICT创新

A 向个人、新生儿母亲和准妈妈、新生儿、新生儿家庭和社区提供的电子卫生服务

ICT创新和服务	世界卫生组织持续护理领域内ICT服务的示例				CoIA国家电子卫生项目示例 [10]
	孕前	妊娠	分娩	产后	
公共卫生信息和教育 • 呼叫中心和服务电话 • 当地广播电台 • 基于 SMS/IVR 的医疗教育和宣传 • 用于改变行为和交流方式的 SMS 和社交网络	获取生殖健康信息 强化积极的改变健康行为，如生育间隔 刺激生殖保健需求	提供有关适当看护的技巧和关于妊娠的一般信息 支持预防和治疗母婴传播 HIV/AIDS 及其它传染病 妊娠妇女的对等支持网络 提高妊娠妇女获取和使用孕产妇保健服务	鼓励妇女在分娩过程中和分娩之后使用可提供熟练护理的医疗机构	能够获取有关婴儿和儿童营养、安全饮用水和卫生宣传等方面的信息	MAMA [2] Text4Baby [40] Medic Mobile [13] UNICEF Reminder Mother System [42]
应急免费电话服务			改善出现并发症的孕妇和新生儿的交通服务 如出生时需产科急救护理，可获得熟练看护		HealthLine [26]
针对准妈妈和婴儿的电子跟踪与告警系统 • 患者注册 • 治疗合规 • 预约提醒		在怀孕的各阶段提供产前咨询 提醒孕妇产前来院检查，并通知护士跟进		婴儿免疫登记 为需要产后看护的母亲和婴儿发出提醒 提醒婴幼儿接种疫苗	M-Chanjo [12] MoTech [32] CommCare [21]
医疗保健提供方的电子目录 • 医院和诊所数据库 • 卫生专业人员数据库	提高世界卫生组织持续护理领域内快速获取医疗服务的的速度				Hospitalsworldwide.com www.hospitalsworldwide.com/ OBGYN.net www.obgyn.net/

[10] 本表所列电子卫生项目将在附件三中做进一步描述。括号中的数字与附件三中的项目编号相对应。

ICT创新和服务	世界卫生组织持续护理领域内ICT服务的示例				CoIA国家电子卫生项目示例 [10]
	孕前	妊娠	分娩	产后	
远程患者监护		检测和监控高危妊娠预警信号和典型症状		庭护理和治疗新生儿并发症	Amanece [16] RapidSMS [35]
电子金融业务	使妇女能为分娩和产后护理节省资金	支付与产前保健相关的医疗保健费用，例如咨询、诊断、实验室测试等	支付与分娩有关的医疗保健费用，例如交通和医院护理费	支付产后护理费用，例如儿童免疫接种	Health System 20/20 [27] Changamka Medical Smart Card [20]

B 向医疗保健提供商、卫生服务中心、卫生专业人员、医生、护士和助产士以及社区卫生工作者（CHW）提供的电子卫生服务

ICT创新和服务	世界卫生组织持续护理领域内ICT服务的示例				CoIA国家电子卫生项目示例
	孕前	妊娠	分娩	产后	
远程医疗 • 音频视频会议 • 远程超声检查，远程心脏病解决方案等 • 远程诊断		检测和监控高危妊娠预警信号和的典型症状 远程产科超声检查	在紧急情况下，能够联系到训练有素的专业医务人员	有关艾滋病毒，梅毒和其他疾病的筛选/测试 为及早进行婴幼儿疾病诊断加快发送测试结果	• CliniPak [22] • SMART [38] • TulaSalud [41] • RAFT [34]
远程培训 • 在线培训材料 • 短信测验 • 基于 SMS / MMS / IVR 的培训	CHW 生殖健康培训	有关健康怀孕与分娩的 CHW 培训	为传统接生员提供培训	CHW 新生儿和幼儿保育培训	• AMREF • www.amref.org/

ICT创新和服务	世界卫生组织持续护理领域内ICT服务的示例				CoIA国家电子卫生项目示例
	孕前	妊娠	分娩	产后	
定点护理支持 • 决策支持系统（例如核对清单和算法）		妊娠危险因素筛查 通过协议驱动型护理，提高整个持续护理的诊断和治疗效率		5 岁以下儿童疾病的综合管理	• E-IMCI using D-Tree [10] • SMART [38]
电子病历 • HER、EMR、PHR	可实现持续护理过程中患者历史数据的无缝集成				
社区电子卫生护理	在家庭出诊和诊所就诊的过程中收集患者的日常数据，实现社区层面的健康指标跟踪 个案管理 报告和跟踪准妈妈和新生儿的健康状况，在出现异常时发出警报 工作人员管理、业绩监督和激励 提高对社区层面的信息反馈 增强医疗机构和接生员之间的沟通及其医疗技能				• Childcount+ [8] • CommCare [21] • Pesinet [33] • Aceh Besar • midwives [6]
转诊系统 • 封闭的呼叫网络 • 基于网络或 SMS			将出现并发症的孕妇和新生儿转诊并运送到资源充足的医院 分娩时能够获得熟练的护理		• SHINE [37] • Ehealth Point [23]

C 向医疗保健管理者及行政人员提供电子卫生服务，以加强医疗系统

ICT创新和服务	世界卫生组织持续护理领域内ICT服务的示例				CoIA国家电子卫生项目示例*
	孕前	妊娠	分娩	产后	
电子健康数据收集和报告 • 网上卫生信息系统 • 结构性短信或移动数据采集形式	收集、汇总和分析有关计划生育要求的卫生数据	收集、汇总和分析有关孕妇 HIV-ARV 分布和产前检查的卫生数据	收集、汇总和分析有关熟练助产以及母亲和婴儿出生后 2 天内产后护理的卫生数据	收集、汇总和分析有关纯母乳喂养、免疫接种、抗生素治疗儿童肺炎，发育迟缓患病率的卫生数据	• 全国农村医疗使命在线汇报，旁遮普邦，印度 www.pbnrhm.orh/online_reporting.aspx
电子出生、死亡及死因登记			电子出生、死亡及死因登记		• e-District Kapurthala, India [1]
电子监控			孕产妇和婴幼儿死亡的通知、审查和监控	针对脑膜炎、疟疾、腹泻或营养的孕产妇和儿童健康监测	• Project Mwana [4] • mCare [11]
电子供应链管理	生殖健康产品的库存管理	救生物品的库存管理[11]	救生物品的库存管理	疫苗、肺炎和腹泻药等的库存管理	• SMS for Life www.rbm.who.int/

[11] www.everywomaneverychild.org/resources/un-commission-on-life-saving-commodities/life-saving-commodities

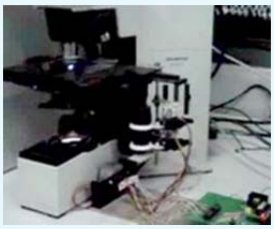
3 发展中国家间的经验交流– 从实施最佳做法中取得的经验教训

本章简要介绍了部分发展中国家已经开发并实施（或正在实施过程中）的电子卫生服务模型。鉴于没有必要再重复劳动，因此可将这些模型作为其它发展中国家的“最佳做法”。

3.1 成员国最佳做法示例

除上述表 2 中的信息之外，本报告附件中进一步列出了有关若干国家在电子卫生领域取得成就的内容。表 3 列出了一些重点，建议读者阅读全文。

表3：成员国最佳做法示例

地点	内容	领域	
阿根廷	电子卫生服务在应用免费开放源代码软件方面取得的多种经验	全国远程儿科网 电子健康档案 第二医疗意见 开放源代码软件的同步培训和远程会诊，同时支持外科手术和超声波传输 术后患者监护 为不同型号智能手机提供 5,000 多种与健康相关的应用程序	
科特迪瓦	电子教育	通过研究中心和公立大学培养年轻研究人员 为研究设施提供支持，用于修复研究站和实验室，重建相关能力（设备和连通性），获取科学信息	
几内亚	在线服务 – 电子卫生，电子教育	泛非网络的组成部分，用于连通非盟的 53 个成员国，以实现与美国的有效通信和连接。成果： 电子教育项目设置完成了 95% 已确定并进入实施阶段的电子卫生项目– 90%	
印度	电子卫生的方方面面	电子医疗病历和医疗自动化 大范围的远程医疗服务及电子教学 创建网上开放图书馆 向建立标准化和远程医疗立法迈出了成功的步伐 电子卫生工具包	
印度尼西亚	远程放射学和远程诊断	大存贮量，有效压缩比为 16:1 和可保证图像重建质量的可用医疗图像存档与传输系统 用于结核病早期检测系统的低成本自动 FoV（现场图）扫描显微镜	
日本	电子医生包	可在移动环境下轻松地发送给患者的高清晰度生物信息	

地点	内容	领域	
日本	多功能心电图仪“Radarcirc”	移动远程医疗系统可从移动救护车向医院实时传输 12 导联心电图（ECG）数据和现场视频。 该系统甚至可在严重运动伪影和实施心肺复苏的情况下，支持 12 导联心电图（ECG）数据的测量，分析和传输	
吉尔吉斯共和国	远程心脏病学、产妇和儿童医疗保健	配备有高水平专业医务人员的国家医疗保健中心为该国最边远地区提供的 24/7/365 ON-OFF 医疗支持 医务人员的专业和 IT 培训	
老挝人民民主共和国	通过电子卫生扩充现有电子政务网	中央医院和省立医院的远程会诊 为医生，护士和其他医务人员提供的远程教育	
黎巴嫩	公共卫生移动应用	应用包括： • 药物目录（检查价格、剂量、形式、合法性...） • 公立/私立医院和初级医疗保健中心目录 • 卫生部的健康服务和活动 • 生活方式和习惯等健康秘诀	
马里	卫生金字塔内的各级电子卫生试点项目	远程治疗- 提供卫生服务的移动车队（外围有 500 部手机可供卫生人员使用）侧重于保障 5 岁以下儿童的健康和孕产妇保健 通过动态网络门户开展电子教学和远程培训	负责机构- 国家远程电子卫生和医疗信息化署
巴基斯坦	基于卫星连接的远程会诊网络 应急远程医疗	放射科、外科、内科、心内科、耳鼻喉科、皮肤科、精神科和骨科的远程会诊； 电子教学 – 医生和护士培训中心	
巴拿马	发电技术和服务于可持续可接入数字包容性的电子服务-LUCY 项目	确保所有因残疾、文盲或年龄等原因而面临获取障碍的人，无论经济状况如何，均可访问并使用互联网及其信息、网上社区和服务，将其用于教育、就业、日常生活、公民参与、健康和安全等诸多方面	www.lucytech.com
坦桑尼亚	远程会诊和远程教育	通过国家光纤骨干网的基础设施连接全国所有地区 通过手机或互联网进行会诊 视频会议：临床病例介绍，临床病理 医学继续教育	负责协调远程医疗举措的国家电子卫生委员会
土耳其	依靠电信公司与医院和软件公司的成功合作开展电子卫生服务	提供全天候服务（7*24 小时）– 值班药房的信息、健康咨询、必要时可免费使用设备齐全的救护车、健康保险 实施综合卫生医疗管理信息系统	

地点	内容	领域	
乌兹别克斯坦	实施卫生管理信息系统	进一步提高访问管理、临床和流行病学数据的水平；使卫生机构和提供商更有效地运作	负责部门 – 卫生部
赞比亚	移动卫生应用	基于开放源代码的框架；婴幼儿早期诊断（DBS HIV 测试结果）和用于产后护理的患者跟踪，加强医疗保健提供商之间的沟通	负责部门 – 卫生部

3.2 电子卫生培训作为国家间援助：国际电联在短期医疗培训方面的 10 年经验

[12]（日本）东海大学与国际电联/电信发展局（BDT）携手为发展中国家的医疗卫生工作者提供培训课程，帮助其了解远程医疗和电子卫生当前的发展趋势和技术，为推广远程医疗服务奠定了基础。

该课程由东海大学主办，得到了日本国际合作署（JICA）和笹川和平基金会的财政支持。课程参与者从活跃在国际远程医疗和电子卫生领域的东海大学所提供的专业技能和设施中获益良多，同时亦从国际电联/电信发展局试点项目的实施过程汲取了经验。此培训设有两类课程。

– 长期博士后培训项目

– 短期培训项目

自 2002 年起共有 10 名学员参加了博士后培训项目（不丹一名、海地一名、印尼四名、中华人民共和国一名、巴基斯坦两名、巴拉圭一名）。该项目包括四个部分：

– 远程医疗研究与实施的传播；

– 日本与他国分享其电子卫生设备取得的进步及其发展和部署电子卫生的经验；

– 丰富和探索远程医疗研究的可能性；

– 列出电子卫生应用规范和实施案例的高级行政和管理课程。

太平洋岛国的培训课程包括 SPF 资助的短期培训项目。培训开始之前，老师们访问了这些岛国，以面试的形式对潜在学员的动机和基本知识进行评估并挑选适当的候选人（学员）。到达日本后，这些学员在东海大学为国际学员安排的地点住宿，在东海大学湘南学区接受为期三个月的培训。学习过程采用了两种不同方法：针对主要内容开展的授课和动手实习；针对额外内容采用的授课和演示。各项练习之前首先授课。我们认为，动手操作、尝试与犯错，对参训学员掌握和切实理解下发材料至关重要。因此，课程在必要的情况下经常为学员提供自我练习的机会。此外，还为参训学员提供了个人计算机、软件和互联网连接。

[12] 撰稿人：Yuichi Ishibashi，日本东海大学医学院。参见文件：RGQ14.3.2-INF-0022

培训内容

我们在从不丹和孟加拉等国取得的经验（支持）基础上制定了一个培训项目，并在项目支持工作中应用了大量的软件和硬件。软件方面，我们强调了信息采集、分析和共享。硬件方面，就医疗领域而言，传感器和 ECG 必不可少，对岛国来讲，无线局域网（LAN）不可或缺。

在三个月内掌握如何构建实用电子卫生系统所需的技能殊非易事。因此，我们将侧重让学员了解大量技术，使其能够为本国选择适当的应用。

数据库和地理信息系统（GIS）是软件授课的重点。世界卫生组织 2005 年报告《全球电子卫生观察》将电子卫生描述为综合性的 ICT 领域，共包括 10 项内容。第一项是电子卫生，第二项是 GIS。GIS 对流行病学来说非常重要。鉴于 GIS 有益于大范围感染的预防和疾病管理，且对数据库中累积的信息加以分析十分重要，因此我们在数据库和 GIS 授课与练习上花费了足够多的时间。学员学习了 Microsoft ACCESS 和 ArkGIS，建立了一个简单的系统，并通过该系统的数据库积累并展示了其各自国家的医疗信息。在实践中，该系统应当是基于网络的系统。因此，为将其最终并入网络系统，信息的安排和展示就显得十分关键。对学员而言，重要的是要掌握安排和表述信息的技能。该项目的系统请参见表 4.

太平洋岛国的情况不同。就斐济而言，两大主岛与众多较小岛屿间的合作必不可少。该国人口众多且医务人员数量也相对较多。因此，考虑家庭采用电子卫生方式将是工作重点。瑙鲁约有 10,000 人居住在一个岛上，医务人员稀少。因此，有必要考虑瑙鲁与澳大利亚等其它发达国家开展电子卫生合作。

学员们在吸收了授课内容之后就如何在本国应用相关技术进行了思考，在课后自我练习的基础上撰写了报告。因难在于，学员们的祖国很难利用自身预算推广电子卫生技术。发达国家提供技术和经济支持不可或缺。我们期望学员们的报告能够获得日本政府，如 JICA 的支持。

成果

课程的组织目前已很完善，且近三年来教材和课本的编写也日臻成熟。除此计划之外，要确保此培训课程的效益还有许多其它必须顾及的方面。缺乏 ICT 基础设施是发展中国家的典型特征，这或将成为本培训计划和其它类似培训计划实际应用的障碍。因此，我们强烈倡议所有相关组织在跟踪本计划的同时关注 ICT 基础设施的发展。

表4：课程安排

分类	方案	科目
软件	信息的采集、积累、分析和表述	图像和电影制作 使用 R 和 MATLAB 进行数据分析 使用 Access 的数据库 电子卫生互动多媒体计划（HTML） 使用 ArcGIS 的地理信息系统
硬件	通信和传感器	通信 传感器 无线 LAN
课题	当前与电子卫生和国际援助相关的系统	不丹的远程心脏病学项目 电视会议系统 世界卫生组织和国际电联的电子卫生发展趋势 电子卫生普遍服务基金 日本政府的官方开发援助（ODA）纲要

太平洋岛国具有多项特征，例如人口稀少、散布于各岛且资源贫乏。太平洋岛国面临的共同问题是，可用于提升医疗卫生服务质量的 ICT 网络和服务资源极其有限。这些岛国的医疗卫生提供商需要启动和实施 ICT 网络与应用，以及开展医生、护士和医院医务人员 ICT 培训所需的种子资金。

我们期望本文所述培训课程能够提供部分此类人才，尽管三年只能培养六位。我们还希望能够扩大并长时间延续此项计划。医疗环境面临的问题具有共性，但如今也发现了一些不同问题。例如，斐济和库克群岛有一些散布的岛屿，因此岛间连网十分重要。瑙鲁仅有一个岛屿，但周长达到 18 公里且医生数量极少；因此，有必要请他国有经验的医生进行会诊。我们可通过此培训课程评估太平洋岛屿当前的医疗现状，获取对此现状加以分析所必须的材料，找到可改变此现状的必要解决方案。

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4 结论和建议

电子卫生已是势在必行，开弓没有回头箭。未来的挑战与前景有如梦幻，需要所有可调动的各层面人士通力协作，相互沟通，制定规划，随时准备好取长补短避免重复劳动。

国际电联，特别是第 14 3/2 号课题，在其长期经验的基础上始终强调要成功地实施电子卫生，就必须满足以下重要前提：

- 鉴于各地区各国家确有不同需求，医疗卫生和管理机构各异，且在期望值等方面也不尽相同，因此需要审慎地对其需求和可用基础设施开展初步分析；
- 对当地传统和文化特性视而不见，可能会让精心筹备的电子卫生商业项目付诸东流。
- 强烈建议让地方/国家的舆论领袖参与进来；
- 保留而非摧毁现有医疗卫生系统是成功的前提；
- 盲目模仿并非最佳方式！例如：发达国家广泛采用的方案并非总是发展中国家梦寐以求的方法！
- 建立网络非常关键。了解电子卫生领域的全球发展状况有助于专业人士：
  - 统一认识和了解，支持他们对地方政策施加影响，尤其是涉及电子卫生在医疗卫生领域的职能时；
  - 树立公众在电子卫生及其潜力方面的意识；
  - 开展建设性的、有意义的对话，促进利益攸关多方就如何以有效、技术对路且符合当地文化的方式实施电子卫生所采用的原则、政策和战略达成共识。

第 14-3/2 号课题所发挥的作用具有很高价值，因为它不仅能够而且可以随时提供高质量的专业技术与建议，调动特定资源，并在必要时可对电子卫生的可靠性和效率加以验证。

依据第 Q14-3/2 号课题在研究期内收集的经验，我们发现下述建议可做为发展中国家医疗卫生政策和决策者的根本依据。

4.1 第 14-3/2 号课题（2013 年）– 建议

如今，所有发展中国家均树立了一定水平的电子卫生解决方案和服务意识，这就要求他们继续采取下一步骤，将这些先进技术投入实践，让其国民从中受益。

- [13]加快步伐，帮助决策者、监管机构、电信运商、捐助人以及用户提升意识，使其了解信息通信技术在改善发展中国家医疗卫生服务过程中所扮演的角色；
- 鼓励电信业与卫生行业间开展协作并做出承诺，从而尽可能地利用双方有限的资源，将电子卫生服务和解决方案应用到医疗实践中去；

[13] L. Androuchko、I. Nakajima、M. Jordanova，日内瓦国际大学，瑞士 Dominic 基金会，第 14-3/2 号课题–医疗卫生领域的电信--报告人

- 促进在电子卫生领域创造社交机遇和进行知识传授（技术部分）
- 有关电子卫生的范围以及在将来各阶段如何更好地使用医疗卫生服务，了解发展趋势和最新技术等的培训
- 推动包括公民在内的各利益相关团体进行电子卫生扫盲；
- 在一系列医疗卫生领域应用创新；
- 以最佳方式使用通信技术，同时更加注重帮助各利益攸关方，使此类通信成为可能。（电子）医疗卫生服务的一般性基本职能便是交流。患者通过它相互交流症状，提供利用其进行疗法沟通。
- 鼓励医务人员参与国际电联开展的电子卫生/移动卫生活动。
- 向发展中国家积极传播电子卫生/移动卫生方面的经验和最佳做法，侧重友好、可靠、低成本高能效系统的应用，例如现代微芯片技术。
- 继续建立与电子卫生/移动卫生技术和应用研究进行联络的专家网，从而加速其在发展中国家的实施。
- 在考虑到发展中国家可用电信网络的情况下，确定开发电子卫生/移动卫生解决方案使用的不同技术，为不同医疗业务制定电子卫生/移动卫生技术平台纲要。
- 为评估电子卫生项目/服务制定一套标准，将重点放在发展中国家所用技术和服务质量之上。
- 与 ITU-T 一起积极促进电子卫生/移动卫生应用技术标准的开发，特别要为发展中国家起草有关如何使用此类标准/建议的导则。
- 对发展国家电子卫生/移动卫生试点项目的经济评估给予应有关注，鼓励私营部门参与电子卫生/移动卫生的部署。
- 通过将本课题纳入众多 BDT 讲习班和研讨会项目的方式，对所有利益攸关方进行电子卫生/移动卫生知识普及。
- 此外，ITU-D 第 2 研究组第 14 3/2 号课题强烈建议发展中国家的政策制定机构，在可行时应用国际电联和世界卫生组织的国家电子卫生战略工具包。

4.2 国际电联和世界卫生组织的国家电子卫生战略工具包

[14]需要开展国家规划

经验显示，将 ICT 用于卫生，需要在国家层面开展战略性的综合行动，以便在尽量利用现有能力的同时为投资和创新打下坚实的基础。确立主要方向和制定所需的详细步骤规划，是实现卫生行业效率、改革或更多基础变革等长期目标的关键。卫生与 ICT 行业在公私双重领域的协作，是此项工作的核心。作为联合国在卫生和电信领域的主要机构，世界卫生组织

[14] Hani Eskanar，BDT 第 14-3/2 号课题联系人，ITU/BDT/IEE/CYB。参见文件：SG02-C-0182

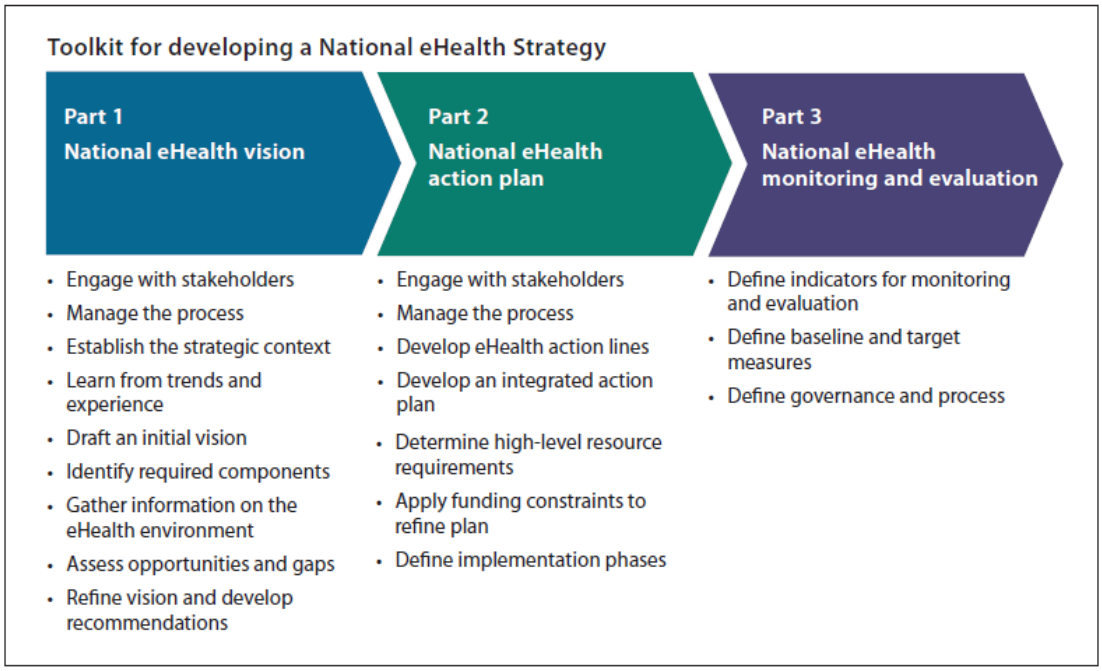
（WHO）和国际电信联盟（ITU）已在其全球性决议中认可了开展电子卫生合作的重要性，在这些决议中鼓励各国制定国家电子卫生战略：本工具包支持这些建议。

卫生部不仅在满足人民健康需求和保障公共卫生问题上发挥着核心作用，而且亦在动荡时期维护卫生系统方面扮演着关键角色。信息技术和通信部是各个领域发展的关键要素，可为卫生行业做出重大贡献。共同的目标和可预测的 ICT 环境支持协调行动包括：就政策达成共识、促进更好地使用共享资源并让私营部门参与其中，投资于技能和基础设施，让卫生行业结出更丰硕的成果。

宗旨和对象

国家电子卫生战略工具包是制定与重振电子卫生战略的一项资源，既适用于刚刚起步的国家也同样适用于已在电子卫生行业投入巨资的国家。这些国家谋求从试行举措中取得具有前景的成果，为电子卫生项目的升级奠定基础，或为反映出不断变化的环境而更新战略。该工具包可供政府卫生部门的各部、局和科室负责制定电子卫生战略的领导使用。应用这一工具需要一个在战略规划、分析、沟通和利益攸关方参与方面均拥有丰富经验的团队。

图3：制定国家电子卫生战略工具包



工具包概述

工具包由三个部分构成，各部分均以前一部分为基础：

– 第 1 部分：针对卫生和发展目标勾勒出国家电子卫生愿景。解释因何需要从国家层面规划，规划将取得哪些成果及其实施手段。

– 第 2 部分：起草能够体现国家工作重点和电子卫生背景的实施路线图。建立中期活动结构框架，同时为长期活动奠定基础。

– 第 3 部分：制定监督实施和管理相关风险的计划。展示实施取得的进步与成果，帮助锁定长期支持和投资。

各节阐述了须采取的行动，同时提供了从现实社会经验中提炼出的实用建议。

各国可以全面照搬各项活动或仅采纳与其国情和限制相适应的活动。工具包的用法和最终成果将取决于实施国的国情、工作重点和远景目标。

可通过如下网址获取工具包：www.itu.int/ITU-D/cyb/app/e-health.html 和 www.who.int/ehealth

Annexes

Annex I: Case Studies: Lessons Learned from e-Health Implementation

1.1 Argentina: Highlights of ICTs for e-Health in Argentina

1.1.1 Introduction

[1]Accessibility to resources, goods and services in healthcare, regardless of geographical location and socioeconomic status, is one of the key factors to ensure that citizens of every nation effectively exercise their Health of Right. Telemedicine, as long as it involves the provision of health care services using information and communication technologies (ICT) for the prevention, diagnosis and treatment of disease, as well as for research and continuing medical education, has become one of the conceptual developments with the greatest potential for ensuring access to health services that meet appropriate quality and coverage standards.

The purpose of the following presentation is to synthetically describe Telemedicine strategies, programs and projects currently under development in Argentina.

1.1.2 Objectives and Strategies

The geographic and demographic characteristics of the country, the diversity of systems to health care access and the unequal distribution of professional resources and equipment, allow planning strategies in which the use of telemedicine, in the widest sense of Telehealth, assist in ensuring the effective exercise of the Right of Health throughout the hole national territory.

In this regard, it has been deemed necessary:

- To develop Telemedicine tools and to implement Telehealth programs and models with adequate standards of quality, social impact, cost – benefit relationship, and interoperability, which allow all citizens reach a better and more equalitarian health care.
- To promote consensus that may unify criteria that will ensure, in the medium term, a legislative and political regulatory framework of ICT and Telemedicine in Argentina.
- To take advantage of already existing resources and programs, engaging them to new local developments and those more significant at national and international level.

1.1.3 Activities Implemented

From a general perspective, although there are some legislative initiatives, to date the country does not have a policy framework for the implementation of ICT in Telemedicine. Likewise, Telemedicine projects have not always benefited from properly manage or support, suffering the vicissitudes of economic and political changes and progressing sporadically and irregularly.

As background, we can mention the National Program for the Society of Information about ICT inclusion in the public sector. This program supported the National Telemedicine Project (2000) which sought the extension of a telemedicine network, establishing clinical and technological reference centers, deploying new terminals systems and mobile solutions (Resolution 10,869 of the National Communication Secretary–SECOM). The socio-economic crisis of 2001–2002 prevented its realization.

Currently, Argentina has a General Plan for ICT (Resolution 1357/97) leaded by the General Secretary of Communications, several interagency plans related to equalitarian access policies (Argentina Connected,

[1] Contribution: Guillermo Bill, Telehealth Network of the América, Argentina. See document 2/205

Decret 1552, 2010), and Integrated Health Information System (SISA) under the Ministry of Health. The latter is a project of information technology with gradual implementation stages and based on a federal concept, meant to record health facilities, health professionals, research, congenital diseases, immunizations, blood donors and evaluation of health technology.

In an overview of the possible applications of ICT in various sectors concerning national development lines (White Paper on ICT-Project Foresight 2020–2009) the Ministry of Science and Technology (MST) considers e-Health as a paradigmatic shift needed to cope with Argentine Health System deficiencies. To achieve this, a drastic restructuring of the health system is necessary, combining the concepts of Telemedicine and Primary Attention Strategy (APS). In 2010 the MST passed a document entitled "Strategic area for information and communications technologies" (Order 004/10d) where Telehealth is considered as a priority issue.

Regarding the development of telemedicine specific tools, it is appropriate to highlight the background related to electronic health records (EHR). Many Argentine provincial states and municipalities followed the line of free software, such as the Group of Buenos Aires BioLinux and the National University of Rosario.

In the province of Salta, Telecom Argentina implemented, in 2009, a web EHR system for management of primary care (ACUARIO SIGMA), developed by the Iberoamerican Foundation of Telemedicine. This system links 49 public health centers with more than 2,000 users, managing 250,000 HER and scheduling 4,000 patients visits by day. GCBA managed several initiatives coordinated by the Health Information Systems General Directory who created a Telehealth Platform. The province of Santa Fe has a video collaboration platform based on open source software for synchronous training and teleconsultations, also allowing surgeries and ultrasounds transmissions. Similarly, in 1995, the Angel Project created the first complete and free medical software, taking into account the laws for Professional Practice (17132), Digital Signature (25506) as well as the Code of Ethics of the Medical Association of Argentina, being compatible with HL7.

Concerning specific education, we should mention that most of the innovative processes, programs and developments in telemedicine and e-Health are concentrated in the academic units of public medical schools in Buenos Aires, La Plata, Rosario, Cordoba, Mendoza, Entre Rios and Tucuman. The valid curricula to train future doctors at these centers include telemedicine and ICT. Also, there is a residence of Medical Informatics at Italian Hospital of Buenos Aires, Biomedical Informatics at GCBA and a postgraduate degree in Biomedical Computing Introduction at the Italian Hospital of Buenos Aires.

In the health care setting, several major hospitals provide projects and programs where ICT and Telemedicine are protagonists. We must mention the program of referral and contra referral of the Garrahan Hospital, which allows remote communication with pediatricians located in provinces that have joined the National Network Tele-Pediatrics. The hospital established the Latin-American Medical Telepresence Pilot Program and offers a Telemedicine Program in Infectious Diseases.

Mendoza has a Telehealth Network formed by universities, the Ministry of Health and private institutions. The Zaldivar Institute (devoted to ocular surgery) in Mendoza has a telemedicine program for monitoring post-surgical patients, first visits, second opinions and training of residents. The Northeastern University has a telemedicine program designed to support rural doctors in Chaco.

Doctors living in small towns of Córdoba province could reach the portal developed by the Telemedicine Center of the National University of Córdoba (UNC) in order to have second medical opinions. The “Mario Gulich Institute”, emerging as a collaborative initiative between UNC and the National Commission for Aerospace Activities (CONAE), is developing various tools for applications of aerospace information to health care, including risk stratification tools for vector-borne diseases and training programs of health applied geographical processing.

Finally, in a country with 51.891 million subscribers to cellular networks, the concept of m-Health should not be neglected. There are more than 5,000 health-related apps for different smart phone models. In addition, several organizations representing health insurance systems and private prepaid companies

operate with cellular messaging systems for different events, such as doctor's arrival, confirmation of appointments, etc.

In the regional context, since October 2011, the Ministries of Health of Latin America and the Caribbean approved the Regional Strategy and Plan of Action on e-Health, whose development the Panamerican Health Organization, World Health Organization (PAHO/WHO), has the mandate to coordinate. This strategy envisages that by 2017 a large percentage of countries have developed their own ALAC National e-Health strategy and represents a challenge and an opportunity for advancement and mobilization for action in Argentina as in all countries of the Region.

1.1.4 Technologies and Solutions Deployed

The key to establish a national telemedicine project is to take advantage of the already installed technology and new programs under development, to promote professional training and to reach agreements on regulatory requirements. In this sense, the Integrated Health Information System (SISA) appears as a possible starting point for major developments and projects in telemedicine.

A program to be considered of immediate usefulness is the national fiber optic network of the Ministry of Federal Planning, Public Investment and Services. Also depending from this Ministry we can find the Argentina Connected Program, as a comprehensive connectivity strategy as well as the three national communication satellites (ARSAT-1, 2 and 3).

National Universities have developed tools for remote support to patients. The Telemedicine Center of the UNER has prototypes and platforms of great social impact potential and low cost. The Institute of Bioelectronics in Tucumán has developed a Rural Telemedicine Application. The Faculty of Medicine of the National University of Rosario has launched a mobile telemedicine station (ETMo) containing sophisticated diagnostic tools built into a suitcase transportable by air, sea or land, able to provide the physician in disaster and/or geographical detachment situation, diagnostic and therapeutic aid from academic specialist located at the university in real time.

1.1.5 Outcomes Achieved. Challenges and Success Factors

Beyond the technical advances, ideas and projects conceived, the Argentina Telemedicine Community achievement has been sustaining internal stability in their working groups, showing the potential social impact of telemedicine and ICTs related to health topics and, last but not least, progressively installing at institutional and government levels the idea that telemedicine is not only important but essential in a Federal and Democratic Integrated Health System.

The unsolved challenges are related to absence of specific legislation, scarcity of means to finance the various projects, the need to train health professionals in the management of the Telemedicine tools, and the slow incorporation of knowledge about the concept of Telemedicine in potential system users and authorities.

A possible successful alternative should be the integration of efforts, the sheared use of technological equipment and human capital available, with the input from the various government levels, investors and private providers of technical resources, as well as academic and hospital medical staff.

Following this vision, emerged the Telehealth Network of the Americas, an organization developed within the OAS-CITEL, which has been formally joined by all medical schools of public administration, various national high complexity hospitals and Ministries of Health of some provinces.

1.1.6 Lessons Learned and Next Steps

The country current situation, with all its infrastructure developments and policies of inclusion and equity, together with the actions of the State and international organizations, to generate a optimistic picture. That is already assembled and tuned the expert protagonists in e-health, appointed before, working together. Is imminent an remarkable progress of e-Health in the country, involving the National State, international agencies, academic and welfare institutions, and the experts who are developing projects and programs worldwide reference.

1.2 Bangladesh

1.2.1 Introduction

[2]Bangladesh is a densely populated country of around 150 million within an area of 150,000 sq. Kilometres with a per capita income of <1000 USD (700–750). The medical professionals including specialist doctors are mainly concentrated in capital city Dhaka and other large cities along with the concentrated tertiary care hospitals. While most people are still living in rural areas, the disparity in health care delivery is easily apprehended by the distribution pattern of the medical expertise and healthcare facilities. The discrepancy opens the options of either establishing equipped health facilities in rural areas or improving the infrastructure so that the service providers feel motivated to stay in village and impart in health service, or to initiate an alternative to provide quality health care to rural areas. In this very aspect Telemedicine can play a vital in a developing country like Bangladesh. There have been small initiatives from some private organizations like BIRDEM, Medinova Telemedicine, Grameen Telecommunication Network, Bangladesh Telemedicine Services, DNS Telemedicine etc. along with personal correspondence like Canadian expatriate initiative with some professors through Grameen Telecommunication Network. But these are very much sporadic and the results of these initiatives are yet to be tested.

1.2.2 Benefits and Future Opportunities

Computer literacy and skill is an integral part of activities in Telemedicine. However, medical professionals are not sufficiently skilled in computer literacy. Training of the medical professional, establishing infrastructure, initiating basic information system, protracted service system and sustainable feedback of the initiative would enable the vast majority of the medical professionals to get on board.

Cost effective service by staying away from travel and accommodation for investigation and consultancy would have been achieved. The family care environment would also be retained for the patient. The emergency services would have been prompt with specialized consultancy served from central to remote and isolated areas. The physicians working in rural areas get the mental strength of handling the patients in their vicinity and thereby the intellectual faculty development becomes a sustainable process.

The telemedicine service can be incorporated in health service networking system connecting the divisional districts with a central server based network. Through collaboration with developed countries telemedicine service could be widened to monitoring of cardiac, respiratory, diabetic, renal and other patients to combat emergency situation. Interactive Continuing Medical Education (CME) and training programs can be initiated to keep track of the latest advances and applications in medical technology and telemedicine. ITU can play a pivotal role to establish tele-consultation network. Robotic tele-pathology network is a dream with pathologists in Dhaka.

The main obstacles that are currently hindering the effort are security and confidentiality of data management, record keeping skill of the facilities, computer literacy, motivation and attitude of the service providers, scarcity of telemedicine supported equipment, patient awareness of the services, network connectivity and speed, cost of band width, and finally, government initiative, policy and support towards this growing demand of service provision.

1.2.3 Conclusion

Health service in Bangladesh is creeping and crawling with the developing economy albeit geographic barrier has become a live history. Medical knowledge should not be constrained by geographical borders. We want to think globally but act locally to bridge the digital divide.

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[2] Contribution: Syed Muhammad Baqui Billah, MHFW, Bangladesh. See document RGQ14.3.2-INF-0023

1.3 Ghana: Ghana Health Service (GHS) e-Health Enterprise Architecture

1.3.1 Background to the GHS EA Programme

[3]The Government of Ghana through the Ministry of Communications commissioned the development of the national Enterprise Architecture (EA) to serve as the technology blueprint for all Ministries Departments and Agencies (MDAs). It is believed that an EA can deliver that improved focus by enabling more informed decision-making and enhanced collaboration between agencies by highlighting opportunities for common solutions, information sharing and concurrent cost reduction. As part of the process, the GHS EA was also developed to enable the Service implement the appropriate e-Health solutions to improve the delivery of services to citizens.

The GHS is a Public service agency established under Act 525 of 1996 as an autonomous agency responsible for the implementation of national policies under the control of the Minister for Health through its governing Council – the Ghana Health Service Council.

The GHS is an independent body with the freedom and flexibility to carry out is functions defined by the Act. The Service therefore needs to develop the appropriate strategies to support its mandate and the EA provides the perfect platform for the GHS to meet its responsibilities by defining the framework for technology selection and implementation strategy to improve health service delivery in the country.

The GHS EA is more than just technology architecture. It involves different architecture perspectives (Business Architecture, Applications Architecture, Data Architecture and Technical Architecture and security architecture), which are key to the implementation of an e-Health Programme.

The GHS EA describes the underlying infrastructure and provides the framework for aligning business and IT strategies of the GHS, enabling the integration of the GHS with organisations such as the National Health Insurance Authority (NHIA) and other international bodies.

The GHS has since adopted the EA reviewed and modified by GHS-EA review committee and has expressed its desire to start the implementation of the EA. It is generally accepted that EA implementation would enable the GHS meet some of its organisational challenges such as improving the delivery of service across the country and improving the efficiency of the Service.

The document serves as a comprehensive introductory paper covering the key aspects for a national rollout of the e-Health technologies. It also acts as a guide on how the different roles of national and local bodies as well as external consultants and Suppliers in the Programme will be achieved.

The Implementation Programme Strategy defines the necessary structures to minimise the risks of failures associated with technology projects in Ghana. It has been designed to avoid some of the mistakes made by other projects in the health sector, which have cost the government a considerable amount of money without delivering real value.

1.3.2 Programme Scope

The key aim of the e-Health Programme is to give healthcare professionals access to patient information safely, securely and easily, whenever and wherever it is needed. It is an essential part of the drive to improve patient care by enabling clinicians and other GHS staff to increase their efficiency and effectiveness.

The Programme is expected to cover all aspects of patient care, the management of facilities, assets and employees as well as the improvement of business processes under the control of the GHS. The scope of the Implementation Programme will be determined by a number of factors or constraints such as

[3] Contribution: Policy Planning Monitoring and Evaluation Division, Ghana Health Service. See document RGQ14.3.2-C-0012

availability of funds. The Programme must also ensure the interfaces with other stakeholders such as the NHIA are effectively maintained by developing the appropriate solutions.

1.3.3 Key Areas to be Considered

The key areas to be considered include:

- Electronic Health Records (EHR) – an important element of EA is the widespread adoption of interoperable EHR. Effective use of EHR has the potential to positively influence both the quality and cost of health care for the nation. The EHR can improve quality by presenting clinical information and comprehensive patient data to the clinician at the point of care. This allows more informed decisions in a shorter time frame. Additionally, the cost of care can be decreased by streamlining data collection, decreasing the likelihood and associated cost of medical errors and by reducing resources used for duplicative or unnecessary information capture and testing.
- Improving data sharing between the GHS and other national and international agencies. One of the key priorities of the Programme is the implementation of the appropriate data exchange mechanism in SDMX standards that will ensure timely and secure transfer of data between the GHS and the agencies, particularly the NHIA.
- A medical billing system that will enable the health facilities to produce medical bills for the payer organisations such as NHIA. The prompt payment of bills is of immense priority to the GHS.
- The need for the introduction of best in class applications to automate business processes such as Clinical Services, Public Health services, Scheduling and Capacity Management, Operational Research, Performance Management, Monitoring and Evaluation, etc.
- A robust network infrastructure that will enable the GHS to connect the health and administrative facilities across the country.

The overall aim of the GHS EA is to move Healthcare towards a series of easily available, interconnected, reliable and efficient services. The EA is a model on which such solutions can be built.

The GHS EA presents a detailed analysis of the current state of the GHS' business and ICT environments with the aim to improve services provided by the Service. It also provides a roadmap to move away from current applications and supporting technologies to an environment that better meets the current and future needs of the Service.

1.4 Central African Republic: Mise en œuvre du Projet Cybersanté en République Centrafricaine

[4]La République Centrafricaine est un pays enclavé, situé au centre du continent africain. Elle couvre une superficie de 622.984 Km² [18]. Elle partage une frontière commune avec la République du Tchad au Nord, la République Démocratique du Congo (RDC) et la République du Congo au Sud, la République du Cameroun à l'Ouest et la République du Soudan à l'est.

La population est estimée à 4.216.664 habitants.

Seulement 45% de la population a accès aux soins de santé de base.

La RCA est subdivisée en sept régions sanitaires et ces dernières ne sont pas en contact permanent; ainsi si nous arriverons un jour à mettre en place la cybersanté dans ce pays nous allons faire un grand pas dans l'amélioration de la prise en charge des patients.

[4] Lemotomo St Alban, Ministère chargé des Postes, Télécommunications et des Nouvelles Technologies, République Centrafricaine. See document SG02-C-0217

Cybersanté est un terme utilisé aujourd'hui par tout le monde pour décrire l'application des technologies de l'information et des communications dans le secteur de la santé. Il englobe toute une gamme de buts qui vont du purement administratif à la prestation des soins de santé.

1.4.1 Objectifs de la Cybersanté en RCA

La cybersanté fait entrer le système de la santé dans l'ère du numérique et celui-ci atteint ainsi un haut niveau de qualité, d'efficience et de sécurité, elle a pour objectif:

De rendre le dossier patient électronique accessible en tout lieu et en tout temps.

Les personnes en RCA obtiendront un accès sans restriction à leurs propres données médicales grâce à la cybersanté. Le personnel de la santé et les ayants droit peuvent rapidement avoir une vision globale de l'anamnèse d'une personne. Le diagnostic pourra être établi plus rapidement et plus précisément, ce qui pourra sauver des vies en cas d'urgence.

De mettre des services en ligne présentant des informations sanitaires de qualité afin de promouvoir la culture sanitaire personnelle

La simplification d'accès à des informations médicales sûres et qui ont préalablement été évaluées, aide la population à prendre des décisions relatives à sa santé, ce qui a généralement un impact positif sur la santé.

D'instaurer la télémédecine et le télémonitorage dans les sept régions sanitaire du pays: prise en charge et conseils médicaux à distance

La prise en charge du patient et les diagnostics pourront être effectués à distance grâce aux technologies de l'information et de la communication(TIC). Le télémonitorage fait partie de la télémédecine et comprend principalement la surveillance des patient(e)s sans l'aide d'aménagements médicaux.

1.4.2 Les Avantages de la Cybersanté en RCA

La cybersanté améliore la qualité de vie, du travail et du lieu, ce qui représente un facteur économique croissant. Une fois installée et les objectifs atteints, elle va nous présenter plusieurs avantages à savoir:

Avantages médicaux de la cybersanté pour les individus, les corps professionnels et les institutions de la santé.

Le dossier patient électronique, les services en ligne ainsi que les conseils et les consultations médicales à distance amènent de nombreux avantages:

- **pour les individus en RCA**

Avec la croissance de la mobilité, les services en ligne renforcent la culture sanitaire des individus, ce qui les aide à prendre des décisions concernant leur santé et a un impact positif sur leur santé personnelle ainsi que sur leur ressenti.

- **pour les corps soignant et médical**

L'accès rapide aux données du patient aide les médecins autorisés à établir rapidement un diagnostic précis. Il est ainsi possible d'éviter de réaliser plusieurs fois le même examen et des erreurs de prescription de médicaments. Les erreurs de lecture peuvent être évitées grâce à la prescription en ligne. Les pharmacien(e)s ayant un accès contrôlé au dossier du patient peuvent reconnaître rapidement les médicaments auxquels le patient est allergique ou ceux occasionnant des effets secondaires. L'introduction des TIC dans le domaine sanitaire en RCA va aussi permettre aux différents sites de prise en charge des personnes vivant avec le VIH de réduire au maximum le nombre des doublant ce qui permettra au ministère de la santé d'avoir des données fiables quant au VIH en RCA.

- **pour les institutions de la santé**

Les services en ligne du système de la santé facilitent les procédures entre les médecins, les hôpitaux et d'autres fournisseurs de prestation, permettant ainsi de renforcer la coordination entre les différents

acteurs et d'accélérer l'échange d'informations. Un système de santé comportant des processus efficients a une incidence sur les coûts de santé.

Avantages administratifs de la cybersanté dans le domaine de l'assurance maladie.

L'utilisation des TIC dans le domaine de la santé simplifie les procédures administratives, comme par exemple l'émission de factures, et permet ainsi de faire des économies.

Avantages de la cybersanté sur l'économie.

La constitution et le développement systématique de services de santé en ligne va représenter un nouveau secteur de services. Il contribuera à l'amélioration de la santé et constitue également un facteur économique croissant. Dans l'ensemble, la cybersanté améliore la qualité de la vie, du travail et du lieu au sein du pays et ouvre de nouvelles possibilités d'exportation.

1.4.3 Conclusion

La cybersanté est un élément essentiel du renouveau en soins de santé: son application au système de soins de santé centrafricain, grâce aux améliorations de l'accessibilité, de la qualité et de l'efficacité du système, résultera en avantages pour les Centrafricains. Le gouvernement Centrafricain pourra investir dans ce domaine.

Un facteur clé du succès du travail du gouvernement est son solide engagement à collaborer.

1.5 Côte d'Ivoire: La Télémédecine en Côte d'Ivoire

1.5.1 Introduction

[5]A l'instar de nombreux pays, nous avons compris l'importance des NTIC dans le domaine de la médecine. Cependant nous nous trouvons dans une situation difficile, à tel point que de nombreux projets ont été abandonnés. Il s'agit pour nous de faire l'état des lieux de la télémédecine en Côte d'Ivoire, de situer nos besoins et surtout de recenser les projets les plus urgents.

Etat des Lieux

A. La formation

Nous avons des besoins pressants en matière de télémédecine. Dans un premier temps il s'agit d'avoir un personnel qualifié. A ce propos, nous pensons que la formation des ressources humaines (Médecins, infirmiers et informaticiens) pour démultiplier le système de télémédecine à Abidjan et en Côte d'Ivoire est d'une importance capitale. A cet effet, La SIBIM, Société Ivoirienne de Biosciences et Informatique Médical, a voulu mettre en œuvre le plan de formation qui consisterait en l'Organisation d'ateliers de formation à l'intention des professionnels de la santé et des professionnels des NTIC.

Les objectifs de ces ateliers seraient entre autres:

- Mettre à niveau en informatique de base des professionnels de la santé (Word, Excel, Powerpoint, Open Office, Acrobat professional);
- Fournir une vision globale sur les outils de l'informatique médicale;
- Apprendre les bonnes techniques de recherches d'informations médicales en ligne sur les moteurs de recherche;
- Apprendre à créer et à mettre en ligne les cours sur un système de télé-enseignement;

[5] Logbo-Allomo Tania, ATCI, Côte d'Ivoire. See document RGQ14.3.2-INF-0002

- Favoriser l'échange entre les professionnels de la santé et ceux des NTIC par le regroupement lors des ateliers;

Cette formation concernant directement les CHU, (Centres Hospitaliers Universitaires), devra intéresser d'abord les Directeurs Médicaux Scientifiques (DMS), coordonnateurs Télémédecine CHU et les Techniciens Informatiques.

Mais à ce jour, ce projet n'a pas encore été réalisé.

B. Le matériel

Nous manquons cruellement de matériel en Côte d'Ivoire. Le matériel informatique dont dispose les CHU et CHR sont désuets voire quasi inexistants.

Ainsi, nous aurions besoin pour les CHU d'Abidjan et les CHR des régions de Côte d'Ivoire, d'équipements pour la retransmissions de la Télé – soins – enseignements. A savoir, la plate forme site web à partir de laquelle nous pourrions émettre nos cours et assurer les soins à distance, d'ordinateurs, de vidéo projecteurs, d'écrans de projection et de tous les accessoires qui accompagnent ces équipements pour faire de la Télémédecine. Enfin, Et à tout cela il faudra ajouter les bandes passantes: c'est le problème essentiel à résoudre pour faire éclore la Télémédecine en Côte d'ivoire.

C. Le cadre juridique

Nous ne disposons en Côte d'Ivoire a l'instar des pays de la CEDEAO d'aucune réglementation ni de cadre juridique pour la télésanté en Côte d'Ivoire.

Nous avons cependant des acquis.

1.5.2 Les Acquis

En termes d'acquis nous avons:

1) La SIBIM, (Société Ivoirienne de Biosciences et Informatique Médical). Société scientifique et de vulgarisation de la Télémédecine, dans toutes ses composantes mais dont l'accent a été mis sur le Téléenseignement dispensé actuellement par le RAFT (Réseau Afrique Francophone de Télémédecine).

2) Un embryon de Télésanté (équipements et logiciels) au CHU de YOPOUGON (Abidjan) à travers un projet Indien dénommé RPSL. Il s'agit du Réseau Panafricain de Service en Ligne mis en place par l'Inde et 53 pays de l'Union Africaine qui consiste en une connexion par fibre optique et par satellite (RASCOM en l'occurrence) permettant de fournir des services de télé- éducation, télémédecine et de communication diplomatique. La télémédecine devrait à cet effet et entre autres, fournir les services suivants: la téléconsultation, la télésurveillance, la télé-chirurgie, la téléformation, l'éducation Médicale Continue (formation continue de 500 médecins et 1000 infirmiers en 5 ans), les logiciels de gestion des patients, des logiciels de stockage de données et de transmission des dossiers médicaux, la mise en place d'un centre de données devant gérer et tenir les archives. Ce projet rencontre quelques difficultés pour l'instant, compte tenu des circonstances du pays la situation sociopolitique du moment.

3) Projet PASRES en cours de réalisation. Le Programme d'Appui Stratégique à la Recherche Scientifique en Côte d'Ivoire (PASRES) est un programme financé par le Fonds Ivoiro-Suisse de Développement Economique et Social (FISDES). Il a été soumis par le Ministère de l'Enseignement Supérieur et de la Recherche Scientifique (MESRS) et le Centre Suisse de Recherches Scientifiques en Côte d'Ivoire (CSRS). Il vient soutenir le MESRS dans son objectif prioritaire de création d'un Fonds National pour la Recherche Scientifique et Technologique (FNRST) en Côte d'Ivoire.

Le PASRES poursuit quatre principaux objectifs:

- financer des projets de recherche contribuant à la lutte contre la pauvreté;

- former des jeunes chercheurs pour assurer la relève scientifique au niveau des centres de recherche et des universités publiques;
- apporter des appuis aux structures de recherche en matière de réhabilitation des stations et laboratoires, de renforcement des capacités (équipements et connectivité) et d'accès à l'information scientifique;
- donner les appuis nécessaires à l'émergence d'un Fonds National de la Recherche Scientifique et Technologique en Côte d'Ivoire;

La dynamique de mise en œuvre du PASRES donnera des bases solides pour le développement durable de la recherche en Côte d'Ivoire. Le projet viendra revitaliser les capacités des structures de recherche lourdement affectées par la crise.

4) l'Emission de cours au niveau du RAFT depuis 2008.

5) Quelques équipements non fonctionnels.

1.5.3 Les Projets

Dans un futur proche, la Côte d'Ivoire a en projet les actions suivantes:

1) L'Acquisition d'un SERVEUR et Construction d'un site web pour faire de la Télémédecine au plan national;

2) L'Extension des salles où est installé le Projet Indien avec l'acquisition de climatiseurs. A cet effet l'ATCI et le CI-CERT prévoient de réaliser une salle entièrement équipée qui servirait pour le téléenseignement et la formation continue.

3) L'Extension de la Télémédecine vers les hôpitaux de banlieue situés aux alentours d'Abidjan tels que l'Hôpital Protestant de Dabou, celui de Bonoua, et ceux des deux plus grandes villes de l'intérieur, à savoir Yamoussoukro et Bouaké et enfin les CHR à moyens termes.

4) L' Acquisition d'équipements pour les villes suscitées.

5) Un séminaire sur la télémédecine mobile en Côte d'Ivoire afin de recenser les besoins et rechercher les financements pour des unités mobiles qui permettraient de développer la Télémédecine en zone rurale. Ce, pour la prise en charge entre autres, des accouchements, accidents et pathologies telles que le Diabète, l'Hypertension Artérielle (HTA) et le SIDA etc. elle est impérative pour nous.

1.5.4 Conclusion

La télémédecine en Côte d'Ivoire est au stade embryonnaire. Les technologies de l'information et de la communication sont disponibles dans le pays (fibre optique sur toute l'étendue du territoire et d'une couverture réseau (mobile) très étendue) mais sont essentiellement concentrées dans les villes et gros villages; ainsi l'accès au matériel, l'absence de politiques sanitaires spécifiques, de formation et de moyens financiers constituent autant de défis devant être relevés dans la stratégie de déploiement de la télésanté en Côte d'Ivoire.

1.6 Guinea: Projet Panafricain de Service en Ligne (e-santé, e-Education) en République de Guinée

1.6.1 La Mise en Place du Projet

[6]Pour la mise en place du projet:

[6] Kébé Abdoulaye, ARPT, Guinée. See document RGQ14.3.2-INF-0001

1) Le protocole d'accord entre chaque pays africain désireux de participer au projet et le gouvernement Indien.

2) Les documents sollicitant des offres auprès des pays membres pour abriter les super hôpitaux et Universitaire directrices. Lors de la session inaugurale du parlement panafricain tenue à Johannesburg le 16 Septembre 2004, le Président Indien a proposé la mise en place d'un projet.

De réseau de Télécommunication pour connecter les 53 Etats membres de l'Union Africaine dans le but de rendre efficace les communications et la connectivité entre les Etats.

Ce réseau panafricain comprendra les stations VSAT et des réseaux de câbles à fibre optique et permettra de fournir aux membres des e-services avec en priorités la Télémédecine et la TéléEducation.

Trois documents ont été élaborés à l'intention des pays membres par le comité spécial consultatif.

La Guinée a signé le protocole d'accords et fait ainsi partie des 19 premiers qui ont adhéré au projet.

1.6.2 Les Avantages du Projet pour les Pays Bénéficiaires

Les avantages du projet pour les pays bénéficiaires sont entre autre:

- Pour la Télé- Médecine: accès aux soi ns de santé dans des zones éloignés ou isolés,

Accélération des diagnostiques et des traitements, réduction des couts et de l'isolement professionnel des docteurs en zones rurales, meilleurs prise de décision entre malades et médecin traitant spécialiste.

- Pour la Télé-Education : une éducation de haute qualité à partir d'un studio ou les professeurs de niveau supérieur peuvent être réunis, professeurs en formation périodique, une approche pour l'éducation formelle et pour l'alphabétisation des adultes.

Conformément à la clause 5.3 du protocole, nous avons désigné un coordonnateur national et nous avons procédé à la mise en place d'un comité interministériel pour le suivi du projet.

Par la lettre en la date du 05 janvier 2007 adresse à Monsieur le Président de la république de Guinée, le président de la commission de l'Union Africaine a félicité notre pays pour cette démarche et a demandé, pour la mise en œuvre rapide du projet dont la coordination sera assurée par la commission de l'Union Africaine, désignation au niveau national d'un coordonateur, point focal, et la constitution d'une commission interministérielle pour le suivi effectif du projet.

Selon le rapport de la sixième réunion du comité de pilotage du Projet Panafricain de service en ligne, l'évolution du projet à ce jour, sur le plan africain se présente comme suit:

- 52 sur les 53 Etats signataires du protocole d'accord avec le partenaire Indien (TCIL) dont la république de Guinée.
- Sur 51 pays, 14 pays ont terminé l'implantation du projet et l'etat d'implantation évolue dans les 17 autres.
- 46 Pays sur les 51 ont identifié les sites pour les trois e – services (Télémédecine, Télé Education et communication (VVIP), les 4 autres étant 1 à 2 sites prés identifiés.
- Les procédures d'acquisition des équipements et service pour les 51 pays sont achevées.

Les deux autres sites sont en phase d'étude.

L'évolution du projet en République de Guinée se présente comme suit:

La réception des équipements disponibles à la Direction Nationale des Postes et Télécommunications (DNPT);

- L'octroi de la licence e des VSAT et autre formalité réglementaires;
- L'identification et l'installation des trois sites devant abriter le Projet à savoir:
  - Le site de l'Université Gamal Abdel Nasser, siège du projet E-Education installé à 95%.

- Le site de l'hôpital de Donka siège du projet E-Santé identifié et en phase d'installation (90%).
- Du Département des Postes et Télécommunication (VVIP), siège du troisième site également identifié et en phase d'installation (80%).

Dans le souci de pérenniser ce projet, une réunion hebdomadaire est tenue par le comité de coordination national et une autre avec le cabinet de tutelle pour le suivi de l'évolution du projet.

A préciser que toutes ces démarches ont accompagnées des campagnes de sensibilisation à travers des correspondances adressées aux tutelles intéressées.

1.7 India: Telemedicine India Country Report

1.7.1 Introduction

[7]Most telemedicine activities are in the project mode, supported by the Indian Space Research Organization, Department of Information Technology, Ministry of External Affairs, Ministry of Health & Family Welfare and few others are being implemented through state government funding. None of the programmes are being adopted into the health system. A few corporate hospitals have developed their own telemedicine networks. Some of the nationwide projects being taken up by the Ministry of Health in the Government of India are Integrated Disease Surveillance Project (IDSP), National Cancer Network (ONCONET), National Rural Telemedicine Network, National Medical College Network and the Digital Medical Library Network. Telemedicine standardization and practice guidelines are being developed by the Department of Information Technology in the Government of India. A National Telemedicine Task Force was set up by the Health Ministry in the year 2005. The terms of reference covered all aspects of e-Health. Various committees and subcommittees have presented their reports. A follow-up action plan is awaited. The External Affairs Ministry has taken up the Pan-African e-Network Project and the SAARC Telemedicine Network Projects[20].

The National Knowledge Commission, a high level advisory body to the Prime Minister of India formed with the objective of transforming India into a knowledge society, has also set up a Working Group for the development of an Indian Health Information Network. This working group has proposed to design, develop, and integrate an end-to-end electronic health care informatics network framework in India to improve public health, health research, and the delivery of health care. A National Resource Center for Telemedicine & Biomedical Informatics is being developed at Lucknow with the support of the IT department of the Government of India. This will piggyback on the infrastructure of the School of Telemedicine & Biomedical Informatics (STBMI)[2] set up by the Uttar Pradesh state government. Besides meeting the need of capacity building in telemedicine and e-Health for the country, this school will be accepting overseas candidates also. Currently, Diploma Courses are being carried out by the STBMI.

India is acquiring a sizeable market segment in health care BPO (business-process outsourcing) and KPO (knowledge-process outsourcing) industries. It is now preferred as a healthcare destination for neighboring and far-off countries. Most of these patients are being catered to by the corporate hospitals. At the same time, both short- and long-term travel by overseas citizens is increasing for business and tourism purposes which increases the potential for the use of telemedicine and e-Health tools to facilitate exchange of electronic health information between hospitals across the globe. The so called medical tourism is getting a boost.

Orissa Trust of Technical Education and Training (Ottet) takes the lead using modern ICT platform and network in Public Private Partnership (PPP) mode in association with Government of Orissa to provide

[7] Contribution: S.K. Mishra, Department of Endocrine Surgery & School of Telemedicine & Biomedical Informatics, SGPGIMS, Lucknow, India. See document RGQ14.3.2-INF-0004

promotive and preventive healthcare and disease management. Delivery of healthcare services at the door steps of villagers in 51,000 villages of the state is envisaged[32]. Gujarat state government is looking to expand telemedicine network in PPP mode. The state health department of Gujarat is all set to embark on to connect all villages through its telemedicine network. If things go according to plan, all panchayats (HQ of group of villages, first level of government administrative hierarchy) and schools in Gujarat villages would have visual-satellite connections within the next two to three years. National Institute of Mental Health and Neurosciences (NIMHANS), Bangalore and Mysore based K.R. Hospital has established connectivity for their telemedicine project in collaboration with Larsen & Toubro (L&T) Ltd., Bangalore which has gifted telemedicine solutions and equipment worth INR 600,000 to both the medical centers under Corporate Social Responsibility (CSR) initiative. Similarly, in April 2006 under the CSR program of Gas Authority of India Limited (GAIL), a telemedicine project was started linking SGPGIMS, Lucknow with District Hospital of Raibareli, located at a distance of 80 kms with fiber optic cable network. GAIL has upgraded the infrastructure by providing advanced videoconference equipment and designing and constructing a board room for eCME in the year 2010.

1.7.2 Electronic Medical Records and Hospital Automation

The majority of the hospitals in the country are rooted in manual processes, which are difficult to access. The insurance sector demands more efficient health information storage and retrieval. Automation alone can help hospitals to meet these challenges. Electronic Health Record (EHR) and Hospital Information Management (HIS) in India is still in the early growth stage. To start with it is a small market dominated by in-house design, development and implementation of customized solutions developed by software developers. In terms of technology adoption, India is far behind its Asia Pacific counterparts such as Australia, Japan, South Korea, Singapore, and Malaysia. Center for Development of Advanced Computing (C-DAC), an autonomous government scientific organization developed and deployed the first indigenously developed total Hospital Information System (HIS) software in collaboration with Sanjay Gandhi Post Graduate Institute of Medical Sciences (SGPGIMS)[22], Lucknow in the year 1998. C-DAC's HIS solution is now deployed in various hospitals like Guru Teg Bahadur Hospital (Delhi), Mahatma Gandhi Institute of Medical Sciences (Sevagram, Maharastra). C-DAC has also developed Telemedicine enabled Hospital Information System. Currently, electronic medical records and hospital automation have been rapidly getting adopted in most of the corporate and few public sector hospitals. Health system development projects in state governments aided by the World Bank are promoting rural electronic health records. Tata Consultancy Services (TCS) is developing a suitable solution to maintain electronic medical records (EMR) for the Tamil Nadu State Government[6]. Ministry of Health & Family Welfare has launched an initiative to standardize Electronic Medical Records for the country. The Apollo Hospitals Group is initiating a major project with IBM, to build a national health data network called Health Highway[30] to provide a diverse set of software applications for the healthcare segment. Health Highway will be offered as a hosted solution managed and maintained by IBM and Apollo with hospitals using it on demand via a pay-per-use model. A major thrust for adapting a standardized EMR is likely to come following the National Knowledge Commission's Working Group recommendation. It has suggested developing a common national EHR with a minimal data set and making it available in an open domain to encourage widespread use in the country. This would facilitate standards-based development of a knowledge base.

1.7.3 Telemedicine Initiatives

Department of Information Technology (DIT), Ministry of Communication and IT (MCIT), Government of India

The Department of IT has taken a pivotal role in defining and shaping the future of telemedicine applications in India. The DIT has been involved at multiple levels – from initiation of pilot schemes to standardization of telemedicine in the country. It has funded development of telemedicine software systems – the prominent ones being Mercury® and Sanjeevani® software by C-DAC. DIT has also sponsored the telemedicine project connecting three premier medical institutions – viz. SGPGI-Lucknow, AIIMS-New Delhi and PGIMER-Chandigarh. DIT has established more than 100 nodes all over India in

collaboration with the state governments. Telemedicine network in West Bengal for diagnosis and monitoring of tropical diseases, Kerala and Tamil Nadu Oncology Network for facilitating cancer care, North-Eastern and Himachal Pradesh hilly states for specialty healthcare access are some of the prominent projects launched by this department.

Indian Space Research Organization (ISRO)[3]:

Towards societal benefit of indigenously developed space technology, Indian Satellite System (INSAT), ISRO[3] has implemented telemedicine pilot projects around the country under GRAMSAT (rural satellite) program which are very specific to the development of the society. In collaboration with state governments it has established a Telemedicine Network consisting of 382 Hospitals-306 Remote/Rural. District Hospitals/Health Centers connected to 51 super specialty hospitals located in major states. Sixteen mobile Telemedicine units are part of this network. Andaman & Nicobar Islands and Lakshadweep are linked to mainland specialty hospitals through satellite connectivity. In collaboration with state government it has supported establishment of Karnataka state telemedicine network where all the district hospitals in the state are connected with five specialty hospitals in Bangalore and Mysore. Similar operational network has been effectively functioning in the state of Rajasthan where all the 32 district hospitals are connected with six medical college hospitals and S.M.S. hospital in Jaipur. ISRO has also assisted Maharashtra, Madhya Pradesh and Orissa states in establishing satellite communication based telemedicine pilot projects.

Ministry of Health and Family Welfare (MoH&FW), Government of India[4]:

MoH&FW is currently implementing Integrated Disease Surveillance Programme network connecting all district hospitals with medical colleges of the state to facilitate tele-consultation, tele-education/training of health professionals and monitoring disease trends. It has funded few pilot projects at national level such as; tele-ophthalmology and rural telemedicine projects. OncoNET India project is under implementation which will network 27 Regional Cancer Centers (RCCs) with 108 Peripheral Cancer Centers (PCCs) hospitals to facilitate national cancer control programme. National Rural Telemedicine Network (NRTN) Project under National Rural Health Mission (NRHM) is under implementation phase. Recently, the ministry has decided to implement National Medical College Network project under the central scheme - e-Health including telemedicine in which all the medical colleges of the country will be linked with high speed high bandwidth optic fiber backbone from “National Knowledge Network”. The proposed network will empower learners and teachers to practice distance medical education using various ICT enabled educational technologies. The digital medical library consortium created by the National Medical Library will be able to expand its reach using this network.

State Governments:

To strengthen the healthcare facilities in their states, the governments of Orissa and Uttar Pradesh supported networking of their secondary level hospitals and then further linked them to SGPGIMS, Lucknow for specialty consultation[7]. C-DAC is now implementing the third phase of telemedicine network in Orissa by connecting remaining 22 districts hospitals. State-level central telemedicine resource centre is coming up on the premises of SCB Medical College and Hospital, Cuttack for promoting, monitoring, storing and maintaining entire state telemedicine activities and digital medical contents[18]. The Government of Chhattisgarh with the support of ISRO has established state wide network linking state Government Medical Colleges at Raipur and Bilaspur which in turn have been linked with premier hospitals across the country. Rajasthan State Government also, in collaboration with ISRO, has established Telemedicine network between 6 state medical colleges and 32 district hospitals and 6 Mobile Vans. Karnataka State Telemedicine Network Project run by an autonomous trust formed by the State Government has set up 30 nodes in collaboration with ISRO. Intel has initiated a joint telemedicine programme to take the benefits of healthcare to rural Karnataka in association with the state government[26]. Andhra Pradesh state government is planning to launch mobile clinics that would daily visit two villages to check blood pressure, diabetes and other health parameters of people and also carry out telemedicine through “104 services”. Gujarat is also starting “104 services” over phone. People can call up and talk to paramedics in call centers who can suggest the primary action to be taken in case of any health

emergency. Also, they would be able to suggest generic and over the counter drugs." Punjab government also launched a Telemedicine Project, with state-of-art facilities at Government Medical College and Hospital to link the five polyclinics set up in the state. In Himachal Pradesh 19 health centers at district, block and tehsil headquarters connected with Indira Gandhi Medical College, Shimla and Postgraduate Institute of Medical Education & Research Chandigarh through ISDN link[24]. The Gujarat government will soon launch a Telemedicine Project with the Indian Space Research Organisation (ISRO) as its technology advisor to enhance the quality of healthcare services in the remote areas of the state. Under this project, government plans to cover 50 Community Health Centers, mainly in interior tribal and coastal areas of the state within a year. Later, this facility will be extended to other remote areas[30]. Maharashtra state has deployed Telemedicine network linking 28 District hospitals with Nanavati super specialty hospital under National Rural Health Mission.

Telemedicine Initiatives undertaken by large hospitals: Academic/Public/Corporate

Various tertiary level super specialty hospitals in public and corporate sector have taken initiatives in telemedicine program with the help of government agencies or on their own. Many of them have now completed a decade of telemedicine journey. Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS), Lucknow, a premier academic medical institution in the public sector, started telemedicine activities in the year 1999 in project mode with the support of various government agencies. SGPGI Telemedicine network has linked 27 national and international nodes and has been carrying out tele-education and tele-healthcare activities. Research and development is one of the focus areas at this center. SGPGI has set up a School of Telemedicine and Biomedical Informatics to train man power in the field of telemedicine and e health. Department of Information Technology, Government of India has now recognized it as a National Resource Center in Telemedicine and Biomedical Informatics. All India Institute of Medical Sciences (AIIMS), New Delhi connected with Jammu & Kashmir, Haryana, Orissa, North East states network and PGIMER, Chandigarh connected with Punjab and Himachal state network and Sri Ramachandra Medical College and Research Institute, Chennai connected with Andaman & Nicobar Island Hospital, Amritha Institute of Medical Sciences, Kochi connected with Lakshwadeep island, Tata Memorial Hospital, Mumbai, Christian Medical College, Vellore are involved actively in Telemedicine.

In corporate sector, the major players are Amrita Institute Medical of Sciences (AIMS), Kochi (69 nodes), Apollo Hospital Group (150 nodes), Asia Heart Foundation, Bangalore, Mumbai (02 nodes), Fortis Hospital (20 nodes), Narayana Hrudayalaya (26 nodes), Dr. Balabhai Nanavati Hospital, Mumbai (32 Nodes) and Escorts Heart Institute and Research Center (08 nodes). Recently Sir Ganga Ram Hospital, New Delhi has launched its telemedicine centers in Haryana and Rajasthan states. With the support of ISRO, Shankar Nethralaya at Chennai, Meenakshi Eye Mission at Madurai and four other corporate eye hospitals have launched Mobile Tele-ophthalmology service for early diagnosis and treatment of ophthalmic diseases under National Blindness Control Program. Sir Ganga Ram Hospital, New Delhi and AIMS, Kochi have

launched mobile Tele-hospital for rural access of specialty healthcare services. Hyderabad-based Global Hospitals announced the opening of their information and telemedicine centre in Ahmadabad. The telemedicine centre in the city is the fourth after Kolkata, Puducherry and Bhubaneswar. The telemedicine centre will help them to reach out to the specialists in Hyderabad and Chennai[29].

1.7.4 Example of a successful development is the m-Health Tool Kit for Low Resource Countries

Introduction

With over 506 million mobile phone subscribers in a low resource country like India, growing at approximately 10 million per month, mobile networks have now become the country's largest distribution platform, promising to deliver information and public services to the masses through innovative applications. On current trends, m-Health systems will be more widely offered by mobile telecommunication service providers, and simple, yet important functions may even be offered as built-in features of mobile phones[1]. Mobile platforms world-wide are being used to provide financial and banking services, agriculture information, health services, telemedicine and e-education in rural and remote areas. The initiatives to provide various services using mobile applications have already started in India. m-Health application potential can be leveraged to boost social and economic activities, governance, and enhance government-citizen interaction. For this transformation to be inclusive and beneficial for the under-privileged and rural population, an innovative and low cost model has to be addressed in the context of developing countries.

Material and Method

m-Health4U®, a portable low cost mobile telemedicine kit, was conceptualized, designed and a prototype developed at the m-Health research laboratory STBMI in 2008. Two versions were worked out, i.e. m-Health4U-B (Backpack) and m-Health4U-S (Suitcase) having a weight of 2–4 kilogram depicted in Fig. 1.

After bench testing, a proof of concept study was undertaken in the field to test transmission of vital signs and ECG and software based videoconference using wireless broadband media during a local festival in the month of June 2009 and 2010 (refer to Fig 2. for technical architecture). An enterprise based six node wireless telemedicine network was set up connecting specialty hospitals at Bhubaneswar and Cuttack, and Orissa in the eastern coast of India using wireless broadband network to exchange ECG and carry out videoconference for tele-consultation. The outcome was successful transmission of vital sign data and videoconference. Subsequently, pilot field deployment was carried out in the State of Gujarat, western India in the month of November 2010. In-service paramedical, laboratory technician and nursing staff were identified to carry out the pilot project. Basic orientation, demonstration and hands-on training were imparted to give them first hand exposure on the kit and then the kit was installed in four Primary Health Centers (PHC) and one Community Health Center (CHC). All five nodes were connected over mobile wireless internet with the expert hospital located in the city. The electronic medical record was created using the Curesoft® telemedicine software and the input from integrated medical devices like ECG, NIBP, and Spo2 etc. were captured through USB 2.0 port into this software, which was then exchanged between the nodes, followed by a videoconference session for tele-consultation after the successful transmission of the data to the specialist.

Result

The outcome of the "proof of concept" was quite satisfactory. The doctors involved in the project were quite excited and found it an innovative solution for strengthening the healthcare services at their hospitals. Subsequently pilot deployment was started in a different environment. The patient data was transferred successfully between the expert doctors and remote end and videoconference could be possible even in low bandwidth. The doctors participating in the study suggested some minor changes in the software architecture, like incorporating more graphics to represent body parts. Overall performance of the kit was acceptable to them.

Discussion

The advancement of m-Health technology should be exploited in rural healthcare delivery setting in low resource countries where the mobile telecommunication network has already reached. The tool kit has been developed keeping in mind the basic health care needs in remote villages in an Indian setting, a situation akin to countries in the developing world. Besides the local available technology and skill, cost factor has been taken into account. While field deployment has been successful in testing, the local available mobile network, human factors such as acceptability of the device and operational simplicity were also taken into consideration.

Acknowledgement

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1.7.5 e-Learning in the-Health Sector

Online Open Access Bibliography:

Two government agencies, the National Informatics Center (NIC) and the Indian Council of Medical Research (ICMR) have established the Indian Medical Literature Analysis and Retrieval System (MEDLARS) Center to cater to the information needs of the medical community of India. This ICMR-NIC Center for Biomedical Information has developed various web-based modules such as a union catalog of the journal holdings of medical libraries of India (http://uncat.nic.in), a bibliographic database of Indian biomedical journals (http://indmed.nic.in) and full texts of Indian biomedical journals (http://medind.nic.in).

Collaborative Knowledge Sharing through Telemedicine Network:

In the interest of professional knowledge sharing, premier academic medical institutions including AIIMS, PGIMER, SGPGIMS, Christian Medical College, at Vellore, and AIMS are actively involved in sharing their academic activities over the telemedicine network.

1.7.6 Education & Training in e Health towards Capacity building:

The Apollo Telemedicine Network Foundation

The Apollo Telemedicine Network Foundation, in collaboration with Anna University in Chennai, was the first to start a 15-day certification course in Telehealth Technology, which is a blend of technical, medical and managerial skills. The first course commenced in October 2003. As part of its efforts to popularize telemedicine, an interactive section on telemedicine has been made available in the division of emerging technologies at the renowned National Science Centre in New Delhi. Thousands of public individuals now have an opportunity to see telemedicine and learn about it.

SGPGIMS

SGPGIMS, in collaboration with the Uttar Pradesh State government and Department of Information Technology (DIT), Government of India, has taken the initiative to set up a School of Telemedicine and Biomedical Informatics in its campus. Curriculum based diploma courses was started in 2009. First batch of the diploma course has finished and second batch is enrolled in this session year. It will house different

laboratories in the field of e-Health such as telemedicine, hospital information systems, biomedical informatics, medical multimedia and image management, medical knowledge management, artificial intelligence, virtual reality, and robotics. The objectives of the school are to create various resource facilities, run structured training programs, conduct research and development, and provide consultancy to government and private health care organizations in collaboration with technological and medical universities in the country and abroad. Five trainees from the Maldives (sponsored by the WHO), 30 Indian trainees sponsored by the government of Madhya Pradesh, and 13 Indian trainees sponsored by the government of Uttar Pradesh learned telemedicine technology and its application in October 2007 and February 2008. Two trainees from the DPR Korea (sponsored by the WHO), 38 Indian trainees sponsored by different organization in 2009 and 69 in 2010. The school is being identified as a "National Telemedicine Resource Center" by DIT.

Tele-training Center at National Institute of Health & Family Welfare, New Delhi

The Ministry of Health & Family Welfare in the Government of India is setting up a teletraining center at the National Institute of Health & Family Welfare in New Delhi to create a facility that will offer tele-training of public health professionals across the country through various e-learning modules. This will enable professionals to switch to more efficient electronic modes from the currently practiced on-site training modules. This initiative would boost capacity building in public health as has been envisaged under the National Rural Health Mission[4].

The National Board of Examinations (an autonomous body under the aegis of Ministry of Health, Govt. of India) offers a satellite-based postgraduate e-lecture program in all medical specialties. It is now mandatory for every institution recognized by the board to make available the necessary infrastructure for receiving these programs.[33]

e-Continuing Medical Education (e-CME)

MoH&FW is planning to network all the government medical colleges with high bandwidth fiber to facilitate an e-CME program.

e-Governance in the Health Sector under the State-wide e-Governance Network

DIT has launched the National e-Governance Action Plan (NeGP) to support the growth of e-governance within the country. The National Informatics Center (NIC) is the DIT arm that provides a range of services to all the government departments at the center, the states and the districts. A separate "e-Governance Standards Division" has been created by NIC to steer the process of evolving the standards.

Common Service Center (100,000 nodes), DIT Project

DIT has formulated a proposal to establish 100,000 common service centers (CSCs) in rural areas, which will serve not only as the front end for most government services, but also as a means to connect the citizens of rural India to the web. CSCs would extend the reach of electronic services, both government and private, to the village level. Various government departments have been advised to design and evolve their mission-mode projects, laying adequate emphasis on services and service levels with respect to their interface with citizens and businesses. Telemedicine has been identified as one of the service modules. It is envisaged that initially, 20,000 CSCs would have tele-health outlet service managed by a village-level entrepreneur.

Village Resource Centre (VRC)

The VRC concept has been evolved by ISRO to provide a variety of services such as tele-education, telemedicine, online-decision support, interactive farmers' advisory services, tele-fishery, e-governance services, weather services and water management. By providing tele-education services, the VRCs act as learning centers focused on the virtual community. At the same time, VRCs will provide connectivity to specialty hospitals, thus bringing the services of expert doctors closer to villages. Nearly 500 such VRCs have been established in the country.

1.7.7 Policy Initiatives

Ministry of Communication & IT

a. Standardization of Telemedicine Platform and Services

To standardize services of different telemedicine centers, a document called "**Recommended Guidelines & Standards for Practice of Telemedicine in India**" has been prepared by DIT. It is aimed at enhancing interoperability among the various telemedicine systems being set up in the country. These standards will assist the DIT and state governments and health care providers in the planning and implementation of operational telemedicine networks. To establish a telemedicine center, standards should be set for telemedicine systems, software, connectivity, data exchange, security and privacy. Guidelines should also be established regarding telemedicine interaction.

b. Defining the IT Infrastructure of Health

DIT also took initiative, in a project mode, for defining **"The framework for Information Technology Infrastructure for Health (ITIH)"** to efficiently address the information needs of different stakeholders in the health care sector.

Initiatives of Ministry of Health & Family Welfare (MoH & FW)

National Task Force on Telemedicine:

1. To work on inter-operability, standards for data transmission, software, hardware, training etc.
2. To define a national telemedicine grid and consider its standards and operational aspects.
3. To identify all players and projects currently involved in telemedicine in India and evaluate their performance, capacity and replicability.
4. To prepare pilot projects for connection of super specialty hospitals/ medical colleges with district hospitals and/or Community Health Centers /Primary Health Centers especially keeping in mind to provide access to remote areas.
5. To prepare national cancer telemedicine network.
6. To examine possibilities of utilization of standalone centers of department of communication in rural areas.
7. To define standards and structures of electronic medical records and patient data base which could be accessed on a national telemedicine grid?
8. To enable telemedicine centers in teaching institutions to impart training to all government medical/dental/nursing colleges in three years time.
9. To prepare curriculum and projects for CMEs through telemedicine.
10. To draft a national policy on "telemedicine and telemedical education" and to prepare a central scheme for the 11th Five Year Plan.

Medical Informatics Education for Graduate Medical Students

The Medical Council of India is considering the introduction of medical informatics in the course curriculum of graduate medical students.

1.7.8 National e-Health Projects under Planning and Implementation

Ministry of Health & Family Welfare Projects

a. National OncoNET Project:

Under the National Cancer Control Program, 27 Regional Cancer Centers will be linked with 100 peripheral centers for primary prevention, early detection, treatment and rehabilitation of cancer patients.

b. National Medical College Network:

The National Task Force on Telemedicine, set up by the Union Ministry of Health and Family Welfare, plans to establish a national grid on telemedicine for networking medical colleges. A few tertiary-care academic medical institutes from different regions of the country will be identified as medical knowledge resource centers (in a regional hub), each of them connected to medical colleges (nodes) in that region. One of these regional hubs will be identified as the central hub, which will have overall responsibility for coordinating the national network in addition to providing infrastructure for a central content development center.

c. National Digital Medical Library Consortium:

The National Medical Library's Electronic Resources in Medicine (ERMED) Consortium is an initiative taken by the Director General of Health Services (DGHS) to develop nationwide electronic information resources in the field of medicine. A total 39 centrally-funded government institutions (including 10 under DGHS, 28 laboratories under the Indian Council of Medical Research, and the AIIMS libraries) have been selected at the initial stage as core members. The MoH&FW aims to provide funds required for the purchase of electronic journals under this consortium project.

Ministry of External Affairs Project:

a. SAARC telemedicine network[20]

The South Asian Association of Regional Cooperation (SAARC), created as an expression of the region's collective decision to evolve a regional cooperative framework, received a major impetus during the 14th SAARC Summit held in New Delhi in April 2007. The pilot project connects one or two hospitals in each of the SAARC countries with three to four super-specialty hospitals in India. The super specialty hospitals in India include the SGPGIMS, Lucknow and PGIMER, Chandigarh which are connected with JDWNR Hospital, Thimphu, Bhutan; Indira Gandhi Child Hospital, Kabul, Afghanistan; and Patan Hospital, Kathmandu, Nepal. This is being developed as an exemplary model for implementing projects at the regional level. It has immense potential to expand the scope of regional cooperation to other ICT enabled areas such as education, business process outsourcing and mass communication.

b. Pan-African e network project:

The Ministry of External Affairs for the Government of India is implementing this project through Telecommunications Consultants India Ltd. (TCIL) to establish a VSAT-based telemedicine and tele-education infrastructure for African countries in 53 nations of the African Union. This will be accomplished via a satellite and fiber-optic network that would provide effective tele-education, telemedicine, Internet, videoconferencing and VoIP services and also support e-governance, e-commerce, infotainment, resource mapping and meteorological services. Ten super-specialty hospitals in India have been identified to provide tele-health services to 53 remote African hospitals. In August 2010, the second phase of the Pan-African e-Network project had been launched[31].

e-Health Industry

Technologically, India is now self-sufficient in meeting the needs of hardware, software, connectivity and services. The prominent industries providing hardware and software supports are C-DAC; The Apollo Telemedicine Network Foundation in Hyderabad; The Online Telemedicine Research Institute in Ahmedabad; Televital India in Bangalore; Vepro India in Chennai; Prognosys Medical Systems Pvt. Ltd. in Bangalore; Medisoft Telemedicine Pvt. Ltd in Ahmedabad; Idiagnosis Technologies in Ahmedabad; and Karishma Software Ltd. in New Delhi. Many sturdy, standard HIMS solutions have been developed by the major IT companies such as C-DAC, Wipro GE Healthcare, Tata Consultancy Services (TCS), Amrita HIS Solution, Sobha Renaissance, and Siemens Information Systems Ltd (SISL).

1.7.9 Research and Development

DIT Initiative:

DIT, along with its societies such as CDAC and Media Lab Asia and in collaboration with many premier medical and technical institutions such as SGPGIMS, AIIMS, PGIMER and IITs, is involved in research, design, development and deployment of advanced telemedicine products and solutions. They also specialize in embedded and VLSI technology and biomedical, electronics, telemedicine and entrepreneurship development. C-DAC's Sushrut, a hospital information system (HIS) has been designed, developed and deployed at SGPGIMS[1]. It has also developed the institution-based application oriented telemedicine software systems Mercury® and Sanjeevani® and validated them at three premier medical institutions: SGPGIMS in Lucknow; AIIMS in New Delhi and PGIMER in Chandigarh. This it has accomplished using ISDN and satellite connectivity. It is also developed web version of Sanjeevani (e-Sanjeevani)[22].

SGPGIMS Initiative:

In collaboration with its technical partner, SGPGIMS developed and validated several application modules in telemedicine in addition to developing the prototypes Tele-ambulance for emergency health care, Mobile Tele-hospital for rural health care, and the portable suitcase telemedicine module for disaster situations.

Research publications:

India has contributed several research publications in peer reviewed scientific journals and book chapters in related field. A compendium of these publications can be found at: http://www.telemedindia.org.

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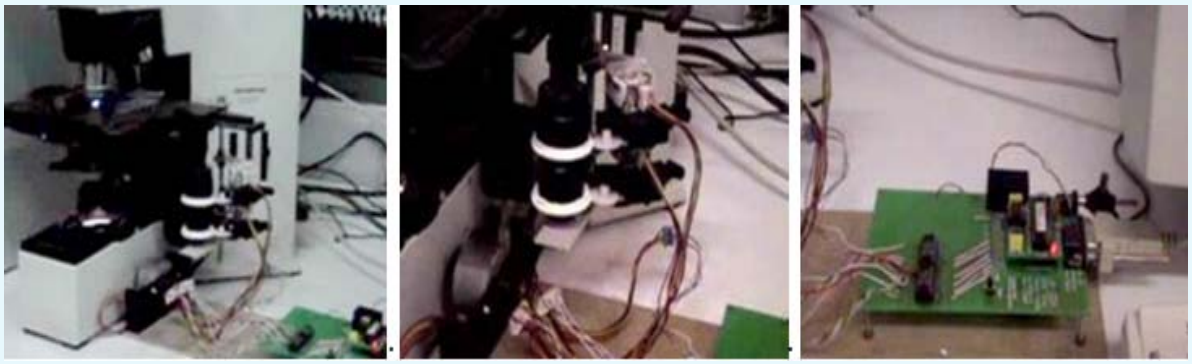
1.8 Indonesia

1.8.1 Case 1: Development of A Low-Cost Automatic Field-of-View Scanning Microscope for Early Tuberculosis Detection Systems

[8]We developed a TB automatic detection system using commodity components. The system consists of an electro-mechanical digital microscope to record the FoV images of sputum samples, image processing software to detect and to count the number of the bacteria in the FoV, and a decision system to determine whether the patient is diagnosed as a positive TB or not.

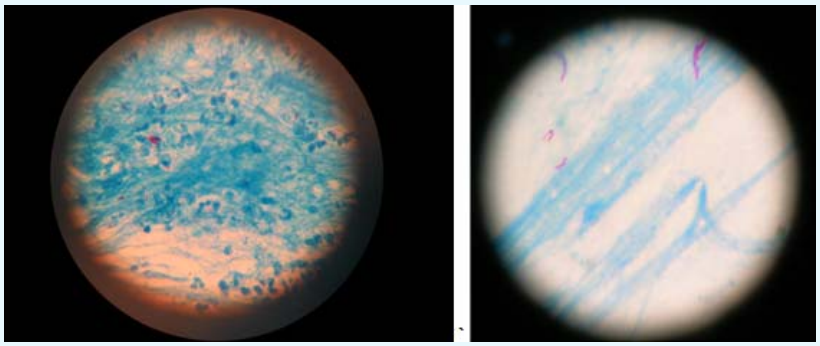
[8] Contribution: Andriyan Bayu Suksmono and Tati LR Mengko, School of Electrical Engineering and Informatics, Institut Teknologi Bandung, Indonesia. See document RGQ14.3.2-INF-0007

Figure 1: The modified optical microscope that is capable of performing automatic FoV scanning.



The electromechanical digital microscope is actually a modified one from an ordinary low-cost optical microscope. We add a two-degree-of-freedom scanner made of two stepper-motors and a digital camera fixed in front of the microscope's ocular. Figure 1 shows the modified-microscope, placement of the stepper motors, and the driver card with a simple microcontroller.

Figure 2: Two FoVs images of a sputum sample showing TB bacteria and its background



The image processing software and the decision system is now under-development. **Figure 2** shows two different FoV of the sputum microscopic images. The staining of the samples shows contrast of the TB bacteria with its background. The image processing software should be capable of separating the bacteria from the background. Then, the segmentation and counting process can be conducted.

Conclusions and further directions

We have described a low-cost automatic FoV scanning Microscope for early TB detection systems. Some parts of the system, i.e., the FoV automatic digital microscope, have been constructed. Our next steps are to complete the prototype with processing software, performing laboratory- and field- tests, and benchmarking with manual sputum analysis.

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1.8.2 Case 2: Picture Archiving and Communication System (PACS) and Teleradiology Development and Implementation

[9]Medical image becomes one of the most valuable assets in medical history and in supporting diagnosis process. Archiving and transferring medical image over telecommunication network is challenging, because of its size. It needs huge storage capacity to archive medical image in a health institution such as hospital. Our research since 2001 came out with effective compression method to compress the medical image in 16:1 ratio, yet maintaining the quality of image reconstruction over certain region of interest.

Figure 3: (Left) Application to manage medical image (right) Desktop Viewer

[9] Contribution: Utoro Sastrokusumo, Andriyan Bayu Suksmono, Antonius Darma Setiawan Bandung Institute of Technology, Indonesia. See document RGQ14.3.2-C-0007

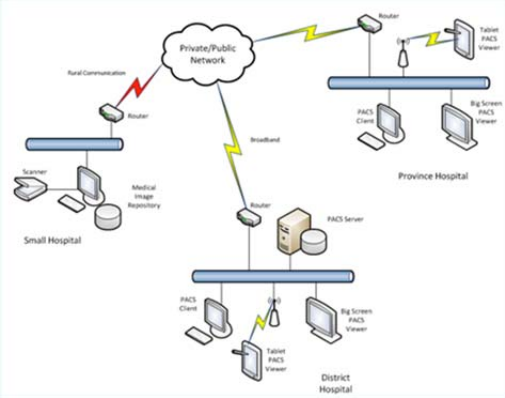
Figure 4: (Left) PACS viewer on Tablet PC (Right) PACS Viewer using large LCD touch screen

Our developed compression method was iterated for several years to meet the requirement from radiolog expert. We named our compression method as Scalable Fuzzy Vector Quantization (SFVQ). In the year of 2011, biomedical engineering of Institute Technology of Bandung cooperated with private company which works on health care area to develop commercial PACS. At the end of that year the beta version of commercial PACS product was launched. The product was implemented at to hospital, Agam General Hospital in West Sumatera and Cililin General Hospital in West Java. The product was design in a very simple user, yet powerful enough. However, there are many rooms for improvement.

The PACS product consists of three major components. The first one is the application to manage all medical images inside PACS. The second one is the application server to manage the interaction between client and storage server or persistence server. The last one is image viewer. We developed three kind of viewer, which are desktop, large LCD touch screen, and tablet PC.

We also develop on the PACS enhancement based on requirement and actual need. There is a need to have teleradiology session between small hospital which lack of radiolog and large computer where there are expert on medical image. Based on this need we expand the capability of our previous product into teleradiology supported PACS.

Figure 5: Teleradiology capability added into PACS



1.9 Kyrgyz Republic - E-Health Introduction in the Kyrgyz Republic - Experience and Further Steps

1.9.1 Introduction

[10]Since its independence in 1991, Kyrgyzstan has seen periods of democratic progress and of authoritarian backlash. With the fleeing of two presidents (in 2005 and 2010) after popular uprisings against authoritarianism, corruption and human rights violations; coupled with regional disparities and the repercussions of the inter-ethnic violence of June 2010, the country is going through a difficult process of transformation. In June 2010 several serious inter-ethnic confrontations took place in the south of the country. About 420 people died and 2,000 were injured, while over 2,000 houses and 300 businesses were destroyed. As result of June 2010 referendum a new constitution has been adopted. The new Constitution defines the Kyrgyz Republic as a parliamentary republic (during the previous 18 years, the country was a presidential republic) thus making it the only country with a parliamentary system in Central Asia. Parliamentary elections held in October 2010 were contested by 29 parties, with five winning places in Parliament and three forming a new coalition Government. Presidential elections held in October 2011 resulted in peaceful transfer of power. However, peace and social cohesion cannot be taken for granted, as the root causes of conflict, including inter-ethnic mistrust and regional tensions, eroded credibility of state institutions, social exclusion and uneven access to economic opportunities remain to be addressed. Kyrgyzstan in the past has seen concentration of powers around the presidency, with state institutions not perceived to be efficient, transparent or accountable. There is still work to be done to support the Government to strengthen the rule of law, address justice issues, reduce the prevalence of human rights violations, improve redress mechanisms and increase the independence and capacity of the judiciary, media (both public service and independent), the civil service and local government. Civil society's impact on decision-making still remains limited although its role has recently increased.

Kyrgyzstan has a GDP per capita of US$2200 (2010) and is classified as one of two low-income countries in the Europe and CIS region. The economy grew 3.9% per annum in 2000–2005 and 3.7% in 2005–2010. In 2011 the economy grew 5.7%. Poverty fell from over 62% in 2000 to 32% in 2009, but after the 2010 events it rose back to 33.7% that year, with an increasing proportion of the poor being female. Foreign debt is $2.803 billion as 2011, about 47% of GDP, while the budget deficit for 2012 is planned to

[10] Contribution: Chynara Suiumbaeva, ICTD component coordinator, Democratic Governance Programme, UNDP Kyrgyzstan. See document SG02-C-0202

be about 5.7% of GDP. There is a large informal sector, particularly in services and agriculture. Meanwhile, 26% of households have at least one member working abroad. Remittances had risen to US$1.7 billion by 2011, slightly over 30% of GDP.

With a human development index ranking of 126 out of 187, the Kyrgyz Republic is in the lower half of the medium human development countries. It raises seventeen places in the inequality-adjusted human development index. The country is 66 of 146 countries in UNDP's gender inequality index. The country's 2010 MDG report indicates that the country is unlikely to meet the MDGs for child and maternal mortality, tuberculosis, sanitation, and gender equality, although it is on track on extreme poverty reduction, access to basic secondary education, and access to improved water sources.

Life expectancy is 73.5 years for women compared to 65.3 years for men, and female literacy is high 97.7% (in the 15-24 age group). But despite progressive legislation on gender issues, women remain vulnerable to rising unemployment, a weak social protection system, and increased influence of patriarchal traditions in social relationships. Gender inequality, social and financial discrimination, and the additional unpaid work carried out by women mean that nearly 70% of the poor are now female. The continuing high prevalence of bride kidnapping in rural Kyrgyzstan remains a serious concern, and nearly 83% of women suffer domestic violence. In the government formed after the October 2010 elections, there were no female cabinet ministers until a lone woman minister for social protection was appointed on 7 April 2011. In those 2010 elections, representation of women in parliament fell from 30%to 20.8%, while in local councils it is now only 12%.

About 32% of Kyrgyzstan's population is between 15 and 25 years of age. Young people do not have full access to education, employment, health care, family decision making, and entrepreneurship. With inadequate educational training and poor economic prospects, many young people turn to crime and drugs. Young women, especially in rural areas, are particularly vulnerable to gender-based violence.

The country has prepared a medium-term Country Development Strategy (2012–2014) in the context of a macroeconomic outlook that looks challenging, but with potential for directing the economy on sustainable development. The Strategy focuses on creating conditions for attracting foreign investment, reform of state regulation aimed at eliminating bureaucratic barriers and expanding economic freedom of business entities, as well as on launch and implementation of 40 national projects in the medium-term. All these fundamental factors will be crucial for long-term sustainable human development and achievement of the MDGs.

1.9.2 Situation Analysis in the Healthcare System of the Kyrgyz Republic

Heart diseases are one of the leading causes of death and a major cause of disability. The importance of cardiology service is emphasized by the fact that cardio-vascular problems account for 50,3% in 2011 (48.3% in 2010) of all death cases in the Kyrgyz Republic.

The second alarming issue is the level of maternal and child mortality.

Child (infant) mortality is the crucial characteristic of national health. The child mortality rate is 20,7 per 1,000 born alive in 2011 (22,8 in 2010) and the structure looks as follows: the main share belongs to perinatal period conditions (65,2% in 2011, 63,1% in 2010, 60.0 % in 2007 and 60.9% in 2006), respiratory apparatus' diseases - pneumonia (12,3% in 2011, 14,9% in 2010, 16.7% in 2007, 17.5% in 2006), inborn anomalies (12,3% in 2011, 12,6% in 2010, 11.3% in 2007 and 11.2% in 2006) and infectious and parasitic diseases (5,3% in 2011, 4,5% in 2010, 6.8% in 2007 and 5.7% in 2006).

The major causes of such deaths are wrong diagnostics and incorrect prescriptions. The registration of child deaths at home shows that children die during the first five years of life because the parents are unable to properly evaluate the health status and do not know how to help. During the recent years the ratio of child's hospitalization caused by pneumonia has been high and made 36% for children up to five years, being one of the main death causes for children under 14.

In the last few years the maternity mortality rate has increased and in 2011 it made 49,3 per 100 000 live births (50,6 in 2010, 62,5 in 2007, 53,0 in 2006 and 60,0 in 2005). The leading place in maternal mortality increase was taken by the Talas region -87,0 per 100 000 live births in 2010 (61,3 in 2009 and 38.5% in

2006), the Naryn region – 83,5 per 100 000 live births in 2010 (135,6 in 2009), the Issyk-Kul region – 70,4 per 100 000 live births in 2010 (72,0 in 2009), Osh region – 59,8 per 100 000 live births in 2010 (117,4 in 2009). Rural areas take the first place in terms of death cases among women (86.8%). The major cases of such deaths are wrong diagnostics.The maternity mortality structure shows that 75.0% of deaths happen during pregnancy and childbirth. The first place of the mortality rate is taken by haemorrhages – 52.2% (in 2007 – 34.4%), the second by hypertension disorders - 22.4% (in 2007 – 34.3%), septic complications account for 10.4% (7.8% in 2007).

Although the prevalence of HIV is still low, the country has registered sharp increases in the number of persons living with HIV, and suffers one of the fastest rates of increase of reported HIV infection in the world. As of end 2011, there were 3111 registered HIV cases in the country, although WHO estimates suggest the true figure may be two or three times higher. Children now make up 8% of HIV cases in the country, following an outbreak in hospitals in the south of the country in 2007 and mother to child transmission. Because of women's vulnerability to HIV, sexual violence, inequality in decision making on contraception and sexual life, and poor sex education, the number of females registered as living with HIV increased by 75 times between 2001 and 2011, compared to 17 times for males. Despite progressive legislation, implementation mechanisms are weak and people living with HIV face continuing stigmatization. At over 12 cases per 100,000 people, tuberculosis prevalence is also high and rated as an epidemic. Much of the tuberculosis is multi-drug resistant, and the disease is particularly prevalent in the penal system because of overcrowding, poor ventilation, malnourishment and inefficient treatment. Meanwhile, an increasing proportion of tuberculosis cases are being registered among women and children. The prevalence of malaria, although still low, is increasing, particularly in southern parts of the country.

1.9.3 Objectives and Strategies

During the implementation of the National programmes on the healthcare reforms in the Kyrgyz Republic: "Manas" (1996–2005) and "ManasTaalimi" (2006-2011) the legislative base for the new health care system in the Kyrgyz Republic were established. The following new laws were adopted by Kyrgyz Parliament: on " The unify payer in the healthcare finance system" (2003), " About healthcare organizations in the Kyrgyz Republic" (2004), "Health protection of the citizens of the Kyrgyz Republic" (2005), " Public health care in the Kyrgyz Republic" (2009), amendments to the laws on "About the main principles of the budgetary law in the Kyrgyz Republic" (2000), " Local self governance and local governance administration in the Kyrgyz Republic"(2000), "Medical insurance of the citizens of the Kyrgyz Republic" (2003).

Every year, starting from 2001 the Government of the Kyrgyz Republic approves the Governmental Programme on State social guarantee provisioning free, preferential and paid terms of the healthcare services depending on the citizen's social status and medical insurance conditions. From 2006 the health care reforms performs under the Sector Wide Approach (SWAP).

The current National Programme of the health care reform "Den Sooluk" for 2012–2016 is a logical continuation of the previous national programmes focused on the 4 programme's directions:

- Cardio-vascular diseases;
- Maternal and child health care;
- Tuberculoses;
- HIV/AID.

The special focus in this programme was taken on the deployment of the ICTs in healthcare system from the view of standardization of the medical information systems and development of the unified telecommunication infrastructure. The implementation of the e-health services recognized as one of the main priority and includes the creation of the national e-health network for e-learning and tele-consultations.

Kyrgyzstan, as a country with difficult mountainous terrain needs the e-Health services because people in remote and rural areas have inadequate access to medical aid and health care. They have to travel for many hours to reach the nearest hospital or clinic. But to be effective, e-Health requires appropriate regulatory, legal and policy frameworks in both the telecommunications and the health sectors. Some of the critical factors for success are proper project management and a coordinated approach following the clear vision, the building up and maintenance of adequate technological infrastructure, the commitment of trained end-users and ICT literate citizens, and the political will to achieve challenging but realistic e-health goals.

Currently, Kyrgyzstan does not have a specific national strategy on e-health, which would require the initiative of the Ministry of Health together with other relevant Government agencies and CSOs. With the support of UNDP in Kyrgyzstan, the project on e-health in one of the remote areas (Batken) was implemented. UNDP is further looking at nation-wide project which would provide policy support and technical assistance toThe Ministry of Health of the Kyrgyz Republic, envisaging the following components:

Component 1: Draft National e-Health (including m-Health) Strategy & Action Plan developed and submitted for approval to the Kyrgyz Government.

Country's e-Health strategy will be based on national health priorities, the available and potential resources, and the current e-health environment. The enabling environment for e-Health is fundamental to scaling up and sustaining ICT adoption in the health sector. It includes aspects such as governance, policy, legislation, standards and human resources. Within the Kyrgyz Republic's national context, where the first pilot e-health project was implemented in 2009-2010 (joint initiative of UNDP, MTC and MH). This project featured a small initiative, within limited time-line, where advantages of using ICTs were demonstrated, including innovative ICT applications (with elements of m-health). The project was not sustainable due to the lack of ownership, commitment and e-health skills. In addition, it had a narrowfocus on certain aspects of e-health, while the changes and overall approach in the health care system were required. A national plan for a country in this context will be focused on making the case for e-health, creating awareness and establishing a foundation for investment, workforce education and adoption of e-health in priority systems and services. Without a parallel focus on creating the enabling environment, innovations in ICT will stay isolated and have only a limited impact on health.

Mobile communications have arguably had a bigger impact on humankind in a shorter period of time than any other invention in human history. Mobiles are also contributing to social, economic and political transformation. According to new WB Report (2012) to human and economic development opportunities, around three-quarters of the world's inhabitants now have access to a mobile phone and the mobile communications. The number of mobile subscriptions in use worldwide has grown from 1 billion in 2000 to over 6 billion in 2012, of which nearly 5 billion in developing countries. In developing countries citizens are increasingly using mobile phones to create new livelihoods and enhance their lifestyles, while governments are using them to improve service delivery and citizen feedback mechanisms. Mobile communications can help provide health care services more quickly and cheaper in many cases, mainly by focusing on primary, preventive and self-empowered approaches to health care. M-Health encompasses any use of mobile technology to address care challenges such as access, quality, affordability, matching of resources and behavioral norms through the exchange of information. It is a dynamic field for innovative new services that move health care away from pure public service delivery toward seeing the patient as a consumer. The recent studies estimated that m-health reduces data collection costs by approximately 24 percent, costs of elderly care by 25 percent and maternal and perinatal mortality by 30 percent (Telenor Group 2012). The same study finds that m-health can improve compliance with tuberculosis treatment by 30-70 percent. Taking into account above, finally, M-health should be integrated with larger e-Health Strategy and Action plan.

Component 2: National Process for e-Health Standardizationinitiated, key technical standards developed/adopted and submitted for approval to the Kyrgyz Government.

Considering the rapid introduction of e-health worldwide and potential growth in Kyrgyz Republic it is necessary to initiate the development of generally acceptable the national standards and guidelines to

facilitate growth of e-health application in Kyrgyzstan. Enormous international efforts are being put in this direction to regulate/guide the growth of healthcare IT ecosystem. These efforts are the result of compelling need for the standardization of processes in which healthcare information is represented and transmitted from system to system. For any developing country to embark on proposing standards for e-health and Hospital Management Information Systems (HMIS) it is imperative to study the existing international standards. Many Standard Development Organizations (SDOs) and Special Interest Groups (Sigs) are active in standardization process for addressing the issues of sharing of health data, data structure, access management, standardizing clinical and business process in healthcare and security and privacy. Some of the key relevant standards such as ISO/TS 18308, CEN/TC 251 EN 13606, DICOM, HL7, CCR-ASTM, CEN/TC 251 EN 13940, ICD-10-PCS, SNOMED-CT, CPT, UNLS, ITU-T H.32x. For any developing country embarking on introducing standardization will benefit by going through the exercise of reviewing these available standards to see their suitability for adoption.

Component 3: National e-Health network (with national e-Health center/node) and mechanisms for rapid deployment of ICT-enabled public e-health services created and some public e-health services (on cardiovascular, maternal and prenatal healthcare) provided to the citizens of Naryn and Osh provinces of the Kyrgyz Republic.

Under this new project it is planned to create national e-health center (s)/node(s) equipped by different modern digital medical and telecommunication equipment, real-time management of medical records, broadband connection and adapted e-health software systems in national e-health center. Thesecondary and primary health centers in Naryn and Osh provinces of the Kyrgyz Republic to enable continuous medical education and tele-consultation will be also established. Webcasting of the interactive courses by leading medical professionals to university students and young professionals in remote areas will be provided as well. Tele-consultations using an integrated system capable of managing patients, storing and forwarding medical records and images and providing second opinion to remote patients will be held. The system will comply with international standards adopted and approved by Kyrgyz Government. Some e-health services in cardiovascular, maternal and prenatal areas will be operational for Naryn and Osh province's patients.

1.9.4 Activities Implemented

UNDP Kyrgyzstan jointly with the Ministry of Health and Ministry of Transport and Communications of KR has successfully piloted in 2009-2010 the first e-health project in the Kyrgyz Republic in the remotest region of the country - Batken province, which lacked medical personnel, health services and special medical equipment. Two leading national medical institutions participated in this first e-health project. Medical receiving stations installed in these institutions and remote equipment for transferring the medical data wereprovided to the regional hospital. 24/7/365 help was arranged at the national centers with high professional medical staff in order to provide ON-OFF medical support with diagnostics and prescriptions. Different types of telecommunication and special medical equipment installed to ensure high quality communication of all necessary medical information to the both ends. Local population had access to health services at their place of residence.

The main objective of the project was to create and implement the first interactive E-Health services in the Kyrgyz Republic in order to decrease the mortality rate, especially on cardiovascular and maternity & child healthcare andto promote effective use of ICT as a powerful instrument for governance, economic and social development, citizen's access to public information and government services. E-Health services are considered as a component of the E-Government implementation in the social sector, which is an effective tool for improvement of health care service delivery through use of modern ICT technologies, especially in remote rural areas with focus on women and children and contributes to MDG 4 and 5 achievements.

1.9.5 Changes and Results Achieved

The project produced the following outputs:

- Access to public medical services was improved for populations in remote rural areas.

- Distance medical services for remotest region (tele-cardiology as well as maternity and child health care) were established.
- ICT possibilities in the healthcare area on provision of different medical services were demonstrated.
- Qualification of local medical personnel was improved through professional and IT-trainings.
- The project's idea and results were presented on round table with participating of the Vice-prime Minister of the Kyrgyz Republic and all interested stakeholders- Government entities, NGO's, mass media, universities and others. Very positive feedback received from all parties. Based on a result of this pilot project, the Ministry of Health of KR developed and submitted the document requesting budget from Government of sharing the best practice in order to implement the project's idea in all other regions of KR.
- The project was also presented at the SWAP meeting – regular biannual meetings of international donors, investing in healthcare sector of KR. It was the request from the Ministry of Healthof KR (from stats-secretary of the ministry) to mobilize additional resources for extension of the project to other regions of KR.
- The information about project was placed in DG TTF 2009 Annual report as best practice example (Democratic Governance Thematic Trust fund Stories from the field).

1.9.6 Lessons Learned

- The project's idea and suggested technological solutions are practical and can be easily replicated in other regions of the country and even more – in other countries with similar geographic and socio-economic conditions.
- State ownership: there was a high degree of commitment of key stakeholders during the project implementation. The Ministry of Health, despite the frequent changes of the departmental heads, remained interested in the project and expressed the intention to sustain project results. Middle managers were included as facilitators in the technical working group, have consistently advocated to the senior management the expansion ofthe interactive electronic medical services through the inclusion of this thematic area in the SWAP strategic objectives.
- Not all modern digital medical diagnostic equipment could transfer its data outside of the device using Bluetooth or USB ports and allow to connect to third party (not own) software.
- Lack of practical experience and knowledge on e-health not only in Kyrgyzstan and the Central Asia region.
- The lower level of preparedness and competences of the local medical personnel to use the computer and modern medical diagnostic equipment.
- Latent resistance (or skepticism) from doctors (rural and central) to accept new way of providing medical services.
- Lack of involvement of NGOs in the project activities. The project document envisaged NGO stakeholders in the steering committee, which however were not able to provide necessary contribution.
- Prior to the project commencement, there was no proper stakeholder and institutional analysis made. This impacted project implementation results.
- Strategies for engagement and cooperation of donors in this area need to be developed and the Government should play a central role in coordination and facilitation of this process.

1.10 Laos: E-Health Activities by Fujitsu, JTEC and Laos Government

1.10.1 Project Information and Background

[11]In Lao P.D.R., the Ministry of Health, headed by the Minister, has the strong intention to utilize ICT in the health and medical fields, and the "ICT Master Plan (ver.1) for MOH" was established in October 2008.

The e-Government Network, led by the National Authority for Science and Technology, which is to be commonly utilized by all the government ministries and agencies, is put into operation mainly in Vientiane capital and under expansion to provincial capitals.

For the Ministry of Health, it is vital to introduce e-health applications in an effective and efficient manner to realize the aforementioned ICT Master Plan by utilizing the ICT infrastructure in e-Government Network.

Thus, in order to effectively promote the ICT application in the health and medical fields, the collaborative research team of Japan and Lao P.D.R. has conducted the study on the scheme and methodology of "How to develop, maintain, and utilize the comprehensible e-health contents" under the support of APT

(EBC-J2) scheme – 2008.

1.10.2 Summary and Purpose of this System

The results of the collaborative research are fruitful and there are high interests and demands for the realization. Therefore, as the practical and sustainable way forward, the pilot project under the support of APT (EBC-J3) scheme – 2009 has been implemented with the purposes of:

1. Establishment of ICT Access Points for proper information provision to the public (especially health and medical information) by expanding the existing e-Government Network.
2. Deployment of the ICT facilities available for (but not limited to):
   - Remote consultation between Central Hospital and Provincial Hospital.
   - e-Education for doctors, nurses, and other medical staff.
3. It is highly expected the pilot project would be:
   - the best practices of ICT based improvement for health and medical field;
   - the best practice of effective utilization of e-Government network;
   - paving the way for the Network expansion into rural areas.

- **Network overview**

As shown in Figure 6Error! Reference source not found., the dot line area shows the part installed in the pilot project. Main part is the IP Microwave Radio System to provide connection for Luangphabang Provincial Hospital in order to connect to the e-Government Network led by the National Authority for Science and Technology. The two hospitals in the map placed at the bottom right of Figure 6 are connected through the e-Government Network.

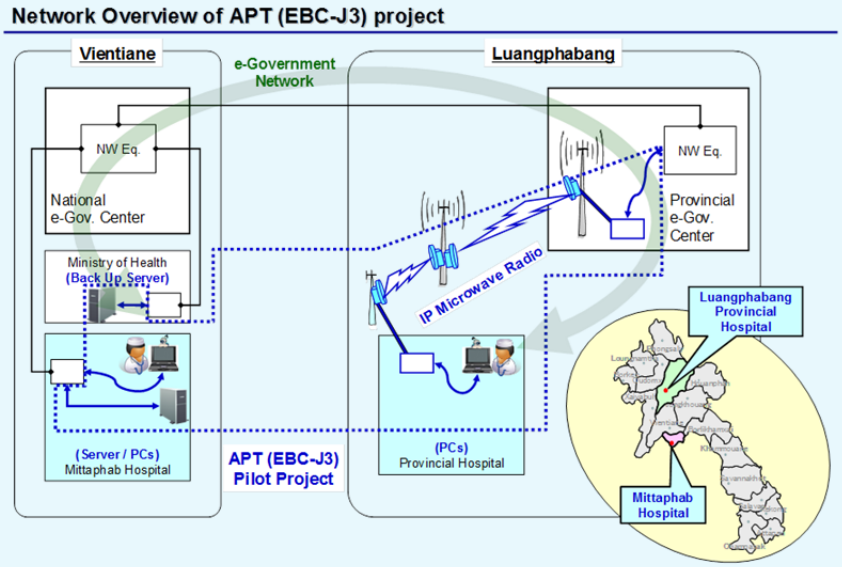
- **System overview**

Figure 7 shows the system overview of the pilot project. In Mittaphab Hospital, Main Server for Web Video Conference System and File Server, and 2 client PCs are installed. Back-up Server for secured

[11] Contribution: Go Maeno, FUJITSU LIMITED, Japan. See document RGQ14.3.2-INF-0019

system operation is located in Ministry of Health headquarters. In Luangphabang Provincial Hospital, 2 client PCs and 1 PC for Open ICT Access Point are installed.

Figure 6: Network overview of the pilot project



For Remote Consultation between doctors, the Web Video Conference System is used for the more understandable communication. Also, document files such as Consultation Reports can be shared through the File Server.

For e-Education, the contents stored in the File Server can be accessed remotely. In addition, the recording function of the Web Video Conference System is quite useful. For example, seminars can be recorded in synchronization with the slide show and explanation for them.

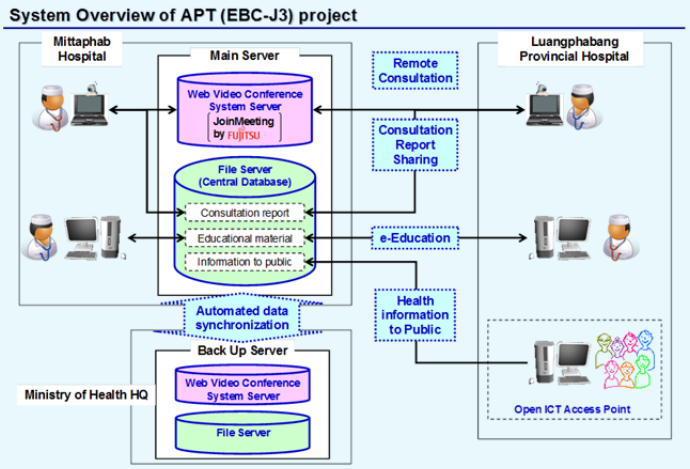
Public who visit the hospital can access health information easily from the ICT Access Point located at the lobby in Luangphabang Provincial Hospital. In addition, automated data synchronization is activated between Main and Back-up Servers. In case of server trouble, system availability can be kept by switching the connection to the Back-up Server.

1.10.3 Major Implemented Items

Major implemented items under the pilot project:

- IP Microwave Radio System has been installed to expand the e-Government Network to the Provincial Hospital.
- Central Database has been assembled for compiling medical contents database, including back-up system.
- Web Video Conference System has been installed.
- Open ICT Access Point to the public has been established in the Provincial Hospital.

Figure 7: System overview of APT (EBC-J3) project



With the system installed, the ICT environment for project sites was improved.

1.10.4 Effectiveness

As a result, we have ready conditions for more understandable communication for Remote Consultation, compensation for the insufficiency of practical training, and provision of proper information to the public with full system installation and continuous utilization. Our aim “improvement of health and medical environment with ICT for rural areas” has just been achieved as the pilot case in Lao P.D.R.

1.10.5 Conclusion

Starting from the establishment of the ICT Master Plan for Ministry of Health, our 3-year continuous activities on the pilot project have come to a conclusion. However, the conclusion of the pilot project is not the goal, and we have the strong intention to step forward to the practical deployment of ICT in health. The system installed reflects the real need to fill the gaps between demands and the actual situation. Thus, the success of the pilot project would be paving the way for the expansion to other provinces and the establishment of nationwide networks of e-health.

As the next step, we will make a comprehensive review on the concluded activities to ensure Roadmap & Action Plan for Practical Implementation, Practical solutions for the identified issues, [Namely, more practical work than theoretical]; Skilled personnel for sustainable enhancement.

These are indispensable for the practical deployment of ICT in health. Therefore, we are applying for the APT (EBC-J2) 2010 program and will keep our close relationship with the current project member organizations. Also, we have set our sights on best practice sharing with other sectors in Lao P.D.R. and with other countries.

Our further target is to formulate the practical project for ICT enhancement in not only Lao P.D.R. but also other developing countries.

1.11 Lebanon: E-Health in Lebanon – Where Do We Stand?

1.11.1 Introduction

[12]This document is based on a recent report that was the outcome of a project funded by the World Health Organization (WHO) in Lebanon for developing a national e-health plan. The purpose of the project was to illustrate the current e-health status in Lebanon. The areas assessed were the existing and planned e-health applications and services, the available/potential information communication technology (ICT) infrastructure for e-health, the human resource capacity, standards and interoperability, e-health strategy and investment, e-health legislation, policy and compliance, and Governance. The assessment is used to establish near term opportunities for e-health projects, and to explore possible actions to be undertaken in developing a comprehensive national e-health implementation strategy for Lebanon in the near future.

1.11.2 Country Overview

In Lebanon the economic, social and political forces have been exponentially influencing the healthcare sector for a number of years, hindering the implementation of any new heath model or strategy. So far in Lebanon e-health is suffering from a low profile even though e-health has increasingly large impact on healthcare. There is a lag in uptake of e-health because the field needs more professionally trained staff on board. The social environment is having an undeniable influence on consumers; there is still a portion of the Lebanese community who are not yet accustomed to the use of Internet-mediated electronic means for the provision and management of health services. Moreover, the preference of face to face meetings for assessment, treatment and consultation may negatively influence the development and implementation of e-health technologies and applications.

Promoting the use of information technologies in healthcare is one of the defined priorities in e-health implementation. Article 5 of the Telecommunications Law 431/2002 specifies that among the duties of the Telecommunications Regulatory Authority (TRA) is “to assist educational and health care institutions in the implementation of their programs by the use of Telecommunications Services, and to facilitate the access of disabled persons to Telecommunications Services.”

As for the use of standards, there are no e-health standards/policies/standardization being implemented at health institutions that make the physicians comply with e-health practices. The lack of standards influences the deployment of e-health practices on a large scale and creates gaps that hinder the benefits from using ICT, mainly its potential in improving care and sustaining cost. In addition, the lack of metrics for measuring successful deployment of e-health are also hindering improvement.

The Ministry of Public Health (MOPH) in Lebanon is concerned with the public health issue more than the e-health per se. According to the General Director, since there are no geographical barriers or lack of specialized doctors in the country, telemedicine is not a target at this point so far. The priority for the MOPH is to have better managed care, better epidemiological reporting, e-billing, and e-pharmacy.

Currently there is no national policy in the country that commits healthcare institutions or clinics to implement Electronic Health Records (HER). Furthermore, the existing e-health applications in health institutions lack the interoperability with the MOPH’s health information systems. In this regard the institutions are not having the full benefits behind the deployment of e-health applications. As for monitoring activities, innovative systems and services for monitoring the health status of people at risk or those suffering from any chronic illness including those associated with ageing, wearable, portable or implantable systems are used. These systems can offer the means to follow patients’ health outside the health institutions. However, very few institutions are able to manage diseases and develop early diagnosis of symptoms from a distance. As for ICT infrastructure, the deployment of a proper ICT infrastructure that demonstrates the benefits of e-health services on a larger scale in the country does not

[12] Soha Saifeddine, Telecommunications Regulatory Authority, Lebanon. See document SG02-C-0210

exist so far. So far the ICT infrastructure has been implemented within some health institutions at various levels to communicate data across the same institution and never across other institutions. In addition, the required ICT infrastructure to create a database for patients' records in health institutions is not up to the level for e-health practice and therefore needs further development.

1.11.3 Activities Implemented

The key trends and developments in the e-health domain in Lebanon, aiming at improving the quality of healthcare, can be classified into the following categories:

- **Physiological monitoring activities**

Physiological monitoring activities are the most used e-health applications in Lebanon. Medical institutions use various systems for monitoring activities such as screens connected to cameras and other monitoring apparatus for inpatients only.

The Ministry of Public Health has implemented the monitoring systems for medications and vaccines distribution and storage. The system allows identification of the medication or vaccine expiry date five days in advance. Also the system will notify about temperature change in the storage media via alert systems connected to the mobile device of the manger. That system was implemented in 2006 in collaboration with the WHO.

The availability of body area networks (BAN) and e-health applications will allow the practice of vital sign tele-monitoring of chronically ill outpatients. Such type of monitoring is not available in Lebanon, very few hospitals provide only cardiac tele-monitoring with the use of holter.

- **Diagnostic evaluations**

The use of diagnostic evaluation tools is limited to the laboratories and radiology departments such as (MRI, PET scan, CT-scan etc…).

An example of a successful development is the Lebanese Ministry of Public Health (MOPH) Mobile Applications.

1.11.4 Lebanese Ministry of Public Health (MOPH) Mobile Applications

The mission of the Lebanese Ministry of Public Health is to improve the health status of the population by ensuring an equitable accessibility to high quality health services through a fairly financed universal coverage.

MOPH' main goal is to protect the population' health through the legislation and development of health promotion and preventive programs, to contribute to the social safety net, eradicate and control the communicable and non-communicable diseases prevalent in Lebanon.

In order to reach these mission and goals, the MOPH launched a unique, one of a kind Mobile app and the first in the Lebanese public sector; aiming to facilitate the cooperation with other ministries, private sectors and the civil Society.

The main objectives of the App are:

1. To develop the health sector and to improve the quality of health care delivery through the use of information and communication technology.
2. To increase transparency through the dissemination of health-related information.
3. To facilitate access to services delivered by using the best and fastest possible electronic means.
4. To increase the accountability through the adoption of a mechanism for complaints.
5. To ensure equity in services' availability and utilization.

Main Functionalities:

Users have direct access to the Drugs Public Price List; they can check their availability, price and legalization in the Lebanese pharmacies. They may as well locate the nearest public hospitals, private hospitals and medical centers, check their full address & call directly from the app.

Users may as well benefit from health info and learn about healthy life-styles and food habits. People and communities can now seek greater and effective participation in the planning, implementation and evaluation of primary health care and public health programs; and report fraudulent actions directly to the Ministry of health through the app. All app users will receive alerts on news, drugs recalls, laws etc. from the ministry.

Main Features:

- Drugs list (check price, dosage, form, legalization ...).
- Rules and Guidelines concerning MOPH disbursed expensive drugs and chronic diseases drugs.
- Public/Private Hospitals and Primary Health Care Centers Directory.
- Ministry of Health services and campaigns.
- Report fraudulent actions directly to the Ministry of Health.
- Healthy tips on lifestyles and habits.
- Push notification.
- Media Gallery (Ministry Activities & events).

About MOPH: Latest News, MOPH Portal, Locate us, MOPH Directory, call center (1214)… MOPH is available for free to download in the iTunes Store and Android Google Play App Store.

Figure 8: MOPH is available for free to download in the iTunes Store and Android Google Play App Store

Clinical decision support system

Clinical computerized decision support systems (CDSSs) which are meant to help address the problems of variable quality and safety in health care, are available in some institutions but mainly limited to laboratory findings and very few to medication administration. The available systems allow comparison between normal and abnormal laboratory findings only upon highlighting the abnormal level in order to grab the attention of healthcare providers.

Storage and dissemination of healthcare data

The first step towards e-health is to create the backbone- the electronic health record (EHR). The EHR will ultimately link all patient information from across the health care system, hospitals, private clinics, pharmacies, and elsewhere healthcare is being provided to individuals.

In some health institutions in Lebanon, patients' health records are being scanned and then stored in digital form as image files. Then patients' records are stored under their ID numbers per hospital visit and listed by date.

Image compression for efficient storage and retrieval: Picture Archiving and Communication Systems (PACS)

The use of Picture Archiving and Communication Systems (PACS) can improve diagnostic radiology. PACS's main purpose is to replace hard film copies with digital images that can be used and seen by several different medical professionals simultaneously.The use of PACS is being practiced at a number of health institutions in Lebanon.

Research:

- Research on e-health practice:

Research on e-health practice can contribute to the overall understanding of the e-health domain and its impact on quality care. Very few health institutions in Lebanon are currently practicing research on e-health.

- Clinical research:

The practice of clinical research can contribute to the overall understanding of the health system in the country and how it is changing. In order to carry out this work, a large amount of aggregate clinical data on the health system is needed. The competencies available to supply this data include data aggregation, data communication and statistical analysis.

In Lebanon, a small number of health institutions practice clinical research in their institutions. As a matter of fact, research needs improvement as the access to clinical data is restricted to administrators and very few clinicians. Furthermore, Health data are being stored as image files which limits data processing and impedes search by computer engines, and therefore creates a barrier to clinical research.

Computerized provider order entry and e-Prescription

Very few health institutions in Lebanon are using Computerized Provider Order Entry (CPOE), a computer system that allows for the direct entry of medical orders by healthcare providers. The CPOE system enables physicians/healthcare providers to check medication and health procedure orders for incorrect drugs, doses, and routes of administration, as well as for any allergies and drug interactions. If the computer system detects any of these problems, an alert is generated to make the provider aware of the issue. The primary goal of CPOE is to reduce medication errors, and enhance communication among healthcare providers to increase patient safety.

As for e-prescription, it is not a trend so far in Lebanon. Most of the health institutions do not have the CPOE or the electronic prescriptions launched yet. Very few institutions practice electronic prescriptions for restricted antibiotics only. Therefore, all health institutions are still using the traditional paper medical chart. For some institutions that are having difficulties with regards to archiving space, they resolved this problem by scanning the patients' charts and storing them as digital images.

Voice recognition for dictation

Voice recognition for dictation is not available at any health institution in Lebanon. What is being practiced in few hospitals is that the doctor records his/her medical report on a tape recorder and then the report is typed by a clerk and filled electronically.

Use of Streaming media in health care institutions

The continuing education of healthcare providers is required for better practice, whereas education of healthcare consumers is necessary for health promotion and better management of patient's own health. Very few health institutions in Lebanon use streaming media such as video sessions, power point

presentations, e-pamphlets for educational purposes to both healthcare providers and consumers. Some institutions have made the educational material accessible from their websites to promote access. The use of streaming media has eased the dissemination of the educational material; also it helped in managing the continuing education (CE) credits for healthcare providers.

Ministry of Public Health's (MOPH) initiatives to promote and support e-health practices

- **TWFS (Transactions and Workflow System):**

The objective of this system is to automate the workflow, track and monitor the transactions and documents involved in the procedures of the Ministry of Public Health's administrative units.

The system is expected to provide user-friendly, secure and reliable methods of performing and tracking all the processes and procedures along with the associated forms utilizing a flexible, quick and easy to use tracking, monitoring and reporting mechanisms that will empower the MOPH administration in performing its duties and functions with minimal effort, high efficiency and productivity. It will also relieve citizens from the burden of administrative procedures and provide them with a better and faster service.

The system allows visitors to the MOPH's website to benefit from the below services:

Administrative Services:

- Search for a specific service through the organizational structure of the ministry.
- Have access to all details related to the service required: the unit responsible of this service, the head of unit, the required documents, the conditions, the fees, the duration of the procedure, working days …
- Download a pdf application form or fill an interactive pdf application.
- Submit on-line transactions with attached documents.
- Login to the website using a Document ID and a Password in order to track and retrieve all the information related to the status of the transaction, and send any comments about this transaction to the related department

Drugs:

- Download the complete list of drugs with their public prices based on foreign currency rates and according to Resolution 51/1 issued in 2006.
- Search for drugs using different criteria: Drug's name/Laboratory/Agent/Country of origin.
- Search for drugs that have been recalled from the Lebanese market.
- View the list of registered drugs according to INN classification (First draft): Ongoing project.
- Check the Lebanese National Drug Index which is a simple verified listing and classification of available products in the Lebanese market.
- View all the information related to the Drugs technical committee including meeting schedules & agendas, the list of applications submitted for Drugs Registration, the Resolutions taken by the committee regarding the registration of medicines @MOPH…
- An instant notification e-mail is always sent to concerned parties when publishing any new information related to Drugs.

Doctors Fees:

Physicians who are treating patients on the expenses of MOPH can login to the website using their credentials to access all details related to their payments from MOPH using an advanced tool for searching and reporting .

- **Decentralization Systems: District Health Information System:**

This is a tool to monitor diseases and their spread over different areas allowing the ministry's officials to plan for intervention and activities in an appropriate and timely manner.

- **Visa System: This system started on May 19, 2003 at the MOPH's visa center. It:**
  - Allows 25 regional visa centers to connect remotely to the MOPH's database using web technology and to MOPH's users through LAN technology.
  - Creates a unified patient medical file, independent of the treatment place and visa issuing center.
  - Allows the MOPH to view the history of every patient's file.
  - Automatically rejects patients who benefit from other public funds (Army, ISF, NSSF, CSC).
  - Creates a unified applicant's file to control the frequency of the requests submitted per applicant.
  - Retrieves accurate statistics to help managers to take appropriate decisions.

- **Billing System:**
  - Allows contracted hospitals to connect remotely to the MOPH's database using web technology.
  - Bills are entered by each hospital.
  - Provides information about bed occupancy status by hospital: the allowed number of beds/day v/s the occupied number of beds.
  - Used as a tool for quality control.
  - Provides admission diagnosis v/s discharge diagnosis, diagnosis v/s procedures etc… .

- **Interconnecting System:**

This system allows the MOPH and other public funds, namely the Army, the Internal Security Forces (ISF), the National Social Security Fund(NSSF) and the Civil Servants Cooperative (CSC), to share information about eligibility in order to avoid eligibility overlapping and double coverage. The main functionalities of the system are:

  - Building a database (@MOPH) for beneficiaries in different public funds (Army, ISF, NSSF & CSC) containing demographic & eligibility information.
  - Providing electronic linking of the beneficiaries databases in different public funds to the MOPH Interconnecting database.
  - Performing a daily update of the Interconnecting database by establishing an automatic connection with public funds and downloading files containing updated beneficiaries information.
  - Giving the public funds remote access to the centralized MOPH database for searching purposes.
  - Is integrated with the Visa/Billing systems.

- **Human Resources for Health – HRH:**

The HRH system manages personal and professional data for human resources working in the health sector in Lebanon. Through this system, the MOPH now owns a database including personal and professional data for all health professionals in Lebanon except for specialized physicians and Dentists.

1.11.5 Challenges, Main Barriers and Difficulties for the Development of E-health in Lebanon

- Governmental Barriers:
  - Lack of national plan for the e-health practice in Lebanon.
  - Absence of e-health policy and standards.
  - The health sector is influenced by many underlying factors in the country, such as political instability, privatization control, and political power.
- Institutional Barriers:
  - The high cost of technology that most of the institutions cannot afford in the lack of funding resources (such as the absence of external financial support), in addition to budgetary constraints.
  - Reluctance to change from the traditional health practice to e-health practice.
  - Lack of qualified e-health professionals and training in the use of new technologies.
  - Lack of collaboration between the private and governmental healthcare organizations/institutions.
  - Lack of leadership and expertise for e-health practice (policy makers, managers).
  - Lack of interoperability in e-health practice.
  - Lack of collaboration among public and private institutions in the health secto.r
  - Lack of awareness about e-health benefits in healthcare practice.
  - The need to update the administrative and organizational structures of existing health institutions.
  - Lack of health information websites.
- Socio-cultural Barriers:
  - Patients' preference of the face to face meeting and interaction with the healthcare provider.
  - Lack of patients' awareness about the benefits of e-health practice.
  - Lack of computer literacy among some patients mainly older patients.
  - Poor internet or lack of internet access especially in villages and remote areas.
  - Fear of e-health failure in a politically unstable country.
  - Electronic signature is not legalized yet by the government.
  - Complexity of the Social Security System dealing with public health insurance.

1.11.6 Lessons Learned, Next Steps and Recommendations

Efficiency in healthcare provision, provision of quality care, reaching the underserved population, and minimizing medical errors are the main driving forces to the implementation of e-health in the country. E-health practice will improve patient safety, reduce healthcare cost, allow better healthcare

management, allow better disease management, and solve the problem of shortages of healthcare providers in Lebanon.

The priorities to for successful e-health implementation are:

- National/Government level:

Compose a National e-health policies and strategies Committee in Lebanon. This committee will be in charge of:

  - Establishing a 5-year e-health strategy plan to advance the use of information technology all over the health sector.
  - Dealing with the local e-health strategic planning including infrastructure, funding, policy and governance of e-health practice, besides collaborating with International e-health foundations.
  - Developing e-health competency framework to guide and help ensuring sufficient skills for various healthcare professionals, who should be also adequately prepared to train other healthcare providers.
  - Establishing a national forum that:
    - Promotes the use of telecommunications and related technology in the delivery of health care and health education in the country.
    - Facilitates and assists various healthcare organizations in developing secure and private electronic health records for the Lebanese citizens and makes health information available electronically whenever and wherever it is needed.
    - Serves as a forum for advocacy, communication and sharing of resources among communities of interest.
  - Raising awareness among the various stakeholders about the opportunities in the e-health sector in Lebanon.
  - Assisting healthcare facilities in securing the needed funds for e-health implementation from national and international resources.
  - Considering innovative financing and compensation schemes for e-health services.
  - Including e-health concepts in medical and nursing curricula.
  - Legalizing electronic signature and making it lawful by the Lebanese government in order to encourage healthcare institutions and insurance companies to promote e-health practices and data protection and liability through the development of guidelines and codes of conduct for e-health services.
  - Putting more emphasis on international cooperation in order to promote benchmarking and evaluation projects that can provide evidence to support the deployment of e-health practices.

- Ministry of Public Health Level:
  - Initiating the Electronic Health Record (EHR) system and facilitate the communication of health data between the private and public health sectors.
  - Encourage national research in e-health practices.
  - Collaborate with healthcare industry organizations such as the Health Information Management Systems Society (HIMSS).
  - Collaborate with professional communities such as the American Health Information Management Association (AHIMA).

- Establish standard national educational programs towards preparing qualified healthcare providers who are proficient in e-health practices.
- Establish standards for e-health practices while benchmarking with international standards.
- Establish a Pharmacies Network for E-prescription.
- Encourage collaboration between private and public/government healthcare organizations.

- Healthcare Facilities Level:
  - Follow the national standards, which should be developed by the MOPH.
  - Maintain confidentiality and security of electronic health data.
  - Facilitate proper access to patient records for authorized personnel.
  - Allow online access to lab and diagnostic results (X-rays, CT scans and MRIs) for patients and healthcare providers as needed.
  - Utilize the Pharmacies Network for better medication prescriptions.
  - Establish interoperability of e-health applications in health institutions with the MOPH's health information systems.

1.12 Mali: La cybersanté au Mali – des projets pilotes à une institutionalisation réussie: leçons apprises et perspectives de passage à échelle

1.12.1 Introduction

[13]Chaque année plus de dix millions d'enfants de moins de 5 ans meurent de maladies prévisibles telles que la pneumonie, la diarrhée et le paludisme. Un grand nombre de ces décès est dû à des causes indirectes entre autres les guerres et le VIH/SIDA. La malnutrition, le faible niveau d'hygiène, le manque d'eau potable et des soins sont incriminés dans près de la moitié des cas. Environs cinq cent milles femmes meurent pendant la grossesse, la plupart pendant l'accouchement ou dans la première semaine du postpartum.

Le Mali est l'un des pays ayant les taux mortalité infantile et maternel les plus élevés dans le monde soit respectivement 196 pour mille et 464 pour cent mille. Huit femmes meurent chaque jour des complications de la grossesse. Près d'une femme sur deux n'ont pas bénéficié de soins prénataux. Plus de 59 pour cent accouchent à la maison sans l'assistance d'accoucheuses qualifiées. Environ un enfant sur cinq meurt avant la célébration de son cinquième anniversaire. Les causes de décès des moins de cinq ans sont principalement les conditions néonatales (26%), la pneumonie (24%), la diarrhée (18%) et le paludisme (17%). Un enfant sur deux meurt de sous-alimentation et beaucoup sont malnutris.

L'accès aux soins essentiels n'est pas équitable au Mali et le taux de couverture sanitaire reste faible. Près de 8 décès sur dix des moins de cinq ans surviennent à domicile.

Selon les principales conclusions issues du Rapport de Suivi de la mise en œuvre des OMD au Mali 2010, il est invraisemblable que pour le pays d'atteindre les objectifs 4 et 5 du millénaire en 2015.

Pour combler son retard dans la mise en œuvre des OMD, le Gouvernement du Mali a élaboré le programme de l'Initiative d'accélération des OMD dans les 166 communes les plus vulnérables. Parmi les stratégies adoptées figure celle l'intégration des services essentiels pour la mère, les nouveau-nés et les moins de cinq ans au sein même de la communauté spécifiquement dans les zones éloignées et

[13] Contribution: Ousmane Ly, Agence Nationale de Télésanté et d'Informatique Médicale (ANTIM), Mali. See document SG02-C-0186

défavorisées proposée par l'UNICEF. Il s'agit d'une stratégie qui intègre à la fois les soins à domicile, le porte à porte, l'approche communautaire et les structures sanitaires.

Le défi est aujourd'hui est d'améliorer la réactivité du système de santé malien afin qu'il puisse assurer une équité et une accessibilité à tous aux services et soins de qualité spécifiquement aux femmes enceintes et aux enfants de moins de 5 ans.

Pour faire face à de défi, malgré la précarité des moyens, avec le plus souvent l'inaccessibilité géographique, l'insuffisance des infrastructures (routes, électricité), et la lenteur de la collecte de données (due au facteur temps, l'utilisation du papier, la lenteur de la remontée de l'information, etc.) il est important, voir indispensable de mettre en place une stratégie qui soutient un mécanisme permettant en temps réel:

- de suivre et d'évaluer les actions,
- d'apporter l'expertise pour la fourniture des services et soins de qualité,
- et d'assurer le renforcement des capacités des Ressources Humaines (RH) à distance.

L'une des solutions à portée des mains est l'utilisation des TIC appliquées à la santé: la Cybersanté.

Dans le but de promouvoir une utilisation judicieuse et efficiente des TIC dans le système de santé, l'Agence nationale de télésanté et d'informatique médicale (ANTIM) a été créée en 2008 sous la tutelle du Ministère de la santé par les autorités maliennes.

1.12.2 Aperçus du Pays

Le Mali est un pays continental situé au cœur de l'Afrique de l'Ouest. Il a une superficie de 1.241.238 km^2. Il est subdivisé en 8 régions administratives (Kayes, Koulikoro, Sikasso, Ségou, Mopti, Tombouctou, Gao, Kidal) et le District Central de Bamako qui a rang de région. Bamako est la capitale et compte environ 1.100.000 habitants.

Les régions sont subdivisées en cercles qui se répartissent en arrondissements. Dans le cadre de la décentralisation, au niveau local, le Mali compte 703 communes dont 684 communes rurales et 19 communes urbaines y compris les 6 communes du District de Bamako.

En 2010, la population est estimée à 14 500 000 habitants avec un taux d'accroissement intercensitaire de 2,2%. La majorité de la population du pays réside en milieu rural (73,2%). La situation sanitaire de la population du Mali, reflet du niveau actuel de développement socio économique, connaît aussi des améliorations significatives. Les dépenses totales de santé sont passées de 109 milliards en 1999 à 165 milliards en 2004 (CNS 1999-2004). Ces dépenses de santé proviennent essentiellement du financement direct des ménages (57%), des fonds publics (18%) et des fonds extérieurs (13%). Pour la période 1999-2004, les niveaux de morbidité et de mortalité du Mali restent parmi les plus élevés au monde et cela s'explique surtout par:

- une insuffisance des ressources financières allouées au secteur au regard des besoins de la politique sectorielle et du Programme quinquennal de Développement Sanitaire et Social (PRODESS);
- un environnement naturel insalubre et propice à la transmission des maladies infectieuses et parasitaires du fait d'une hygiène individuelle défectueuse et des comportements très souvent inadéquats face à l'environnement;
- une insuffisance de l'accès des populations à l'eau potable;
- des habitudes alimentaires sur le plan nutritionnel qui ont pour conséquence des apports nutritionnels non équilibrés et déficients aussi bien en quantité qu'en qualité (fer, iode, vitamine A), ce qui provoque des maladies et des carences;
- la persistance de certaines coutumes et traditions souvent néfastes pour la santé;
- un faible niveau d'alphabétisation, d'instruction et d'information de la population;

- une insuffisance en nombre et en qualité du personnel sanitaire et social.

Le Mali est classé selon l'OMS parmi les pays présentant une pénurie aiguë de personnel de santé, cette faible démographie se traduit par:

- 1 médecin pour 14.612 habitants (norme OMS 1 médecin pour 10.000);
- 1 infirmier d'État pour 18.145 habitants (norme OMS 1 pour 5.000);
- 1 infirmier pour 13.989 (normes OMS = 5.000);
- 1 sage femme pour 21.440 femmes en âge de procréer (norme OMS 1 pour 5.000).

Plus de la moitié du personnel socio-sanitaire du pays travaillent à Bamako: 57% des médecins, 41% des infirmiers et 64% des sages-femmes.

1.12.3 Objectifs et Stratégies

Mettre à la disposition du Ministère de la Santé, de ses services déconcentrés et décentralisés, et de tous les acteurs du système de santé l'ensemble des informations et données nécessaires pour la conduite de leurs activités en tant réel.Avec les axes stratégiques suivants:

- Renfoncement des structures technologiques supportant les services de Cybersanté;
- Télémédecine et Téléexpertise: expertise et fourniture des services et soins de qualité;
- Renforcement de capacité: formations initiale et continue, la gestion des connaissances, partage des bonnes pratiques;
- Statistiques sanitaires: flux et analyse de l'information sanitaire pour la prise de décision (situation sur le terrain, recherche, prévention, promotion, données sanitaires, données relatives aux infrastructures, aux équipements, aux ressources humaines, aux produits pharmaceutiques, aux vaccins, aux réactifs et autres consommables, données économiques et financières).

1.12.4 Activités Implementées

Les activitées implémentées par l'ANTIM sont de trois catégories:

- les activités de cybersanté pour soutenir l'administration de santé, à travers des solutions spécifiques s'adaptant aux réalités locales;
- les activités de cybersanté pour soutenir les pratiques cliniques et les soins aux patients, à travers des outils adaptés aux pratiques cliniques locales et la délivrance de soisn adaptés;
- les activités de cybersanté pour soutenir les activités de formation initiales et continues des professionnels de santé, avec des plateformes faciles à prendre en main et adapté aux conditions de faibles bandes passantes.

1.12.5 Technologies et Solutions Deployées

L'agence a déployé des solutions intégrées de cybersanté et d'autre sont en phase de test pour diffusion ultérieure.

Solutions pour l'administration de santé: faire de l'administration numérique une réalité quotidienne au sein du ministère de la santé au Mali avec:

- LE SITE WEB: il a été developpé avec le CMS joomla et intègre l'ensemble des textes législatifs du ministère de la santé et les textes généraux du gouvernement du Mali, est le lien électronique entre le ministère et les usagers. Il a permis à l'agence de gagner le prix du jury aux TIGA Awards 2009 de la comission économique des nations unis pour l'Afrique.

- IRED MAIL: Système sécurisé de gestion intégré de la messagerie électronique avec fonction d'annuaire informatique pour les professionnels de santé permettant aux utilisateurs des services web du ministère de la santé de s'identifier une seule fois.
- LA VISIOCONFERENCE AVEC UN PONT RMX 1000, DES STATIONS POLYCOM VSX 8000 ET SOLUTION LOGICIELLE POLYCOM PVX: Ce qui permet au ministère de la santé de tenir plusieurs réunions virtuelle par visioconférence depuis Février 2008. En 2009, le passage à échèle a été effectif avec les multiples participations du ministre aux rencontres internationales et audiences interministérielles.
- Solutions cliniques (télémédecine et informatique médicale): soutenir la santé des usagers par une utilisation judicieuse du numérique.
- REEVASAN: Réseau Electronique d'Evacuation Sanitaire qui est une plateforme en ligne basée sur le moteur de IPATH (Internet Pathology) pour la gestion des évacuations sanitaires en ligne du ministère de la santé. Cet outil a aussi été utilisé pour préparer plusieurs mission humanitaires qui sont venu faire des interventions gratuites au Mali.
- IKON: qui est une plateforme de téléradiologie, permettant aux radiologues spécialistes de Bamako de donner leur second avis sur des clichés pris dans les hôpitaux régionaux (Kayes, Sikasso, Ségou, Mopti, Tombouctou et Gao).
- PESINET: est la première plate-forme mSanté supporté par l'ANTIM. Il consiste à l'utilisation du téléphone mobile pour le suivi des enfants de 0 à 5 ans. A chaque visite des enfants, les agents de pesée saisissent les poids et les données annexes concernant la santé de l'enfant (vomissements, diarrhées,…) sur un téléphone portable. Ces données sont enregistrées sur la mémoire du portable, puis transmises, via le réseau GPRS, sur une base de données.
- FRONTLINESMS: est un logiciel installé sur un téléphone mobile qui permet l'envoi et la reception de message SMS. En utilisant ce logiciel, un ordinateur branché à un téléphone portable devient un centre de communication à faible coût. C'est la plateforme qui a été utilisé dans le projet de remonter de l'information sur les décès maternels et infantiles et les stocks de produits de santé de la reproduction avec le soutien du fond des nations unies pour les activités de population (FNUAP).
- GRH PROS SANTE 21 (GRH PS21): est un logiciel de gestion des ressources humaines en ligne customisé par l'ANTIM pour les pays francophones sur la base de la plateforme iHRIS de capacity project (USAID).
- MEDIBOARD: est un système web libre de gestion d'établissement de santé. Il se définit plus précisément comme un SIH (Système d'Information Hospitalier) c'est-à-dire un PGI (Progiciel de Gestion Intégré) adapté aux établissements de santé de toute taille, du simple cabinet de praticien au centre médical multi-sites.
- OPENCLINIC: Le système d'information médicale et hospitalière OpenClinic est une solution dédiée pour structures sanitaires hospitalières et de premier niveau. Il intègre, outre la gestion classique d'une structure sanitaire, des outils de reporting d'activité conçus spécialement pour l'approche district et répond donc à une double préoccupation: avoir de l'information sur les pathologies et les activités, ce qui permettra de mettre en œuvre plus facilement un système de gestion basée sur la performance, mais sera également précieux dans le cadre de la mise en œuvre future d'un système d'assurance maladie (ou des systèmes d'exemption de paiement).
- Solutions pour la formation: faire de la formation à distance une alternative attrayante pour les professionnels de la santé au Mali.
- DUDAL: est un outil de téléenseignement à faible bande passante. Développée par le réseau RAFT à partir du système e-cours de l'Université de Genève, elle est basée sur des technologies totalement logiciels libres. N'importe quel PC java compatible peut recevoir les cours. Chaque jeudi les professionnels de santé des structures sanitaires suivent des cours diffusés sur cette plateforme dans le cadre de la formation médicale continue et du renforcement de capacité.

- ELLUMINATE/BLACKBOARDTM: La plateforme Elluminate est un outil de téléenseignement à faible bande passante développé par la société Elluminate INC du Canada. Elle est basée sur la technologie java comme dudal et est multi environnement. Cette plateforme est utilisée au niveau de l'agence de télésanté pour soutenir le programme de formation initiale en maintenance biomédicale, en collaboration avec l'Institut National de Formation en Science de la Santé et le collège communautaire de Barthust au Canada.

1.12.6 Changements et résultats obtenus

Le premier résultat obtenu pour le Mali est l'institutionalisation de la cybersanté. Depuis la création de l'agence les questions de cybersanté ont été prises en compte dans les formulations des politiques sanitaires et de leurs stratégies de mise en œuvre. Ainsi dans le document du programme decenal de développement socio-sanitaire prolongé 2011, le système entendr tré explicitement profit des avantages qu'offernt les technologies de l'information et de la communication.

Par ailleurs les outils web mis en place permetten de rendre plus facilement accessible les informtions sur le système ce qui a eu un fort impact sur la prise de décision à temps.

Il faut noter que grâce aux différents projets pilotes d'utlisations de la téléphonie mobile pour améliorer l'accès des mères et des enfants aux services de santé de qualité, l'ANTIM a été lauréat en 2011 des prix TIGA 2011 catégorie e-santé de la comission économique des nations unis pour l'Afrique.

1.12.7 Défis et facteurs de réussite

Malgré les résultats obtenus, il reste de nobreux défis à relever qi sont essentiellements de trous ordre:

- Les problèmes liés à l'interopéranbilité des outils et solutions déployés, surtout quand il n'y a pas suffisament de coordination entre les initiatives des différents acteurs,
- Les problèmes de connectivité, faiblesse des bandes passantes et cout elevés de l'accès à Internet,
- Les problèmes de changement de comportement, l'innovation fait souvent peur et son adoption fait face à des resistances,
- Enfin les problèmes de financement structuré des activités de cybersanté surtout à partir des budgets alloués à la santé.

Toute fois les facteurs de réussite sont l'existence de champions locaux qui pousse les projets de cybersanté, la disponibilité de ressources humaine qualifiées dans le domaine de la cybersanté, la volonté politiques des autorités sanitaire d'adopter la cybersanté comme moyen de renforcer le système de santé.

1.12.8 Leçons apprises et prochaines étapes

Les projets pilotes et initiatives de la société civile sont nécessaire spour demarrer des activités de cybersanté. L'institutionalisation est l'étape primordiale pour preparer le passage à échelle. Le passage à échelle a besoin de resources financières conséquentes pour que l'utilisation de la cybersanté face la différence pour améliorer les sytèmes de santé.

Enfin la perspective la plus importante pour le Mali est la suivante:

- Utiliser la cybersanté pour renforcer et améliorer le système d'information sanitaire.
- La détection des cas de maladies, le lancement des interventions pour prévenir la transmission ou réduire la morbidité et la mortalité, l'identification de nouveaux problèmes de santé (des maladies émergentes et/ou négligées), la mesure des tendances sanitaires et la recherche, nécessitent des données en général produites par la surveillance épidémiologique et le recueil périodique des données des systèmes de santé. Cette surveillance épidémiologique et ce recueil périodique des données des systèmes de santé constituent un mécanisme systématique de collecte, d'analyse, d'interprétation et de dissémination des informations sanitaires.

Pour le renforcement des systèmes d'informations sanitaires deux impératifs sont à respecter:

- Il convient de renforcer les systèmes d'information et de statistiques sanitaires dans leur ensemble plutôt que de s'intéresser à une maladie spécifique.
- Il faut tout particulièrement renforcer le rôle directeur des pays dans la production et l'utilisation de l'information sanitaire.
- Il s'agit de produire des informations pertinentes dont les parties prenantes du système de santé peuvent se servir pour prendre des décisions transparentes qui reposent sur des bases factuelles concernant les interventions sanitaires.

La cybersanté peut aider les pays à accroître considérablement leurs moyens de stockage de données et à réduire les délais précédemment nécessaires pour leur traitement. Les technologies de l'information et de la communication peuvent donc améliorer de manière spectaculaire la disponibilité, la qualité, la diffusion et l'utilisation des données liées à la santé. Si les TIC permettent d'accroître le nombre de données recueillies et d'en améliorer la qualité, elles permettent aussi de réduire les délais et d'améliorer l'analyse et l'utilisation de l'information. Une infrastructure de communication est donc nécessaire pour exploiter pleinement les informations qui sont disponibles.

Au niveau central et local, les responsables de la santé doivent donc avoir accès à une infrastructure de l'information offrant notamment des ordinateurs, le courrier électronique et un accès Internet. Bien que l'accès à Internet soit de plus en plus important, les systèmes téléphoniques de base (fixes ou mobiles) restent toujours extrêmement utiles.

Un renforcement cohérent des capacités portant sur les moyens électroniques et les ressources humaines dans l'ensemble du système de santé constitue une approche efficace.

Le minimum requis est une base de données sur les établissements de santé et les services essentiels fournis. Il faut ensuite cartographier les établissements, les ressources humaines, les budgets et les dépenses, les produits de base et les services essentiels aux niveaux national et du district. Un équipement GPS (Global Positioning System) et un système d'information géographique (SIG) sont en général utilisés pour déterminer la position géographique des sites de prestation de services et les frontières administratives, et pour les localiser sur une carte informatisée. En effet, la cartographie des ressources disponibles, des interventions spécifiques ainsi que des pathologies peut fournir des données importantes du point de vue de l'équité, et encourager les efforts visant à ce que les interventions nécessaires soient menées dans les zones périphériques et ne restent pas concentrées dans les centres urbains.

Lorsque des infrastructures de communication électronique sont disponibles, les données peuvent être saisies au niveau décentralisé pour pouvoir être immédiatement notifiées à tous les niveaux.

Enfin, le but du stockage, de l'assurance qualité, et du traitement et de la compilation des données est de présenter des informations utiles de manière crédible, cohérente et pertinente. Les données doivent être intuitives et évidentes pour les acteurs du système d'information sanitaire. Pour que l'information soit intelligible, il faut qu'elle soit lisible. Les contenus du système de gestion des données doivent être clairement libellés. Les acteurs de ce système souhaiteraient également pouvoir séparer et combiner les données du système de différentes façons. Les outils qu'ils utilisent pour accéder au système doivent être simples et faciles à utiliser, et doivent permettre de répondre aux demandes qui ont été formulées dans des délais très courts.

Une information n'a de valeur que lorsqu'elle est intégrée à d'autres informations et qu'elle est évaluée à la lumière des problèmes auxquels le système de santé est confronté. A ce stade, une information devient une base factuelle qui peut être utilisée par les décideurs. Ces bases factuelles, une fois regroupées, sont encore plus utiles lorsqu'elles sont mises en forme aux fins de présentation, de communication et de diffusion aux décideurs, de manière à changer leur perception des questions et des besoins de santé. On entre alors dans le processus de transformation des bases factuelles en connaissances qui, une fois appliqué, peut se traduire par des décisions ayant un impact direct sur la santé et sur l'équité en santé. Le

système d'information sanitaire permet ensuite de mesurer cet impact réel sur la santé, ainsi que l'évolution des indicateurs de santé.

La prise de décision est itérative et fondée sur des données factuelles, tout en s'appuyant sur un système d'information sanitaire complet à l'échelle d'un pays.

Un système d'information sanitaire n'a pas seulement pour but de produire des données de qualité, dans l'espoir qu'elles soient ensuite utilisées; il doit aussi les convertir en données crédibles et convaincantes qui éclairent les décideurs au niveau local. Des données de qualité stockées dans des systèmes d'archivage bien structurés n'ont guère d'intérêt si les utilisateurs ne peuvent y accéder pour produire des informations utiles à la prise de décision.

Beaucoup d'innovations se sont récemment produites dans le domaine des TIC et ont permis de présenter des informations et des bases factuelles complexes dans des formats qui attirent l'attention des décideurs et de communiquer efficacement les messages contenus dans l'information. Certaines méthodes s'appuient sur un accès via Internet ou un ordinateur à des données provenant de systèmes d'archivage ou d'observatoires présentées sous une forme interactive. De nouveaux outils d'analyse informatisés permettent d'établir des rapports normalisés riches en présentations graphiques (et même cartographiques) de l'information. Les formulaires de notification, les descriptifs et les résumés normalisés sont également très efficaces. Ces formats doivent orienter les décideurs en leur fournissant des interprétations fondées sur les conséquences probables des décisions et des scénarios de rechange qu'ils envisagent. L'information peut également être diffusée par l'intermédiaire d'ateliers, de revues médicales, de réunions entre homologues et des médias.

La mise en place d'une architecture de l'information en tant que ressource commune au niveau national et du district est une étape indispensable pour améliorer les pratiques en matière d'information et pour pouvoir effectuer les analyses de qualité nécessaires. C'est à partir de ce niveau d'analyse que les résultats sont utilisés pour l'élaboration des politiques et la planification stratégique. Ces analyses, interprétations et activités de sensibilisation ne sont pas spontanées. Elles requièrent en effet la mise en forme, la communication et la diffusion selon une présentation et dans un langage accessibles aux décideurs de haut niveau. Un aspect qui est souvent négligé dans la plupart des systèmes d'information sanitaire.

L'une des fonctions les plus importantes du système d'information sanitaire est de relier la production à l'utilisation des données. Ceux qui sont chargés de collecter les données doivent aussi tirer parti de leur utilisation. Les utilisateurs comprennent les prestataires de soins, les responsables de la gestion et de la planification des programmes. De manière plus générale, les utilisateurs comprennent ceux qui financent les programmes de soins dans les pays (ministères de la santé et des finances) et à l'extérieur (donateurs, banques de développement et organismes d'appui technique). Les utilisateurs des données sanitaires ne se limitent pas aux professionnels des soins de santé, aux gestionnaires et aux statisticiens. La prise de décision concernant les priorités de santé d'un pays implique nécessairement les populations, la société civile et les décideurs.

1.13 Niger: E-health Status and Prospects in Niger

1.13.1 Current Status

[14]The implementation of e-health in a country often calls for the establishment of either an e-health policy or an ICT development policy with an e-health component. In Niger, there is something of a blank

[14] Contribution: Yaya Arouna, Telecom Engineer, Multisectoral Regulatory Authority (ARM), Niger. See document SG02-C-017

slate, insofar as, apart from the NICI plan[15], there is nothing to suggest that there are any policies, standards or legal or institutional arrangements in this area.

There are however some activities that may be considered as falling within the domain of e-health, namely communications using VSAT to connect regional structures to the districts under a project known as RAFT (Telemedicine Network in French-speaking Africa).

The activities focus primarily on remote radiology between national, regional and district hospitals, remote consultation and remote expertise using the RAFT Ipath tool, as well as distance learning with weekly RAFT e-courses every Thursday at 0900 hours UTC.[16]

There has also been some institutionalization of e-health with the establishment of an E-health Development Support Unit under the responsibility of the office of the Minister for Public Health.

Even though these are only very basic steps, it is encouraging to note for the future that Niger is getting involved in a regional movement towards establishing a genuine e-health framework in order to address and overcome some of the inherent problems within the health system, with the aim of achieving the MDGs. What does this movement entail?

1.13.2 E-health prospects

Rather than confining themselves to a national perspective, the member countries of the Economic Community of West African States (ECOWAS), including Niger, have shown a clear desire to move forward together as a region.

With this is mind, they have envisaged an e-health strategic plan for this regional African block. The plan sets out the vision and strategic orientations, along with implementation projects. It is these aspects which we will try to develop for the future of e-health in Niger.

1.13.3 Vision

The ECOWAS countries are committed to implementing e-health through an agreed vision: "*E-health: reducing distances and improving access for rural populations in particular to quality health services in an integrated space*". A strategic plan[17] with orientations has been established for the period 2011–2013.

1.13.4 Strategic orientations

Several strategic directions have been defined to ensure the success of the plan, whose primary aim is to significantly improve the quality of the management of health and treatment systems for the populations of the region, by developing and supporting integrated health policies and reform initiatives.

These strategic directions are as follows:

- Strengthening countries' systems using e-health as a means of improving coordination, harmonizing human resources policies and management in the health domain within the regional Community space.
- Use e-health to strengthen and improve the health information system.
- Integrate e-health in the overall service portfolio of health structures within the Community space.
- Ensure the availability of a reliable and sustainable subregional infrastructure capable of supporting e-health applications.

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15 Plan for the implementation of a governmental intranet. http://www.pnud.ne/RaportplanNICI.pdf.

16 Strategic plan for the development of e-health in ECOWAS – 2011 to 2013.

17 http://www.sante.gov.ml/docs/PSDC_OOAS_1er_fevrier2011.pdf.

- Use e-health as a means of initial and continuous training, knowledge management, promotion and dissemination of good practices within the Community space.
- Use e-health to support research activities.
- Use e-health to promote traditional medicine.
- Ensure that e-health is accepted and adopted by all stakeholders, through successful change management.

It is these defined directions that must guide projects to be implemented. We shall confine ourselves here to highlighting a few projects which appear to be the most important.

1.13.5 E-health Implementation projects

The projects identified include:

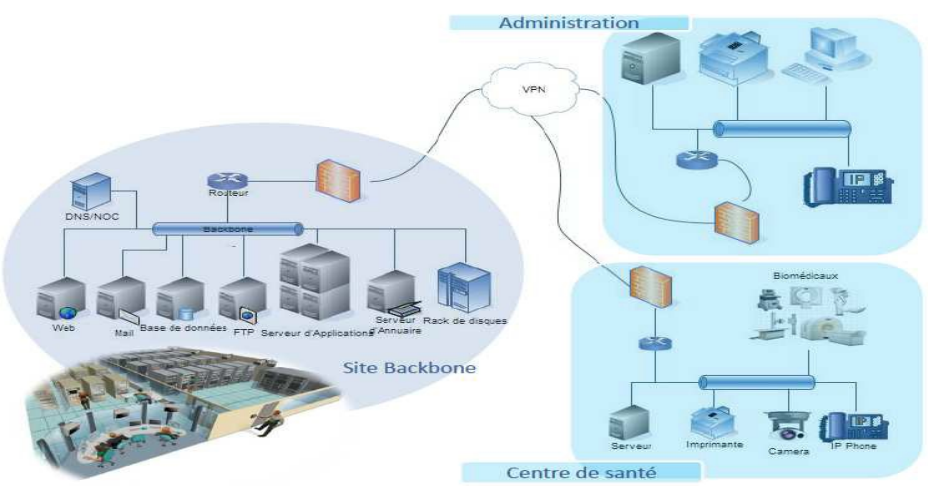
- **Project for the elaboration of a national e-health plan**

Under this project, each member state, including Niger, is to draw up a national e-health plan (NEHP).

- **Project for a national health data repository (NHDR)**

Countries' health systems are confronted by serious problems of management, storage and archiving of data collected by the various health information subsystems. This observation is corroborated by recurrent delays in the publication and dissemination of collections of health information statistics.

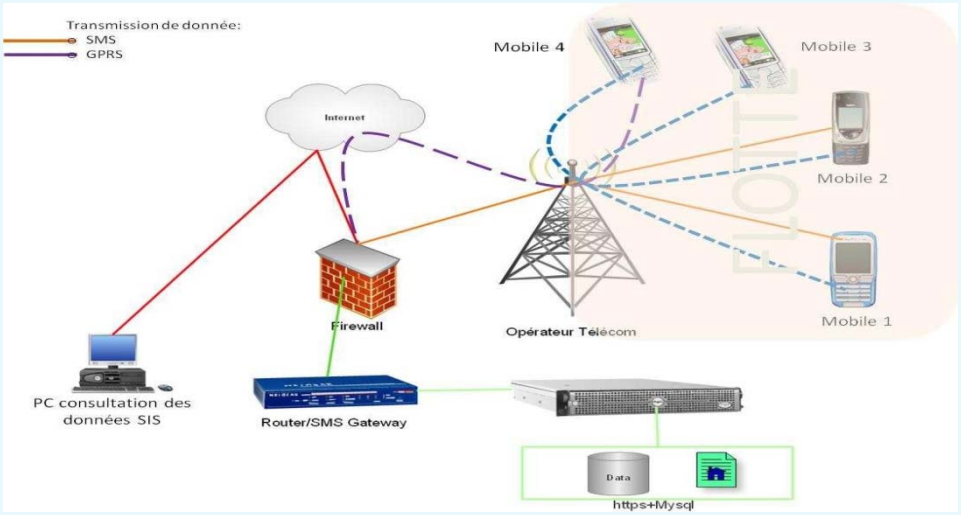
Figure 9: Project for a national health data repository (NHDR)



The NHDR is a comprehensive and definitive solution to the problems of management, dissemination, use, storage and archiving of health information.

NHDR is a reliable medium supporting various applications: telemedicine, medical information (Clinical Information System, Medicine Information System, Radiology and Laboratory Information System, etc.), administrative management, health information system and planning.

Figure 10: Project for a mobile health fleet



The objective of this project, in the mind of its developers, would be to allow real-time and secure transmission of health information using mobile telephony and to automate the process of analysing, processing and disseminating health information.

To this end, technological solutions are considered, as described in brief below.

The idea is to network mobile telephone terminals supporting the transmission of data and sms. The fleet also supports voice. An infrastructure diagram for such a mobile fleet is shown below.

Terminals are loaded with forms to be completed with data in the field, which once captured will be transmitted via GSM terminals or smartphones to specially-equipped servers in the NHDR.

The data transmitted are automatically processed and can be exploited by any authorized health professional. In addition to data transmission for the health information system, health professionals with terminals in the fleet can communicate with each other by voice and sms. The terminals in the fleet can only communicate with each other.

Figure 11: Terminals in the fleet

- Physical infrastructure

The physical infrastructure consists of mobile terminals and the infrastructure of the suitably equipped NHDR. The mobile terminals are GSM phones, smartphones and netbooks.

- Software solution

FrontlineSMS is a freeware allowing the sending and reception of sms messages. Using this software, a computer connected to a mobile phone (see Figure 11) becomes a low-cost communication centre. Only the operator's sms price is charged.

Figure 12: Computer converted into an sms communication centre

Use of the Patient View module creates a new user interface in FrontlineSMS. It allows all relevant data concerning a patient to be displayed. Health workers will also be in a position to sort, update and add new entries concerning the patient via the central computer and the mobile phone. This yields a mini computerized medical file, as shown in Figure 12**.**

In addition to these projects, it should be mentioned that, in cooperation with India, a project for a pan-African e-network with an e-health component is under way, which provides for the installation of a VSAT in the national hospital (NH) at Lambordé (university hospital centre).

1.13.6 Conclusion

It clearly emerges that, in terms of e-health, Niger is really only at the planning stage. Today, based on the current development of the telecommunication/ICT infrastructure, Niger intends to speed up these projects. To this end, it will be requesting ITU/BDT support through the relevant programmes, in particular Programme 5, whose purpose is to help least developed countries (LDCs) members of ITU with targeted assistance for their economic and social development.

1.14 Pakistan: e-Health in Pakistan

1.14.1 Telehealth initiatives in Pakistan

- [18]Telemedicine/e-health Training Centre was established at Holy Family Hospital, Rawalpindi to train medical staff of the region in telemedicine applications. This was a joint collaboration between ministries of science and technology of Pakistan and USA. The project was a six months' pilot in which a model training centre was established in Holy Family Hospital and connected to a remote telemedicine centre in a rural area. This has acted as a training ground for telemedicine training of doctors and nurses. In the initial phase 45 doctors and nurses from Rawalpindi region were trained in telemedicine applications.

[18] Asif Zafar Malik, Professor of Surgery, Holy Family Hospital, Rawalpindi, Pakistan. See document RGQ14.3.2-INF-0003

- Ministry of Information Technology: Health Net Project - Ministry of Information Technology launched its Health Net Project in November 2007 and this initiative is in the implementation phase. This project is being funded by Federal Ministry of Information Technology for three years with a commitment from Provincial Governments of Punjab and Sind to continue and bear the cost of recurring expenditure. MoIT-Health NET is a telemedicine project meant to assist the government in transforming delivery of healthcare services and making them available at the door-steps of the common man, through the use of Information and Communication Technology.
- The project demonstrated the use of technology as a solution for overcoming the lack of quality healthcare infrastructure in rural/remote areas of Pakistan. The objective is being achieved through setting up telemedicine hubs in tertiary care centres connected via PAKSAT-1 to 4 telemedicine centres in rural hospitals, by utilizing and complementing available national resources and infrastructure. A total of fifteen satellite based telemedicine centres have been established all over the Pakistan. Tertiary care centre at Holy Family Hospital, Rawalpindi and Mayo Hospital, Lahore in Punjab Province and one hub centre JPMC, Karachi in Sind Province have been identified as hubs for providing telemedicine consultations to their remote catchment areas. Each of these hubs has been linked with four remote sites through satellite connectivity. All these centres are equipped with telemedicine peripherals to facilitate the teleconsultations in radiology, Surgery, Medicine, Cardiology, Otolaryngology, Dermatology, psychiatry and orthopaedics. Regular consultations are being provided to remote patients through this network. The Government of Pakistan has taken a bold initiative to utilize ICT for transforming delivery of public services by making such services more effective, inclusive, efficient and available at the door steps of common men. Setting up rural telemedicine centres has enabled rural population to seek consultation, advice and treatment from specialist doctors in urban centre hospitals, without having to travel hundreds of kilometres and spending their meagre financial resources on related transportation and accommodation costs. The project also provides training in advanced treatments and diagnostics to doctors working in rural/remote hospitals, through interaction with specialist doctors in urban hospitals. In the last three years thousands of patients in these remote districts have benefited from the Telemedicine rural support program.

1.14.2 e-Health initiatives: The Aga Khan University Karachi (AKU)

- Telehealth/telemedicine: Tele-radiology Project between AKU and French Medical Institute for Children (FMIC) Kabul, Telehealth Project in Northern Areas of Pakistan (Districts Gilgit, Gizar and Hunza) extending up to the Pakistan China Border.
- Health Informatics: Developed 47 integrated clinical information systems, PACS are implemented according to global standard. AKU is also conducting a Cost Benefit Analysis of available Hospital Information management system. The University is working with Ministry of Health (HMIS-cell) in designing and implementing Real time Bio Surveillance system for the country.
- E-Learning
- Geographic Information Systems (GIS) GIS: Environmental Health, GPS use in Tobacco Control study to collect point data

1.14.3 Ministry of Science and Technology: Multitasking of Telemedicine/E-Health Training Centre

- Joint collaboration between USA and Pakistan in field of science and technology opened a new era of telemedicine training. This has led to the establishment of Telemedicine/E-health training Centre at HFH to train doctors and nurses in the field of telemedicine.
- Telemedicine/E-Health training centre is a designated facility for e-health training and is jointly working with Virginia Commonwealth University, USA. Four remote hospitals are attached to the centre through satellite connectivity. These hospitals are DHQ hospitals in Attock, Khushab, Gujrat and THQ hospital, Pindi Gheb. This centre has trained more than 100 doctors and nurses in

Telemedicine applications so far. In the initial phase medical staff from Rawalpindi/Islamabad region was trained and now in the second phase 60 more people have been trained. These trainees were from various institutions all over Pakistan and after completing their training are actively using telemedicine to strengthen healthcare delivery in their own institutions.

- Telemedicine/E-Health Training centre also established tele-rehabilitation centre in Muzzafarabad, Kashmir for paraplegics of recent earthquake. During the earthquake of 2005, 194 paraplegics (because of spinal cord injuries) were brought to Rawalpindi Medical College and allied hospitals. These patients received their initial treatment at these hospitals and were discharged after that. The hub of this Tele-rehabilitation network is at Holy Family Hospital. The remote centre is in Muzzafarabad hospital. Telemedicine/E-health training centre will train patients and their attendants in utilization of Tele-rehabilitation services. Development of pressure ulcers, which are a known complication of paraplegics, will be monitored. Physiotherapy measures will be taught to patients and progress will be evaluated. Moreover satisfaction of patients and their attendants regarding the use of this technology will be evaluated.
- US State Department's Pakistan Telemedicine Project – is providing expanded medical care – pre-operative planning and follow-up; cardiac assessment; ophthalmology, dermatology, radiology, infectious disease, and perinatal evaluations; and medical triage for traumas and acute illnesses. Another important aspect of the project is building capacity for healthcare services via virtual clinical grand rounds for medical education. The partnership includes Wateen Telecom, Motorola Inc., Medweb Inc., USAID, the U.S. Department of Defense Telemedicine and Advanced Technology Research Center, the Pakistani Government, and Telemedicine & E-Health Training Center, Holy Family Hospital in Rawalpindi and District Headquarters Hospital in Attock.
- Emergency Telemedicine Response in Pakistan.

1.14.4 Role of International Telecommunication Union

- The 2005 Earthquake of Pakistan left widespread destruction, killing at least 80,000 people, severely injuring another 70,000 and leaving 2.8 million people without shelter. Telemedicine center developed mobile telemedicine units with collaboration of International telecommunication union (ITU) and INTEL. International Telecommunication Union provided on loan 15 Inmar-Sat Satellite modems to be deployed in areas where there was no communication available. Telemedicine centers were established in NWFP and AJK, most affected areas of Pakistan. These centers were established in existing relief hospitals. The Medical staff got consultation about the earthquake victims from consultants at the hub.
- On 10th December 2007, the International Telecommunication Union (ITU), and the Telemedicine & e-Health Training Center, Holy Family Hospital of Rawalpindi in Pakistan signed a Memorandum of Understanding (MoU) for Cooperation in Disaster Preparedness and Response through Telemedicine and e-Health. The Parties have already successfully collaborated in the area of telemedicine and emergency telecommunications following the massive earthquake that struck the Pakistan-India border area in October 2005, during which a total of 25 medical doctors were trained in the use of 55 satellite terminals in delivering telemedicine services and applications. The Parties intend to implement joint projects/activities, share information on e-Health, and cooperate on enhancing access to information related to emergency telecommunications and telemedicine for disaster preparedness and disaster relief.
- Emergency Response Telemedicine Vehicle: 2009 – Holy family hospital (HFH) was one of the hospitals actively involved to provide health care to Internally Displaced Persons (IDPs) of Swat and Mardan districts. Apart from mobilizing teams to provide on-site medical care, telemedicine was added to strengthen these services. Initially, teams comprising of doctors of all major specialties like Surgery, Medicine, Ob/Gyne, ENT/EYE and Paramedics were in Mardan. It was then possible to cover all other specialties and at the same time have opinions from senior medical staff based at Holy Family Hospital. This was possible by Mobile Telemedicine vehicle made operational under supervision of Telemedicine/E-Health Training Center at Holy Family Hospital. Teams from HFH

including doctors and paramedics were sent to refugee camps to address their medical problems. Specialist support to these teams was provided through Teleconsultations utilizing a Mobile Telemedicine vehicle. This was indigenous customization of an ordinary vehicle. The capsule of the vehicle was designed and developed locally. The satellite dish for communication was mounted on the top. The vehicle was further equipped with Video Conferencing equipment and telemedicine tools like general examination camera, Otolaryngoscope, ECG, related medical and IT equipment. Satellite connectivity was provided by Pak Datacom. The medical staff at refugee camps, after initial evaluation of the patients, used to discuss it with specialists at HFH for further evaluation and management.

1.14.5 Floods in Pakistan in 2010

- Multitasking of Existing Rural Telemedicine network
  - Rajanpur and D.G. Khan are in the middle of the worst affected areas of lower Punjab. Hospitals in these cities are part of the Telemedicine network of rural support program Pakistan. Fortunately these facilities were not damaged during the floods. Telemedicine and e-Heath training centre streamlined the Emergency Telemedicine response in the wake of foods utilizing the existing satellite network provided by the Ministry of Information and Technology. Mayo Hospital Lahore and Holy Family Hospital Hubs have been running virtual clinics and providing teleconsultations to patients in attending remote sites.
  - The methodology is simple, utilizing video link. Specialists from Departments of Medicine, Paediatrics, Dermatology and other specialities are available daily according to schedule provided to remote sites. The IT resource person and paramedics at the remote sites are facilitating these consultations while staff at the local hospital is busy providing care at camp sites. Since the start of these services more than 3593 patients have received treatment. Predominant amongst these are skin conditions and waterborne diseases like Gastroenteritis as predicted and expected. This data is extremely useful for Health departments to plan relief operations by mobile health teams.
- Mobile Telemedicine centres in Gilget, Baltistan, Rural Sindh and Punjab:
  - International Telecommunication Union was once again in the forefront to assist Pakistan during the floods. It airlifted equipment for Telecommunication like data terminals, Inmarsat satellite modems and Satellite phones. Federal Ministry of Information Technology coordinated these efforts by releasing the equipment, and getting relevant licences from PTA for using this equipment. Telemedicine and e-Health training centre was entrusted the task of training and coordinating these efforts in setting up mobile telemedicine centers. On-site training was arranged for staff of AKU, HDF, SEECS (NUST) and Attock district staff. These centres are operating all over the country, and ITU has very kindly extended the connectivity period for a further three months.
- International e-Health Conferences in Pakistan:
  - First International e-Health Conference – The e-Health Association of Pakistan organized its first International e-Health Conference at the Aga Khan University, Karachi on 23-24 January 2010. The conference was telecasted live at the National University of Science and Technology, Islamabad. The conference attracted stakeholders from the Ministries of Health and Information Technology, National and International development organizations, health care institutions, academic institutions in health, engineering and telecommunication, and students from a variety of disciplines. Several keynote addresses, scientific sessions, workshops and panel discussions were arranged to provide opportunity to the experts, researchers, and participants to share their views.
  - Second International e-Health Conference – The e-Health Association of Pakistan organized its Second International e-Health Conference at the International Islamic University, Islamabad, Pakistan on 22-23 January 2011. The conference was telecasted live at the Aga

Khan University, Karachi. This Conference was a unique feature in Pakistan, allowing healthcare providers, allied health professionals, IT experts, telecommunication companies, managers, and educational institutions in health, biomedical and IT fields to reflect on ways to collaborate for improving health of the population.

- e-HAP Workshops – Considering the growing demand of e-Health, a two-day Knowledge Sharing Workshop "e-Health Knowledge Sharing workshop", was organized by e-Health Association of Pakistan (e-HAP) in collaboration with LIRNEasia, Sri Lanka on 29-30 September 2010 at Islamabad Club, Islamabad, Pakistan. The purpose of the workshop was to share and compare the findings of e-Health initiatives in Pakistan and other South East Asian countries. The workshop was attended by representatives from the Ministries of Health and IT, public and private healthcare institutions, NGOs and academic institutions.

1.14.6 Research and Development in e-Health Pakistan

- NUST University Islamabad: Healthcare Applications Interoperability through Implementation of HL7 Web Service Basic Profile.
- FAST University Islamabad: Next Generation Intelligent Networks Research Centre Remote Patient Monitoring System with Focus on Antenatal Care.
- LUMS, LAHORE: A Low Cost Ultrasound Training Simulator: Investigating Wavelet based Video Coding and Video Conference Applications.
- Aga Khan University: PANACeA project (PAN Asian Collaborative for Evidence-based e-Health Adoption and Application):
  - Research in e-Health in 12 Asian countries. Use of Mobile Phone in Bridging the Gap for Referral of Pregnant Women.
  - Mainstreaming e-Health initiatives in primary care: an evidence-based approach Online TB Diagnostic Committees for Clinically Suspect Sputum Negative Patients in the TB-DOTS Program.
- Regional and International Cooperation: Telemedicine/E-health.

Pakistan is playing a key role in establishing collaborations internationally and in the SAARC region, to promote e-health by partnering with International organizations like: APT, SAARC, WHO, ATA and Rockefeller Foundation.

1.15 Tanzania: Status of e-Health in the United Republic of Tanzania

1.15.1 National Optical Fiber Backbone: For Telemedicine Services

[19]The e-governance initiative of the Government of Tanzania is to establish the National Fibre Optic Backbone to provide essential connectivity for e-services. The network now covers all regional centres and will be extended to all districts beginning the second half of year 2012. We are planning to take advantage of this e-governance initiative to establish the connectivity needed for telemedicine.

In June 2011, the India-Tanzania Centre of Excellency in ICT provided, among other things, telemedicine related facilities (bed + mattress; ECG Machine; DVD Player; X-ray Scanner; Microscope with Digital Camera; TV Screen; Conferencing camera and telemedicine software) which have been installed in 10 hospitals.

[19] Contribution: Deogratius A. Moyo, Tanzania Communications Regulatory Authority (TCRA), Tanzania (United Republic of). See document SG02-C-0228

In mid 2011, the Hon. Prof. Makame Mbarawa, Minister of Communication, Science and Technology called a stakeholders meeting to discuss on how to harmonize the telemedicine initiatives in Tanzania. During that meeting, the National e-Health Committee was formed including members from different organs as outlined below. It was further agreed that, to start with as pilot project, two rural hospitals and three referral hospitals will be connected this year. Currently, all necessary preparations for establishing this pilot project are in place. The project is planned to offer the following categories of services:

- Consultations with Specialists: patient/doctor consultation through mobile phones or internet;
- Videoconferencing: Clinical Case presentations, Clinical Pathological Conferences, Tumor Boards, State of the Art Presentations by specialists;
- Continuing Medical Education: Clinical Materials prepared by Specialists, Service Policies & Procedures for quality improvement, and Pre-service training of various health professionals.

1.15.2 Challenges

The connectivity and operation of this project, however, faces some challenges as follows:

- High cost in connectivity from the National Telecommmunications company.
- Lack of fund for training of doctors and nurses.
- Lack of sustainability assurance.
- No framework for telemedicine and related policies, regulations and procedures.
- Telephone Communications among Health Workers

Communication among health workers is essential for consultations, referrals and facilitating the telemedicine services. In 2011, the National Referral Hospital in Dar es Salaam (Muhimbili) initiated a plan to establish a closed user group among health facilities, staff and doctors within hospital through mobile network services from national telecom company (Tanzania Telecommunications Company Limited-TTCL). In this initiative, all doctors, wards, laboratories and radiology sections were included in a closed user group with freely unlimited calls among them. Extension of the closed user group countrywide is constrained by limited coverage of TTCL mobile services.

While TTCL is exploring the possibility of integrating their landline services for countrywide coverage, the Ministry of Health and Social Welfare (MOHSW) has agreed to join efforts with Switchboard Company of the USA and one of the largest mobile company in Tanzania (Vodacom Tanzania Limited) to establish a mobile closed user group to include all key health workers in all Vodacom covered areas in Tanzania. There will be no direct financial implications to MOHSW and all voice calls and text messages within the group will be free. An MOU is being finalised and network establishment is planned to start this year.

1.15.3 Recommendations

Following the challenges faced by the Government of Tanzania in implementing e-health services, we appeal to ITU and other players for support in knowledge sharing, fund, and training.

1.16 Turkey

1.16.1 Case 1: TEPE – Turk Telekom Technological Cooperation: Integrated Healthcare Management Information System

[20]Integrated Healthcare Management Information System (IHMIS) is realized by TEPE Technologies and Turk Telekom Cooperation. IHMIS is an integrated software system that permits to manage and store all data of "A Class" Healthcare Providers. In this cooperation, the software system is provided by the TEPE Technologies and Turk Telekom provides 2 Mbit internet connection and personal data security.

IHMS can be a good example of the cooperation between telecommunication companies and software information companies in the health sector.

Introduction

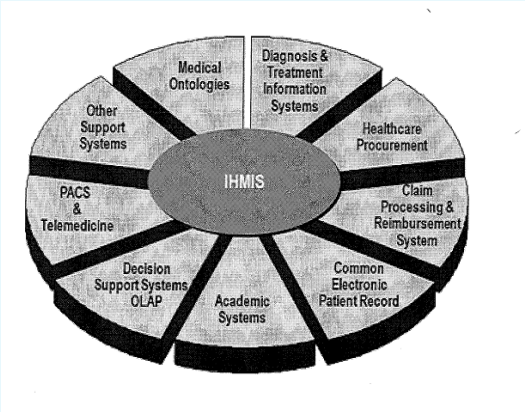
Integrated Healthcare Management Information System (IHMIS) is designed by TEPE Technological Services. IHMIS is an integrated software system that permits to manage and store all data of "A Class" Healthcare Providers. The main purpose of IHMIS is to serve the right information at the right time to the right person continuously and directly, all the system components are designed and implemented for asynchronous (Store-forward) operation as well as synchronous for the highest resilience.

Since Integrated Healthcare Management Information System (IHMIS) is a holistic system primarily developed for forthcoming healthcare providers. IHMIS is a total system comprehending:

- End-to-end collaboration of primary, secondary and academic healthcare units upon standardized clinical and administrative Hospital Information System (HIS) workflows and business processes.
- Utilization of centralized framework using common Master Plan Index and Electronic Health Records databases.
- Empowerment of medical diagnosis and treatment systems with state-of-art Medical Ontologies, Classification and Coding Corpus.
- Co-execution with a centralized and Coding Corpus.
- Elevated point-of-interest decision support and in-depth OLAP analyses designed for different command levels.
- Centralized system administration and control functions warranting rapid, remote and scalable installation.

[20] Contribution: Arikan Dalkilic, Turk Telekom Group, Turkey. See document SG02-INF-0058

Figure 13: Integrated Healthcare Management Information System (IHMIS)



IHMIS infrastructure designed upon core technological components listed below:

- Medical Data Dictionary: Enterprise Medical Data Dictionary, a specific database, has an information model that will be the guide for forming an electronic patient record. Medical Data Dictionary will be an information system that will consist of a controlled medical vocabulary including third party coding systems such as ICD-10, CPT and SNOMED, a semantic tool that makes possible to establish semantic relations between medical concepts and a database.
- Clinical Data Repository: In order to create life-time electronic patient record, Enterprise Clinical Data Repository(CDR) will be developed which will support problem-oriented medical record structure and will become a central database that the physicians could reach at the point care, analyze data, input data. CDR will be developed as complying with ASTM and HL7 standards.
- Master Patient Index System: Enterprise Master Patient Index (MPR) will be developed in order to describe patient patients' (?) apply to one of the institution' rapidly and correctly. Enterprise MPR will integrate about patients' demographic and their applications will be obtained centrally and summarized.
- Clinical Workstation Application Software: An easy to learn and user friendly interface will be developed that allows users to reach previous records (if any) of inpatients and outpatients. The user interface having open system characteristics will be developed via utilizing CCOW (Clinical Context Object Workgroup) standards and components as DCOM, COM+, etc., XML technologies.
- Enterprise Registration System(ERS): will provide unique solution for executing all record processes of all related departments according to the Enterprise workflow, ERS will be developed as complying with ASTM and HL7 RADT(registration, administration, discharge, transfer) standards and Enterprise MPR will be a part of ERS applications. ERS will also include an appointment system that allows programming institutions, medical sources and patients' time.
- Case-Mix Classification Systems: Standard data sets will be created for inpatient and outpatient in order to be able to evaluate healthcare quality and costs and deliver internationally comparable information.
- Data Entry Tools: One of the main principles in creating electronic patient record is to guarantee entering structured and coded data of the electronic patient records. By using enterprise medical data dictionary; will be developed natural language processing tools for structured and coded data entry from free medical texts in electronic environment and dynamic data entry tools for directly structured and coded data entry.
- Enterprise Object Oriented Workflow Platform: will be developed in order to make it possible to set relations possible to set relations between Enterprise EPRS and enterprise resources such as

healthcare personnel, medical units and medical equipment, work according to the enterprise workflow and exchange data institution's other information systems. Enterprise Object Oriented Workflow Platform; will include a flexible and adaptable modelling tool that will make possible to model enterprise sources and workflows and a messaging interface with HL7 standard to provide data exchange between other health information systems such as hospital information system(HIS) of Enterprise EPRS in institution, laboratory information system(RIS), radiology information system(LIS).

Successful Case Analysis: Turkish Armed Forces and IHMIS

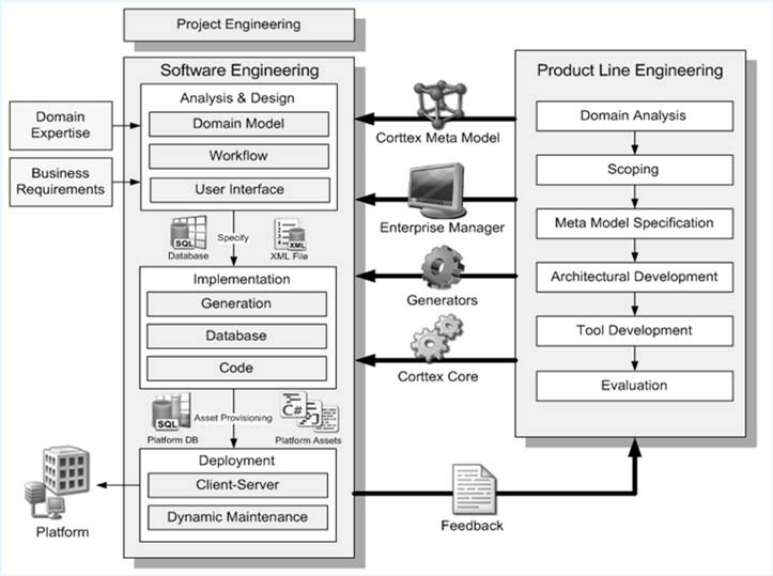
Turkish Armed Forces (TAF) has used the Integrated Healthcare Management Information System (IHMIS) for more than 10 years. TAF IHMIS covers whole country, 3 academic level and 44 secondary level hospitals, and served over 2,5 million people. TAF IHMIS is the second largest national healthcare system of Turkey, after Ministry of Health hospitals.

TAF IHMIS holds and executes total capabilities of a healthcare system including essential medical processes, military healthcare logistics and public reimbursement regime. TAF IHMIS is a globally unique project not only due to its extended capabilities but also its technological pillars. TAF IHMIS, is almost one of the successful projects throughout the world employing longitudinal electronic health records (EHR). TAF IHMIS ensures lifetime health records of personnel accessible under patient privacy and safety legislation. TAF IHMIS executes an end-to-end healthcare logistics workflow which is traceable from procurement till terminal point-of-use. In financial terms TAF IHMIS manages a healthcare service approximately two billion dollars per year. TAF IHMIS project is accepted as a backbone system for TAF military requirements, namely progressing towards mission area mobility and interoperability.

TEPE Technological Services, as a total solution provider supports its clientele with an implementation methodology. An illustrated development and deployment methodology of TEPE is given below.

The methodology encompasses hand-to-hand execution of project engineering and product line engineering. Since IHMIS is an enterprise management platform is stretch, primary step of the implementation starts with domain analysis. Domain analysis step ensures proper and in-depth analysis of client requirements. The analysis also covers workflow and user interface requirements. The logical design of the tailored solution accordance with the client requirements are supported by domain expertise and whole perspective of business requirements. The outcome of domain analysis is converted into initial system implementation. The implementation steps were shown in Figure 14.

Figure 14 Deployment methodology of TEPE



The initial implementation is the transition phase before full scale implementation and covers all preliminary setup of databases, preset user interfaces and roles/privileges that is adapted to user environment. Over the initial implementation, the software bundle customized with respect to client workflows, additional development were accomplished and finally the final system design is made to ready for integration tests. Integration tests were conducted with simulated yet full scale data sets plus, integration of medical devices and other third party solutions. After the successful integration tests, the system deployed to client production environment and data migration tasks finished. With the ultimate performance tuning, the system is accounted as available to go-live phase.

About Tepe Technologies:

TEPE is an innovator and leading company that produces and invests real national technologies, has a place in international information technology market, produces and shares information and sets standards, is perceived as a brand, is being consulted and its solutions are taken as a reference in the field of health informatics and workflow systems.

TEPE Technological Services designs and delivers applications on internationally acknowledged health informatics standards since 1993. Company:

- Produces information technology solution to provide the information management requirements of institutions in all levels and make them work in more efficient, qualified and productive manner.
- Develops information systems that deliver the right information to the right person at the right time and in the right level.
- Delivers information systems that determine working manner of the customers and cause measurability of works, in the field of production, development, implementation and integration of information technologies.

1.16.2 Case 2: The Application of Central Hospital Appointment System (CHAS)

Generally, the main problems of developing countries, like Turkey, are the financial problem and lack of the specialist doctors. Moreover developing countries face with the challenge of using existence resource in effectively.

The project which was designed by the cooperation of the Turkish Ministry of Health and Turk Telekom can be good example for developing countries common problems. We believe that the project Central Hospital Appointment System (CHAS) must be assessed in the ITU's platform.

What is the CHAS?

CHAS is a kind of service that helps citizen for make an appointment for the health centres according to needs of the citizens.

Firstly, citizens must call the number 182 in order to benefit from this system. The alive operator will answer the call. The main purpose of the call centre is to direct the citizen to the most suitable health centre. Of course, citizen can declare his/her demand about the name of hospital and the name of the doctor. Call Centres try to help the citizen to realize his request. However, if citizen's request is not suitable in the selected time slot, call centre can direct the citizens another health centre. Moreover, Operator must interest the problem of the citizen intimately. If first aid information is needed, Operator can help; also during emergency situation Operator can inform emergency teams like ambulance etc.

The citizens also benefit from the number 182 by expressing their concerns and their complaints about the health services. Operators interst and note the complaints, and they send their notes to the relevant division of the Health Ministry.

Basically, how does it work?

1) In order to benefit from the services, the citizen must call the number 182. The citizen can use either fixed or mobile phones.
2) The alive operator will answer the call. The citizen must share his/her identity number by operator for acceptance of request.
3) Citizen declares to operator to which hospital he wants to go and which doctor he wants to contact.
4) Operator checks the agenda of the relevant hospital and relevant doctor.
5) Operator informs the citizen about the available time slot.
6) If the appointment date is not suitable for citizen, Operator can suggest alternative time slot.
7) After the agreement, the talk is finished.
8) Citizen must be in hospital 30 minutes before the appointment time and Citizen must make registration at the hospital.
9) Citizen can cancel the appointment time with by 182 thereafter.

CHAS system has 4 main processes:

- Main Process 1: Processing the appointment request
  - After calling number 182, the citizen must give his/her identity number.
  - After the endorsement of the identity number of citizen, the appointment is approved by the Operator.
  - If Citizens doesn't know his/her identity number, Citizen must share his/her identity information with operators.
- Main Process 2: Cancellation of Appointment (by Citizen)
  - If the citizen wants to cancel the appointment, she/he must declare his/her identity number or information by calling the number 182 again.
- Main Process 3: Cancellation of Appointment (by Doctor)
  - If the Doctor has some urgent work to do, appointment can be cancelled.

  - Patients are called by the operators
  - New Appointment time is offered.
- Main Process 4: The Pursuit Of Appointment
  - Operator also controls all appointments day by day.
  - After the appointment time, Operators call the citizens who benefit from CHAS
  - The purpose of this call is to learn the view of the citizen about CHAS services, if there are important complaints; the complaints are recorded than the results sent to Center of the Minister of Health.
  - Moreover, Surveys are applied by the operators.

General Survey Question:

- Did you examine in the appointment time?
- Did your doctor examine you in the appointment time?
- If another doctor examined you, how they explained this situation?
- In general, how many points you give CHAS? (1=minimum, 5=maximum)

Figure 15: Example of CHAS survey

Participants in the Survey (MAY 2010)

Citizens Who	Number	%
Participate	4013	65%
Don't participate	2197	35%

Obeying the Appointment time by Hospital (MAY 2010)

Doctor is	Number	Percentage
On Time	3513	88%
10-19 minutes of waiting	369	9%
More than 20 minutes	131	3%

Few Solution of Question

The organization chart of Hospitals for CHAS

The main responsibility of Hospital is to organize the CHAS system properly. Each Hospital employees must work for the success of the CHAS.

The assistant head of hospital is the main responsible for the project. She/he must prepare the working agendas of each doctor in the hospitals. The agendas must be approved by head of hospital.

Responsible of Working Agenda controls the fulfillment of the all working agendas.

Responsible of CHRS Software deals with technical aspect of project.

Reception Employee must welcome the citizen and they must answer all questions of the citizens.

The Duty of Doctors

- Hospitals must prepare each doctor’s working agenda for every month,
- Doctor must accept and sign the conditions of working agenda for every month,
- Doctor must obey the conditions of the working agenda properly.

- Doctor may not be in holiday during process.
- Doctor can cancel the appointment only if acceptable urgent conditions are occurred.
- Working agendas of Doctors is controlled by the assistant Head of Hospital.
- The purposes of CHAS Projects are the following:
- To increase the efficiency and the quality of health services which are given by Turkish Health Ministry.
- To increase the public satisfaction about health services.
- To compose the limited resources allocation (the usage of the man power and equipment).
- To decrease the crowd density in the hospitals.
- CHAS will also help for equal services rights of the people. With this system, people will access to the equal health services.
- The health workers will work more efficiently.

Figure 16: Example of CHAS or doctors

Doctor who obeys the appointment time

(MAY 2010)

Doctor	Number	Percentage
obeys appointment time	3852	96%
doesn't obey appointment time	161	4%
Total	4013	100%

The Cause of Doctors who are not on time the appointment time

Doctor was	Number	Percentage
On Vacation	48	31%
In Surgical Operation	25	16%
In Different Department	13	8%
In Lunch	5	3%
Unknown	65	42%

How many points you can give for CHAS?

Point	No of People	%
5	3206	80%
4	544	12%
3	178	6%
2	48	1%
1	37	1%
Total	4013	100%

Did you experience a problem with call center?

Answer	Number	Percentage
No	3963	99%
Yes	50	1%

Some years later, the data which will be obtained by CHAS sources can be used for reshaping the Health Policy of Country.

Propagation of CHAS project

A CHAS service firstly was started in Erzurum and Kayseri cities in February 2010. These cities are among medium sized cities of Turkey. After that, the services were propagated 10 other cities of country on summer 2010. Those cities are chosen from different geographical part of the Turkey.

The Support of Turk Telekom

In 19 August 2009, Turk Telekom and Minister of Health signed the cooperation agreement. According to the agreement, Turk Telekom accepted very critical commitment.

For realizing this project, Turk Telekom finances all technological and human resources infrastructure. Turk Telekom employed 150 operators in Call Centre which is situated in Erzurum.

Moreover, Turk Telekom increased the capacity and the scope of the existence telecommunication infrastructure of Turkish Ministry of Health. Almost all Turkish Hospitals have broad band Internet connection.

Today, Turk Telekom implements CHAS project in the 10 different cities of Turkey. However, the duration of the agreement which signed between Turk Telekom and Ministry of Health will finish at the end of the 2010.

Ministry of Health wants to propagate the scope the CHAS services to 81 cities of Turkey. Therefore, Ministry will invite tenders for the render of CHAS services in all 81 cities of Turkey. Turk Telekom is also candidate for the new period.

Conclusion

CHAS is very important part for the transformation process of the Health Sector of Turkey. If Turkey increases the scope of the CHAS to the all cities of Country properly, total efficiency of health sector will be higher and the crowd in the hospitals will be decreased and the hospitals will be better places for working comfortably.

1.16.3 Case 3: Acibadem Mobile Emergency Health Bundle Services

Introduction

[21]In order to develop the national e-Health policy, the creation of a national strategy is critical. Governments must work to implement the e-Health policy. During the creating of a national e-Health policy, the support of the private companies is needed. Especially, according to World Trade Organization (WTO) Agreements, many countries privatized their incumbent companies and they created the competitive market in the telecommunication sector. Moreover, in health sector, many private hospitals worked with public hospitals. The governments must support the cooperation between telecommunication companies and hospitals in terms of regulation. The incentive of the government leads to very efficient cooperation between the health and the telecommunication sectors. The e-Health Master Plans must contain the financial and regulative incentives for sectoral cooperation.

In this document, the cooperation between Turk Telekom (incumbent private telecommunication operator) and Acibadem Hospital (Private Hospital Groups) is shared.

Stakeholders

Turk Telekom is the leading communications and technology company in Turkey with a $14.5B market cap. Also:

- Strong consumer base: 16.3 M fixed voice, 6.5 M broadband, 11.5 M mobile subscribers.
- Extensive service and distribution networks: access to 2.5 K corporate, 179 K SME, 1.5 M SOHO accounts with 1K+ dealers.
- Diversified portfolio of businesses; owns verticals such as education & online games.

[21] See document SG02-INF-0056

- Operates digital platforms: IPTV, WebTV and mobilTV.
- Ability to attract high caliber technical human capital in Turkey (in recent year, out of 100K applicants, recruited 5K+ mainly technical people).
- Strong ties with regional telecommunications operators: access to a large population base.
- Strong financials & willingness to invest for high growth areas.

Acibadem Healthcare Group has been providing its services through its 24 branches spread all over the country with it's over 7.000 employees, 1.350 of whom are physicians since 1991.

On the other hand, Acibadem Mobile Healthcare Services Inc. was established in July 2008, as a partnership between Acibadem Hospitals Inc. (80%) and Acibadem Polyclinics Inc. (20%).

Company's Goal

Acibadem Mobile Healthcare Services aims to provide mobile healthcare services at the highest quality level possible, in line with the mission, vision and quality policies of Acibadem Healthcare Group, which was selected as the "Most Valuable Brand" of Turkish healthcare sector in 2007.

Medical Team

With its over 300 employees, over 100 of whom are physicians as of the end of year 2008, Acibadem Mobile Healthcare Services provides mobile healthcare services to individuals and entities with its leading edge mobile medicine technology.

Definition of Services

The service is called Turk Telekom Acibadem Mobile Health Services (TAMHS). The TAMHS was created by the cooperation between Acibadem Hospital and Turk Telekom. The TAMHS which is the bundled service includes different services: Emergency Health Insurance, Medical Coaching, Emergency Healthcare Services (Land and Air Ambulances), Home Care Services, Resident Infirmary Solutions, Mobile Healthcare Screening, Organizations (Providing mobile healthcare services for various events), Telemedicine (Remote access online healthcare service), Affinity (Group) Programs.

The bundled services are provided by the Acibadem Hospital Staff for 16 million Turk Telekom Customers. The customers who benefits from the bundled health services, pay their fee with Turk Telekom invoices.

Purpose

Turk Telekom offers this beneficial bundled health services with very suitable conditions to the millions of people. Because of the -economies of scope advantages, these important services can be provided very cheap conditions for each customers of Turk Telekom.

Besides, the number of fixed subscriber decreases day by day in all worlds of fixed markets. The health services can be very good opportunities for increased loyalty of the customers.

The Main Characteristics of the Services

For 1 year, Turk Telekom customers can benefit from TAMHS in 7 days 24 hours.

With AHMS;

- Customer can be informed about pharmacy on duty.
- Health consultation services.
- For subscriber and his family (max. 3 people), a free fully equipped ambulance service.
- For subscriber and his family (max. 3 people), a free 1 year health insurance.

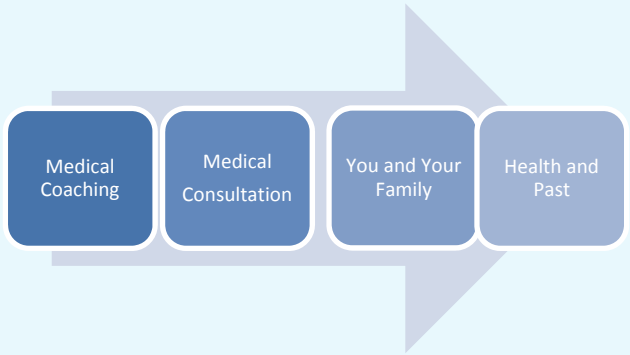
The subscriber and his family's health reports and talks are stored with property rules. Those data can be used again in further health problems. The health insurance is valid in all private hospitals in Turkey. Insurance includes all charges related with treatment, room and intensive care. The charges couldn't be exceeding approximately 4000 U.S. dollars. If the subscriber has insurance, it is not a barrier for benefit from AMHS.

Target Audience – All Turk Telekom subscribers and their family (max. 3 people, until 65 years of age)

Application Requirements

- All Turk Telekom PSTN subscribers can benefit from the health services
- Subscribers must be already Turk Telekom user for at least 2 months (60 days).
- Subscribers, who benefit from these services, can also benefit from other Turk Telekom services.
- Customer must accept to be subscriber of Turk Telekom for the following 12 months.

Figure 17: Turk Telekom Acıbadem Mobile Emergency Health Bundled Services (AMES)



Turk Telekom Acıbadem Mobile Emergency Health Bundled Services

AMES includes 4 different parts.

Medical Coaching

For 1 year, Turk Telekom customers can benefit from TAMHS in 7 days 24 hours.

Medical Consultation.

Customer can be informed about pharmacy on duty and other important information for free.

You and Your Family

In emergency situations, subscribers and their family can benefit from a free fully equipped ambulance service and a free 1 year health insurance.

The subscriber and his family can benefit from all advantages in all parts of country.

Health and Past

The subscriber and his family's health reports and talks are stored with property rules. Those data can be used and shared in further health problems.

How Customer Can Apply To The Services?

- Call Center

The Customer can apply to the campaign by using Turk Telekom Call Center.

- Turk Telekom Office

The Customer can apply the campaign by signing application forms in Turk Telekom offices.

Conclusion

Technological improvements contribute to the development for the new medical solution. Besides, Information and Communication Technologies are very important for spreading health services efficiently in the country. Especially, mobile broadband technologies serve new opportunities for the health sector.

Governments must support all e-Health investment in their countries. Governments must create economic incentives to create suitable environment between Health and Telecommunication sector.

The cooperation between Turk Telekom and Acibadem Hospital can be a good example for the competition environment. This cooperation serves very suitable bundled health services to the customers. The bundled service includes health insurance, first aid, family health opportunities in the same time.

The convergence between health and telecommunication sector can produce very successful solutions. International Telecommunication Union (ITU) must work for creating the right incentives between these two different sectors.

1.17 Uganda: Uganda's Approach to Implementing Broadband Connectivity in Underserved Areas

1.17.1 Introduction

[22]Uganda Communications Commission (UCC) established the Rural Communications Development Fund (RCDF) to stimulate provision of telecommunications services in the rural and underserved areas. The RCDF is therefore acts as a mechanism for leveraging investments in communications infrastructure and services in rural underserved areas of the country. This was recognition of the fact that although the sector had been liberalized and opened to competition some parts of the country which were non-commercially viable would not attract private capital for investment in infrastructure and services.

The RCDF main objectives include to provide access to basic communication services within a reasonable distance; ensure effective investment in rural communications development and to promote ICT usage in Uganda.

1.17.2 Uganda's Universal Access Policy Framework

Uganda's Universal Access Policy (2010) is developed within the premise of the global development agenda, the Millennium Development Goals (MDGs), to which Uganda is one of the signatories; and its country-specific National Development Plan (2010) that was originally linked to the national vision called Vision 2025. The policy is also developed building on the previous universal access policy (2001) and within the framework of Uganda's ICT policy and telecommunications policy.

Objective

One of the main reasons why the Internet has not spread to the rural areas are the cost of access, insufficient bandwidth and power issues and more important for the rural communities, illiteracy and the absence of relevant local content in vernacular. The new policy therefore has the main objective of ensuring provision of broadband connectivity and supporting the development of local content. However, the main impediment for the ICT sector in Uganda today is the lack of broadband infrastructure network

[22] Contribution: Moses Okello, Uganda Communications Commission (UCC), Uganda. See document SG01-INF-0017

meant to accelerate access and use of the Internet in particular and ICTs in general. This is especially because of the heavy capital requirements that cannot be left to the private sector alone and thus requiring special intervention from government.

Broadband Policy Implementation

Uganda government has embarked on supporting the interconnection of all higher local governments' capitals and major towns with a national data backbone infrastructure so as to enable provision of wide array cost effective ICT services to the users. This expected to facilitate the establishment of institutional data access points with initial focus on vocational, tertiary and secondary educational institutions, and government health units for levels IV and III.

Broadband connectivity will be provided for selected sub-counties to connect to the high speed National Backbone Infrastructure. The connection is considered as a 'last mile' solution for the sub-counties. To this end, a detailed study to determine the most cost effective technological solutions (wireless, cable) that could be implemented for each location is underway. Additionally, the study will help in identifying the districts that will not be covered by the national backbone infrastructure. The backhaul links will then be deployed to link such sub-counties to the identified districts.

The initial proposal is to outsource the design and implementation of the proposed access network to competent telecommunications service providers. The project once implemented is intended at lowering the price of bandwidth paid by the consumers while providing high quality and a wide variety of broadband services. The project will also entail providing computers and capacity building or training programmes to the end users such as schools, health centres and local governments.

1.17.3 Expected Benefits

- E-government: The project will help in collecting information from lower local governments upwards to the central government. The information will be part and parcel of the national demographics and other socio-economic related statistics.
- E-education: The project will facilitate e-learning and already this is gaining popularity in the country. For example major local universities are having satellite campuses in upcountry locations in which long distance and online education are now being offered.
- E-health: The project will facilitate data and voice flow from the rural communities to the health centre onwards to the district hospitals and regional referral hospitals and finally to the national referral hospital. The reverse flow will happen. Additional traffic is expected between the Ministry of Health head office and the district offices and also between the ministry and the health centres.

1.17.4 Conclusions

Internet penetration, access and usage in Uganda is still very low and is estimated at (5%) users of the total population. This is also largely confined to urban commercial centres owing to commercial considerations by the private service providers. Although Uganda's previous policy had supported the installation of Internet points of presence in all the underserved districts, the internet bandwidth speeds and quality of service issues (outages) has been of major concern by the end users.

Therefore the new policy objective is expected improve broadband uptake in selected underserved areas. This is envisaged offer lessons and experiences for developing a national broadband policy and subsequent rollout strategies for the country. Therefore ITU-D Study Group meetings offers Uganda an opportunity to gain experiences on how other countries are addressing this developmental concern.

1.18 Uzbekistan: Health Management Information System in Uzbekistan

[23]Currently in Uzbekistan a wide range of socially significant reforms are carried out. There are the administrative reform, education and health care reforms, etc. Much attention is also paid to the development of information technologies – informatization of state agencies and set up the ground for future e-Government in the near future.

To speed up the introduction, use and further development of computer information systems, the program of computerization and ICT development in 2002 – 2010 has been adopted by the Government of Uzbekistan. The program was designed to create conditions that will allow Uzbekistan to achieve a higher level of ICT penetration in all spheres of life, including public administration and social activities.

1.18.1 HMIS in Uzbekistan

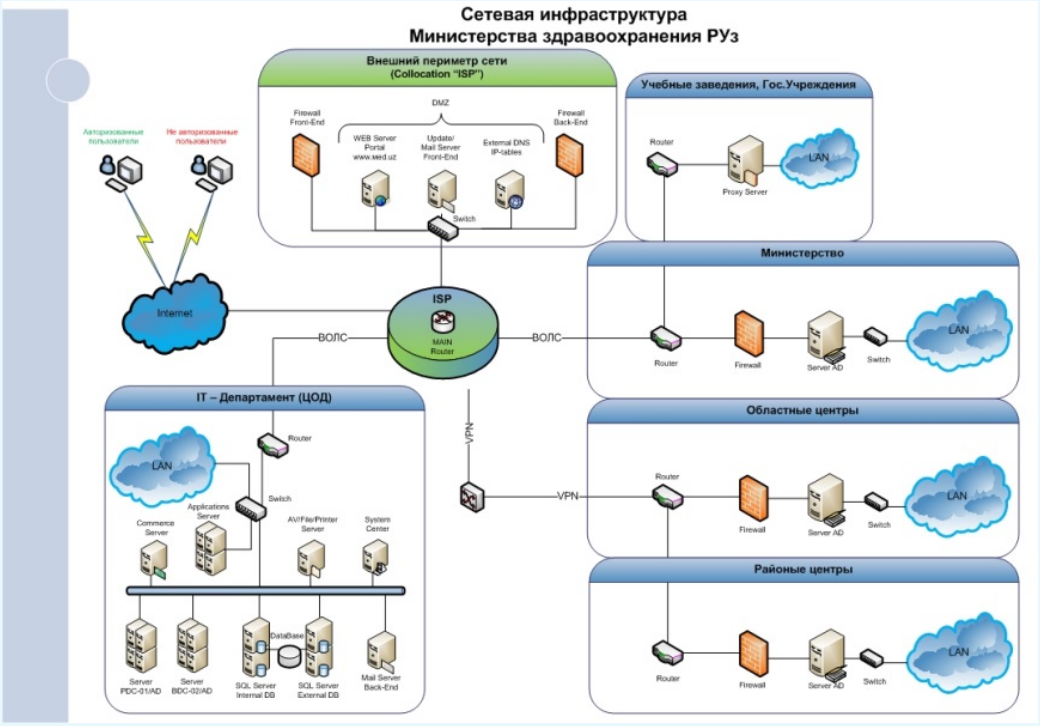
Integrated Health Management Information System means a multi-tiered system consisting of software and hardware in departments and divisions of the Ministry of Health, medical institutions, laboratories, sanitary-epidemiological surveillance departments, research institutes and universities as well as in departments/units of medical statistics. The development of the Health Management Information System should be based on the use of Internet technologies and integration of all available information resources into a single corporate network of the Ministry of Health.

The Ministry of Health approved the concept of HMIS (Decree №99, March 31, 2009) after detailed considerations and evaluations. It was selected a star type architecture of HMIS with the Data Center located in Tashkent based on open integration-communication platform. The structure of HMIS is presented in Figure 18. The decision to select the centralized architecture was well justified at this moment because the environment is not well prepared for computerization and it is needed some control. The Healthcare Integrated Platform is the common telecommunication and information infrastructure and it is a backbone of HMIS. It will be built component-wise, mutually connecting all entities into powerful common infrastructure. Of course, each entity has its own Local Area Network (LAN). This approach also allows adding or subtracting any component as appropriate and needed. It is important to stress that one of the main advantage of such architecture is scalability.

The all organizations belong to the Ministry of Health will transmit their information according to the agreed protocol directly to the Data Processing Center which is the repository of all information of the Ministry. The Data Center will be connected with all information systems and databases such as “Management and planning of human resources of health care system”, “Monitoring of infectious diseases”, “Basic register of blood donors and persons not permitted to donate”, “E-passport of health facilities”, etc.

[23] Contribution: Mirodil Baymukhamedov, Ministry of Health, Uzbekistan. See document SG02-INF-0039

Figure 18: Architecture of HMIS in Uzbekistan



Openness and standard pursuance of selected HMIS architecture enables interconnection of any other kind of register or database that healthcare service process requires. Furthermore, central system management reduces administrative costs.

The Data Center will get raw data without any intermediate levels and process it into required format, presentation or report. Data Processing Center (DPC) of Ministry of Health, which will be the heart of the HMIS should also include a Service Center and Call Handling, which is a standard feature of any data center. The access to the information will be restricted and regulated.

The advantages of this architecture are the following:

- Direct transmission of primary information in the database eliminates the possibility of modifying the original raw data.
- Instant display information in real time by any criteria.
- A single data repository eliminates duplication.
- Paperless process will bring some saving.
- Only the owner of raw data has a right to make correction of his presentation.
- Manager will get a chance to view the situation at any time.
- Quick search of any information related any region & Sampling only interest criteria.
- Universal access via the Internet (Intranet) in the presence of access rights.
- Complete elimination of middlemen, who collect and aggregate data.
- High level of security.
- Opportunity to get quickly any analytical or statistical reports.

1.18.2 Activities Undertaken by the Ministry of Health

In line with the approved HMIS concept and according to available resources, the Ministry of Health is providing the number of servers and computers to organizations in order to connect them to corporative information network.

The Ministry of Health decided to establish a database and distribution of computer equipment based on the concept adopted, with phasing for connection of each organization to the corporate network of the Ministry. The introduction of some e-Health services is considering as well.

The main objective of e-Health services is to provide expert medical help to the people situated in rural and remote areas where highly qualified and experienced doctors are not available. Improvements in all aspects of information and telecommunication technologies are enabling health and healthcare organizations to share information electronically across previously impossible distances and borders, and bring clinical practice and administrations alike to the healthcare staff in any location. New technologies are emerging and rapidly maturing. In some cases even faster than users can absorb and integrate them.

The introduction of the telecardiology monitoring service (and other e-Health services) will give the opportunity to provide quick and highly needed service at a distance for many patients suffering from cardio-vascular and other chronic diseases.

1.19 Zambia: Project MWANA

[24]Project Mwana is one of e-Government service that Ministry of Health has implemented with the help of the cooperating partners to improve early infant diagnostics services, post-natal follow up and care using mobile phones.

1.19.1 Country Overview

Zambia has shown growth in attracting investment in the Information and Communication Technologies (ICT), Sector. The sector has recorded over 42 percent penetration rate growth compared to 0.02 percent recorded 14 years ago. The ICT sector have continued to pour in since the country launched the policy in 2007 adding that the policy has created an environment for the growth of the sector. Mobile manufacturing company and various internet and mobile service providers are some of the investments that the country has attracted. The unfortunate scenario is that most of development are concentrated along the line of rail, leaving large areas in the rural and remote place unserviced or underserved.

In Zambia, large numbers of infants are infected with HIV either at delivery or when breastfeeding. If no interventions provided, most of these children who contract HIV from their mothers die before the age of two years. These deaths contribute to the high levels of national under-five mortality rate. The government made it mandatory to test every infant born and begin treatment within the first twelve weeks of life.

The challenge faced by the Ministry of Health in particular area was how to transmit infant diagnostics services results from the three (03) test centres (Laboratories) in the country to the respective remote places within the shortest possible time. The turn-around time under the courier systems available would take an average duration of forty-two (42) days to complete the process, a period too long for a mother wait without breastfeeding. This challenge led to the birth of Project Mwana in 2009.

[24] Contribution: Beaton Sibulowa, Ministry of Transport, Works, Supply and Communication, Zambia. See document SG02-C-0215

Objectives and Strategies:

- To strengthen early infant diagnosis with an aim both to increase the number of mothers receiving results and to reach mothers in a faster, more efficient manner using the SMS application (m-Health).
- To improve the rate of postnatal follow-up, increasing the number of birth registrations for clinic and community births, while also raising the number of clinic visits for mothers through community-health worker tracing using the "RemindMi" application.
- To enhance service delivery of government to its citizens.
- To reduce bureaucracy, turn-around time in providing government services.

Activities Implemented:

- Procurement of ICT Infrastructure (Servers and Connectivity) for the project.
- Development of Project Mwana using RapidSMS, a free and open-source framework for building mobile application for dynamic data collection, logistics coordination and communication, leveraging the basic short message service mobile technology.
- Piloted in the project 6 provinces across Zambia, servicing 31 clinics and the pilot evaluation showed that it had substantial positive health impacts.
- Scaling the project nationally between 2011–2015.

Technologies and Solutions Deployed:

- SMS technology – powerful innovation that in Zambia has reduced delays in receiving early infant diagnosis (EID) DBS HIV test results, improved communication among health care providers and community volunteers, and more important, encouraged patients to return to the clinic for their test results with greater confidence.
- RapidSMS Technology – addresses Early Infant Diagnosis (EID) of HIV. SMS messages are used to send the HIV results from the labs where they are processed to clinic workers in facilities where the samples are collected. The results arrive on phones in smaller clinics and SMS printers in larger facilities. The system also tracks samples and provides real-time monitoring for the province and district officials.
- RemindMI RemindMi addresses Patient Tracing for post-natal care. SMS messages are sent to Community Based Agents who seek out caregivers and infants and ask them to return to the clinic for 6 day, 6 week and 6-month post-natal check-ups or special circumstances, such as results arriving at the facility.

Changes and Outcomes Achieved

Project Mwana RapidSMS pilot reduced delays in transmitting results from the HIV test laboratories to the rural health facilities via SMS message from the average of 42 days to an average of 4 days. To date, the project has been piloted in 31 predominantly rural districts of Zambia and has produced desired results, which has prompted the government to schedule a national scale up program.

1.19.2 Challenges and Success Factors

Challenges:

- Ownership of the project prior to initiation, and coordination among the partners.
- Sustainability of the project after scale up and when cooperating partners hands over the project totally to government.

- Lack of investment in research and development in ICT.
- Digital gap between the Urban and the rural areas.
- Socio-economic disparitie.

Success Factors:

- Leadership taken by government on the project & Government beginning to fund the large component of the project

1.19.3 Lessons Learned and Next Steps

- Government leadership
  - When undertaking a project in the government, Users should be involved from the beginning project. This step helps in understanding user requirements and processes involved to complete tasks.
  - There is need to integrate the project into long-term planning.
  - Integrate data into district reporting.
- Locally sourcing – Employ a permanent local software development team; Have a permanent project manager who can coordinate partners; Create government-led working groups.
- Cost control
  - Negotiate with telecom companies for scale, not pilots.
  - Utilize the phones people have rather than purchasing and supporting a national phone system.
  - Create district-level training teams.
- Co-creation
  - Make decisions based on identified needs of the end users.
  - Create the tools with the people who are going to use them.
  - Test early and often; don’t worry about failing and stay adaptable.
  - Use open source tools that can be customized to local needs.

1.19.4 Next Steps

A national scale-up plan has been developed, commencing with a preparation phase and then shifting to an iterative phase where clinics are trained and added to the system and the problems and successes of the additions are evaluated. The aim is to achieve national scale by 2015, with health facilities offering early infant diagnosis services. The preparation phase will focus on solidifying the technical, physical, monitoring and human infrastructure to allow the system to handle the stresses of scale. Throughout the scale-up process, the project will be closely monitored to ensure the systems are having a positive effect on the targeted health challenges.

Annex II: Lessons Learned from e-Health Implementation: Knowledge

The following examples of strategies and implementation of e-Health services and devices were cordially provided by members of ITU-D Study Group 2 Question 14-3/2.

2.1 Czech Republic: 1. Interoperability in Integrated Biomedical Systems

[1]Our work on biomedical research projects has led us to the conclusion that successful integration of partial solutions is strongly dependent on the issue of interoperability of medical devices and information systems. It comprises problems of standardization of data acquisition, communication, processing, and storage; and connected problem: correct data mapping between different ICT applications. The key issue is the ability to understand the semantic content of the exchanged information.

With development of more advanced sensors, body area networks and ICT the focus will be on the integration in larger systems collecting and processing large volumes of data, evaluating more complex situations and scenarios, precise identification of potentially dangerous situations and finding solutions (e.g. alarms in case of health or life threatening events, access blocking in case of security attack). Key issue is in information reporting and visualization (as widely used in Business reporting). Although many issues have been successfully solved and introduced either in applied research or in development of prototypes or final products there are still many problems on the waiting list. There is a possibility to use an integration platform; however the systems should be able to communicate directly using world-wide recognized standards without third party.

2.1.1 Technological Trends

If we want to develop flexible e-Health, assistive technology (AT) or ambient assisted living (AAL) systems we have to define standard interface that allows “plug-and-play” type of connection. Especially AT and AAL systems are composed of different hardware and software modules that must communicate. The basic condition is that the receiver understands correctly the content of the message. Thus it is not sufficient to be able to receive the message, i.e. to understand the syntax of the message, but it is necessary to understand the semantics. This requirement implies development of data model that maps semantic content from the data received from the devices into an information system that is usually used for collecting and evaluating data from monitored persons. Also there must be guaranteed latency of the information transition and a possibility to verify the source of the message (for example by PKI infrastructure) and to clearly determine the time order of messages. We propose a system architecture allowing above mentioned interoperability. Interoperability may significantly influence effectiveness both of design and development of an integrated system and of its routine operation.

Integrating information deriving from different sources and implementing it with knowledge discovery techniques allows medical and social actions to be appropriately performed with reliable information, in order to improve quality of life of patients and care-givers.

Currently the mobile technologies, sensors and other devices enable collecting vast amount of data of individuals. This multi-parametric data may include physiological measurements, genetic data, medical images, laboratory examinations, and other measurements related to a person's activity, lifestyle and surrounding environment. There will be increased demand on processing and interpreting such data for accurate alerting and signalling of risks and for supporting healthcare professionals in their decision making, informing family members, and the person himself/herself.

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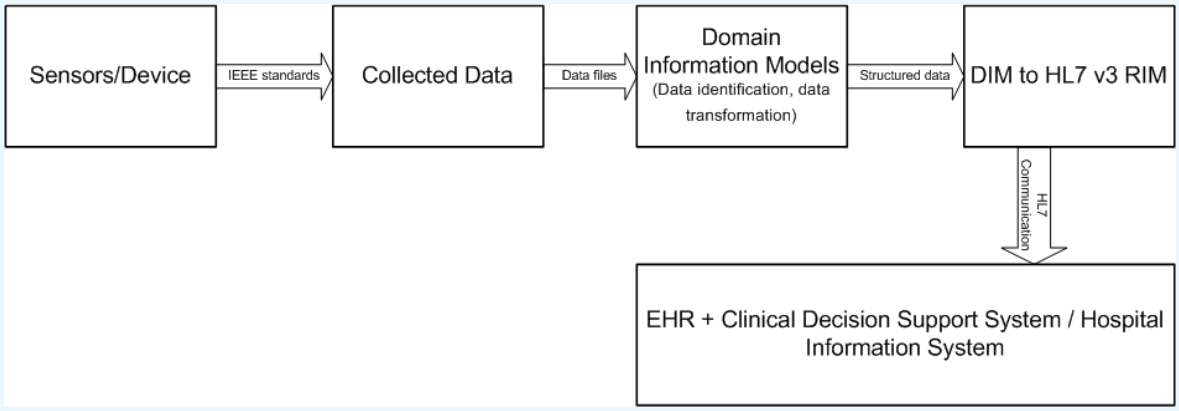
[1] L. Lhotska (1, 2), M. Bursa (2), and M. Huptych (2) [1] Czech Society for Biomedical Engineering and Medical Informatics & [2] Czech Technical University in Prague, Department of Cybernetics, Czech republic. See document RGQ14.3.2-C-0014

Recent development in ICT [1] [2] shows that it is almost impossible to design and implement a complex system as fixed to certain hardware, operating system, and infrastructure. A possible solution is to create a tiered integration platform. However it is usually ineffective and expensive (to create and maintain). Thus it is necessary to develop such architectures that will be easily extensible and modifiable. For easy extensibility the basic requirement is to understand data exchanged between individual parts of the system.

2.1.2 Proposed Architecture

Based on the facts mentioned above we have tried to define requirements and subsequently system architecture that would satisfy these requirements. The proposed architecture [3] covers the whole chain from data acquisition/measurement over data collection, identification, transformation up to evaluation and storage in an EHR system (see Figure 19). From the description it follows that there must be interfaces between individual modules. To allow the "plug-and-play" approach the interfaces must be.

Figure 19: Proposed architecture of the chain from medical devices to EHR and HIS



Based on well-defined standards, we have in mind especially following categories: ISO units for measurement of physical quantities, ISO IEEE standards in communication, standard file formats in software area, HL7 standards on the side of information systems and guarantee data accessibility even after long time when there would be data for long-term clinical studies. Another inseparable part of the architecture is constituted by data models. The models will ensure correct exchange of data between devices and information systems. This part represents a great challenge and at the same time the greatest space for future solutions because the correct mapping of acquired data onto a data model that describes electronic health/patient record is not satisfactorily solved yet. A crucial part is to select proper backend solution (such as information systems, databases, platform, etc.). The architecture must also keep pace with the versioning of the information models. Each batch of data must reference the version of information model that was active at the moment the data was acquired and the model must be available together with the archived data.

The proposed architecture is not necessarily centralized. It can be composed of highly distributed units utilizing, for example, multi-agent platforms as software infrastructure [4]. For example, it can be used for more efficient data handling. For data storage there can be smaller local storages and a central data storage used for different types of data. Also replicated and/or distributed storage can be used. Since there can be collected health state data and daily activities patterns the large volumes of data can be stored locally and based on the data analysis during system development the professionals (e.g. medical doctors) can define, which type of data should be sent to a central data storage maintaining electronic health care records.

2.1.3 Current State in Czech Republic

Legislation

The state of interoperability in biomedical systems is strongly influenced by legislation. Currently the law on sensitive information has been introduced with no regard to current e-Health and EHR development in EU and from many aspects it blocks the e-solutions even in government projects. Regarding the Health Records, there is regulation that covers health documentation in paper form only. No legislation exists regarding the EHR. There has been a pilot EHR project (called IZIP), however the funding has been suspended and the project represents only a health-book merely. The IZIP project did not use any interoperable standard and the application data interface is not available, so no third party can take advantage of it. Moreover, no developers of hospital information systems (HIS) are forced to use any interoperable standards.

Communication

Although the meetings regarding e-Health are taking place, usually no consensus is reached as there is a lack of communication and the conversation usually gets stuck at unimportant details. The government representatives do not act as active intermediates between IT and medical experts. Also there is not sufficient participation from the standardizing organizations. The e-Health is not presented to the medical experts and public in understandable form. They see more an bureaucratic burden then any advantage. From our experience in working with medical doctors, there is usually no use of explaining highly-sophisticated technical issues. It is better to present a GUI of an application, schematic diagrams and demos.

Financial Issues

There exist many opinions against interoperability implementation. At the first place there is usually the financial aspect: IT developers, government, health-insurance companies, medical facilities and even patients are asking the crucial question regarding financing. The need of functional e-Health solution is often overlooked without understanding the negative consequences. As mentioned above, there it lacks a constructive debate and communication in the direction to patients and the society that would unify the heterogeneous groups.

2.1.4 Conclusions

With respect to future development and possibility to sense and store far more larger volumes of heterogeneous physiological parameters the issue of interoperability becomes more and more important. Interoperability may significantly influence effectiveness both of design and development of an integrated system and of its routine operation. It will become more and more important with the development of telemedicine, home care and possibility of remote monitoring of patient state. As the technology is developing very quickly we have to assume that new types of sensors and devices will appear. The newly designed and developed systems must be necessarily created as open modular systems allowing direct connection of the new sensors and devices without any need of modification of the communication and data input. Possibly new data processing module will be added. However if we only replace an old type of sensor by a new one delivering the same data (concerning semantic content) in higher quality there should not be any need for changing the software part.

Presented issues show that successful applications need coherent approach of experts from many different disciplines, i.e. information technology, electronics, communication technology, medicine. Standardization can make the way from an idea to an application much easier and faster. Thus acceleration of standardization process represents a key issue. It is important that involved companies, researchers, and standardization bodies agree and cooperate towards the ultimate goal – defined standards. There has not been space to mention the expressive power of ontologies, their flexibility, extensibility, and their potential in various applications in biomedicine. We should be aware of their potential for future applications. It is expected that new tools will be developed that allow more efficient work with ontologies, including development of virtual ontology libraries, or ontology visualizations. We

should also mention the inevitable spread of no SQL databases. These might find their use in the EHR solutions due to their inherent properties.

For the Czech Republic, there is no informative material that would present medical experts the advantage of the electronic solution and persuade them that the change can be carried out with minor invasion. The question is whether the impulse should come from government, medical experts or even patients. There is missing a communication based on the view from the position of the patient that might influence medical doctors, medical doctors would apply to medical insurance companies, medical insurance companies to the government, etc. Currently there is no solution for m-Health, so there is perfect opportunity to start from scratch with correctly defined interoperable structure using widely acknowledged standards.

Electronic signature is widely used and understood. However the medical records should also have a guaranteed timestamp that reflects the order of data-change. The permissions and authorizations for manipulation of medical data together with defined responsibility need to be defined.

Acknowledgment

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[4] L. Lhotska, and O. Stepankova. Agent architecture for smart adaptive systems. Transactions of the Institute of Measurement and Control. Vol. 26, pp. 245–260, 2004

2.2 Japan: Case 1: Best practice of SaaS type medical network solution in Japan

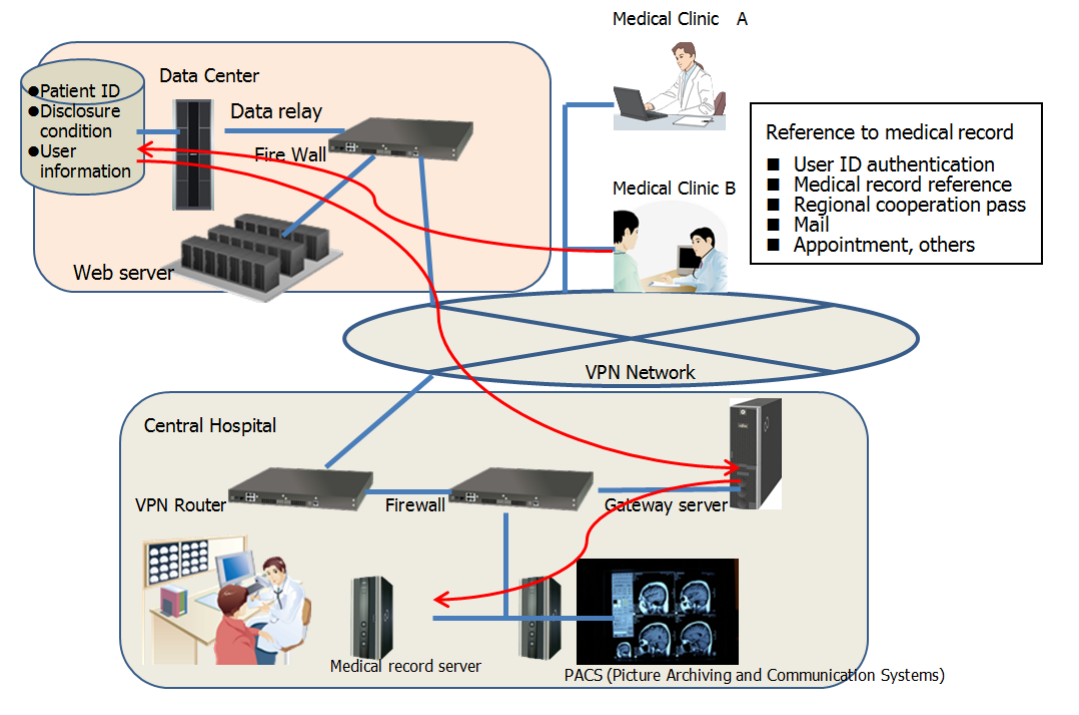
2.2.1 Background

- [2]There are increasing needs and financial concerns for healthcare services for the aging societies in Japan. ICT is one of the important tools to solve these issues. Fujitsu Limited introduced the SaaS type regional medical network solutions as a platform to share the medical information for the collaboration among healthcare related parties.
- In the developing countries, there are shortages of doctors and facilities for medical services, and the gaps between rural and urban areas. Telemedicine is one of the ICT applications expected to work effectively to improve the situation.
- We introduce the SaaS type medical network solutions in Japan for the study of its effectiveness in the different countries.

[2] Shigehiko Yasumura, Fujitsu Limied, Japan. See document SG02-C-0184

2.2.2 Overview of SaaS Type Medical Network Solution

Figure 20: SaaS type medical network solution



- As the medical record or other patient information are valuable personal information, it is necessary to keep such information secured from the threats, such as leakage and manipulation, vicious stoppage of services.
- The system (Figure 20), keeps the patient information stored at the original medical institutions where the patient information was recorded. When a doctor of other medical clinic would like to see the information remotely, he or she should access Data Center as an intermediate connection center. The Data Center will only provide gateway function without storages, and you will be released from the security risk for keeping the precious information outside of hospital.
- Off course, the Data Center is protected with strong facility management and security counter measures so that the medical institutions can use its services safely.

2.2.3 Key Benefits of Services

Applicable usage for developing countries

- In developing countries, the shortages of medical doctors and medical facilities and equipment for inspections or treatments are critical issues, especially in remote areas.
- Therefore, it is useful to realize the seamless medical cooperation among the doctors and medical institutions in rural and urban areas. Together with the telemedicine, this kind of service will help the patients to access the advanced medical service at major cities and the results can be shared with the local doctors.

Advanced features

- This system will enable relevant medical institutions to access the patient information, such as medical record, inspection report, MRI and other images, etc. according to the predetermined

condition of disclosure. Using this service as the common data base for hospitals, clinics, pharmacies, etc., we can provide the cost effective value-added advanced services to patients.

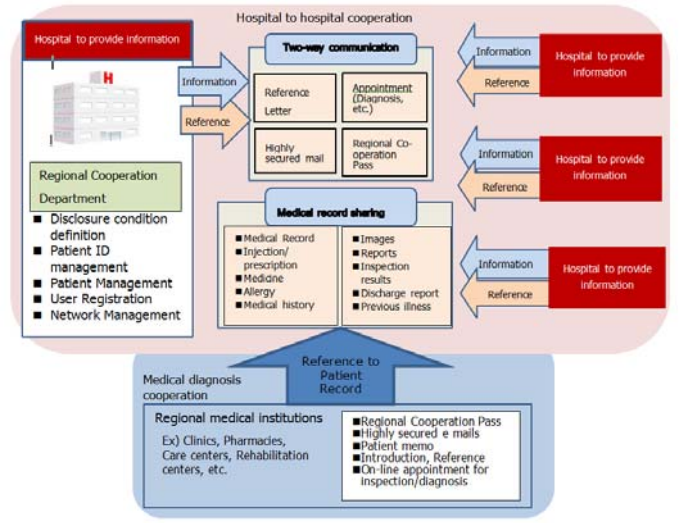
- For example, “Forwarding Cooperation” (name of service) is the introduction of patient from a clinic to Central hospital for advanced medical treatment and “Backward Cooperation” is the introduction of patients from Central hospital to clinics or Care centers so that the patient in the recovery process can use suitable rehabilitation facilities or would be introduced to home doctors for daily cares.
- For the advanced inspections such as MRI, the appointment with the special doctors of MRI can be made with the relevant information through the system. The MRI images can be reviewed at clinics remotely on the same day of such inspection.

Figure 21 shows the possible information sharing and medical support features.

2.2.4 Conclusion and further action items

With the use of SaaS type medical network solutions, we can realize medical care network connecting the servers and equipment at various medical institutions and share the information stored in the servers at each location. This will enable the effective use of advanced medical equipment and connection between rural and urban areas.

Figure 21: Key functions



- To make the best use of the service, it is important to improve the availability, convenience and cost effectiveness so that the service will be used more frequently. By adopting the industrial standards, such as SS-MIX (*1) standardized storage and DICOM (*2) and others, we can cooperate with various vendors to increase the availability and cost effectiveness.
- After the Great East Japan Earthquakes, from a view point of BCP (*3), there is an increasing need to keep the data such as medical record in the secondary safety places. We should study further the solution for disaster management such as data back-up services.

Notes:

*1) SS-MIX: Standardized Structured Medical record Information eXchange. SS-MIX promotes the electronic processing and standardization of recorded medical information related to all the medical institutions.

*2) DICOM: Digital Imaging and COmmunication in Medicine. A standard developed by ACR and NEMA to define the format for medical images, such as CT, MRI and CR, and the protocol of communication between medical imaging equipment.

ACR: American College of Radiology

NEMA: National Electrical Manufacturers Association

*3) BCP: Business Continuity Plan. It is a plan to minimize the damages on the business assets and to keep the core business continuing or the prepared plan for early recovery from the damages in case enterprises face the emergency situations, such as occurrence of natural disasters.

2.3 Japan Case 2: Development of the Electronic Doctor's Bag

2.3.1 Introduction

[3]Japan, regarded as a super-aging society, must consider how to suppress the coming inflation of nationwide medical cost in the very near future. Moreover, a declining population in rural areas is accelerating the disparity of health care services.

To tackle these problems, the Japanese government is promoting the policy to encourage home medical care. The home care support clinic system, which intends to spread clinics operating house visit services on 24-hour schedules, was established in 2006. However, in the case of a small clinic, a physician may be forced to work in a sleepless and hard working environment. And transportation times to patients' homes reduce the efficiency of medical care.

On the other hand, information and communication technology (ICT) is a possible strong means to solve these social problems. Our research group established a consortium, "The Consortium for Medical Information Communications System in the Mobile Environment", on March 4, 2009. The consortium consists of a university and seven companies, and its main purpose is to provide the ubiquitous communications system for home-visit medical service, mass examination, emergency care and disaster medical care. In collaboration with the Sendai Area Knowledge Cluster Initiative supported by the Ministry of Education, Science, Culture and Sports, the consortium has newly developed a prototype of the ubiquitous communications system named "Electronic Doctor's Bag", which can easily send biological information with high-definition image of a patient in mobile environment. The main purpose of this system is that a nurse with the Electronic Doctor's Bag visits a patient's home instead of a doctor, but an equivalent face-to-face communication can be realized between the doctor in his clinic and the patient at his home, respectively.

The first prototype, which is called "P1" here, had been developed and evaluated by a few doctors and nurses. Their opinions were used to improve the system. In January 2010, the second prototype "P2" was developed and tested. In this report, the validity of the Electronic Doctor's Bag, including both prototypes, is reported.

2.3.2 The first prototype of the Electronic Doctor's Bag (P1)

System configuration

The features of the proposed system are as follows:

- Secure telecommunication is established between a patient and a doctor using personal authentication and encryption technologies.

[3] Isao Nakajima, Department of Emergency and Critical Care Medicine, School of Medicine, Tokai University, Japan. See document RGQ14.3.2-INF-0012

- In addition to submitting biological information such as electrocardiographic (ECG) and blood pressure, pseudo face-to-face clinical examination can be achieved by sending high-definition images of a patient.
- The system is available in the mobile environment. So it is possible to examine in a patient's house without the Internet setup or in a moving vehicle such as an ambulance.
- The system can flexibly meet the diverse health care needs of various conditions and diseases in combination with portable measurement devices.
- The system can control biological data or medical records as digital data because it is based on a personal computer. Thus, it will be able to be used in conjunction with electronic medical charts and online medical bill processing systems in the future.

Here is shown the use of P1. First, personal verification of a patient is done with a non-contact type IC-card "Felica" to avoid mixing-up patients. Secondly, high resolution video picture of the patient is taken to verify his state such as complexion, skin trauma, motion of joints and gait. The video is highly compressed and coded for preserving individual security and is sent to a medical doctor staying in his clinical office via the mobile network and the Internet in a real time fashion.

The proposed system targets the diagnosis of general chronic diseases such as circulatory disease, diabetes and respiratory organ disease. Therefore, in the system, not only the patient's video image but also various kinds of biological data can be measured with portable measurement devices such as the 12-lead ECG monitor, a blood-pressure meter, a blood sugar level meter and an ultrasonic diagnostic system. Most of these devices are connected directly to a main body of the Bag via general interface such as USB. The biological data is also sent to the doctor's computer after compression and encryption as well as the video image.

Experiments using P1

Experiments using P1 were performed at two clinics and one regional center hospital with three medical doctors and two nurses to test the validity of P1 under the assumption that a nurse visits a simulated patient's home for a medical care.

As a result of the experiment, it could be verified that video images transmitted by P1 were useful for checking the patient's state from the view point of the medical doctor. And the function of almost automatic transmission of biological data: ECG and blood pressure was highly evaluated by the nurses. However, they assessed that the setting procedure of the video camera and the connectivity of the main body of the Bag with the peripheral devices and the electrical power unit should be improved to be much simpler. In particular, it was found that setting and operation of the video camera may prevent the nurse from taking care of the patient and performing other usual medical tasks.

Improvements of the Electronic Doctor's Bag

In consideration with the evaluation results of P1, the Electronic Doctor's Bag has been reviewed. The device that the nurse carries has been improved mainly in its portability (Figure 22) and the unit that the doctor uses has been simplified because of the introduction of a central streaming server.

I mprovements in the new system (P2) are as follows:

a) Personal authentication

A vein authentication tool is adopted in P2 instead of the IC-card which was adopted in P1. Such a biometric tool reduces risks of the loss of the card and mixing-up among patients.

b) Interface for transmitting the ECG data

ECG data is submitted to the main body of the Bag via Wireless LAN to enhance the operability. A mobile router for the Wireless LAN is incorporated in the Bag.

c) Video camera

A digital video camera used in P1 had high performance such as the function to avoid blurring of images due to hand movement but it was heavy and not easy to operate. In P2, a light weight and inexpensive web camera is adopted to improve the operability.

d) Ultrasonographic monitor

Some medical doctors who evaluated P1 pointed out that the portable ultrasonographic unit used in P1 did not have enough image resolution to check cardiovascular states of the patient. In response, a new portable ultrasonographic unit with high resolution is adopted in P2.

Figure 22: The second prototype (P2) of the Electronic Doctor's Bag

e) Central streaming server

In P1, the dedicated server "Digital Gate" which controlled communication between the Bag and the doctor's PC had to be located in each clinic. On the other hand, in P2, this server has been replaced with a central streaming server located in a server center. This change enables plural doctors to receive the data of the same patient simultaneously anywhere and all over the world by accessing the central server via the Internet. Furthermore, this enables the doctors to refer and share the patients' previous data.

f) Split-screen display

The video image from the ultrasonographic unit and that from the video camera are submitted to the central server and these two images can be displayed on one screen of the doctor's PC. This function enables the doctor to check the position and the posture of an ultrasonic probe operated by the nurse while watching the echographic image.

In addition to the doctors who had evaluated P1, we asked another two doctors, who were working mainly in home visit medical services, to evaluate P2. As a result, most of the doctors gave a good evaluation on the basic function of the system, but required further improvements in the portability and operability to put it into practical use. And there was a problem that the proposed system was strongly affected by the quality of mobile communication network. This means that the streaming video of the patient can be broken up at worst when the Bag is connected to a busy network. For this reason, P2 should be used in consideration of a place and hours that affect the communication speed. In the future, the Bag should incorporate a technique of switching the mobile network to connect automatically and dynamically based on communication volume. And it is necessary to develop a database for patients to use, a system for cooperation among medical doctors and a link to the database of electronic medical charts.

On the other hand, the proposed system may be applied to some healthcare services other than home-visit medical service, i.e., healthcare rooms in schools or companies, mass examination, emergency care in ambulance cars and so on. In particular, if emergency medical technicians on ambulance cars can submit high-definition video images of patients' body or their echographic images to doctors in a hospital, these data will be a very useful for procedures or treatments in the hospital.

2.4 Japan: Case 3: Mobile Support Tool for Doctors

2.4.1 Introduction

[4]EMR systems are becoming popular in medicine (A.L.Rector. 1996, Anderson JD. 1999, David W. Bates et al. 2003, Samuel J. Wang et al. 2003, Jim Johnson. 2010). This is because such systems enable doctors to manage mass medical data easily. As represented by POMR (Weed LL. 1968), medical record systems have been expected to support doctors' planning. However, most of these EMR systems are only capable of performing electronic data storage of legacy medical records. To help doctors analyze medical data that are generated over time, the system has to have the ability to present medical data that occur over various time spans. Because medical data often occur over various time spans, doctors have to study it over various time spans when performing a medical analysis. With current systems, doctors can look at medical data for only a few days at most. Accordingly, they cannot analyze medical data effectively. In addition, there is another problem that doctors do not have much time to use the EMR at their desks. As a result of these problems, doctors require a system that can support their cognition and medical analysis regardless of where they are. In view of these problems, we developed a brand new EMR system that supports doctors' understanding and medical analysis. This system has the features listed below:

- It has the ability to present medical data that occurs chronologically over various time spans.
- Its client application works on mobile devices such as a mobile phone or a tablet PC.
- In spite of the narrow bandwidth of wireless mobile networks, the system responds quickly.

In this paper, we introduce the conventional EMR systems in section 2 and explain their problems. In section 3, to solve these problems, we introduce the Mobile Timeline EMR System and its technological features.

2.4.2 Conventional EMR Systems

In this section, we introduce the conventional EMR systems. Typically, a conventional EMR system has a user interface similar to legacy medical records written on paper. Also, it displays the patients' SOAP information and the patient's information for one day. With these systems, by treating medical data as electronic data, doctors can search and manage their patients' medical data easily. This ability of mass data management is a significant advantage compared with legacy medical records. However, there are various kinds of medical data that are generated over various time spans. Thus, with these systems, which can make medical data available for only a few days, doctors cannot always look at it and infer the relationships that may exist among the various data. In other words, though doctors can look at and understand the state of patients who come for consultations two or three times with these systems, doctors are unable to examine and understand the state of patients who may have been suffering from certain conditions for years, such as asthmatics, diabetics or patients suffering from hypertension. Accordingly, these systems are unable to attain the purpose of supporting doctors' analysis and understanding.

2.4.3 Mobile Timeline EMR System

As described above, in order to meet the need to support doctors' understanding and medical analysis, the system must have a function to present medical data that are generated over various time spans and allow doctors to look at medical data from any perspective. In order to solve this problem, we have introduced a timeline interface. The timeline interface has a multistage time scale including years, months and days. With a timeline interface, the system can present chronological data over various time spans.

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[4] Keisuke Ogawa, KDDI R&D Laboratories Inc., Tokai University, Graduate School of Medicine, Japan. See document RGQ14.3.2-INF-0013

In addition, in order to meet the demands for mobility and portability, we use a mobile device as a client of this system. By adopting a mobile device, the system gains a significant advantage in that doctors can analyze data anywhere. However, mobile devices have the problems listed below:

- Difficulty with input and reading using a small display.
- Low data transmission rate through a mobile wireless network.

To solve problem (1), we adopted an advanced word completion function using an optimized lexicon for each field of medicine.

For problem (2), we implemented the Adaptive Event Merge algorithm that reduces data transmission.

By means of the above, we can create a tool that is capable of supporting doctors' understanding and analysis wherever they are.

2.4.4 Timeline Interface

The timeline interface is the most important part of this system. With timeline interface, doctors can change the time scale to various time units. For example, doctors can change the unit time scale from hour to day or to month. By changing to a smaller time unit, doctors can observe medical data over a short time span in detail. Conversely, by changing to a longer time unit, doctors can look at medical data over a long time span. The length of the time unit can also be changed by pinch-in/pinch-out. The reasons why we use this interface are presented below:

There are various kinds of medical data. They occur over various time spans and they are interrelated in various ways.

If the different data are interrelated, the appropriate time scale for observation can be chosen. By selecting the appropriate time scale, the system can elucidate the relationships among the data.

For example, take the case where relationships can be discerned when data are observed over a long time span, where this would not be case if observation were to occur over a short time span. Conversely, there are other cases where relationships are not apparent when data are observed over an excessively long time span. Accordingly, the system must have a function that allows users to select the appropriate time scale.

With this timeline interface, doctors can change the time scale at will. Therefore, the various relationships between various data can be observed. In other words, doctors can examine medical data from various points of view.

In this manner, this system can serve not only as a tool for managing medical data, but can also support understanding and medical analysis.

Word completion using lexicon for medical data

The input method is not only an important factor that decides the usability of the system on mobile devices, but also a difficult problem. This is because mobile devices only have poor input accessories such as small touch panels and keyboards. In particular, in EMR systems, doctors have to input special characters for medical treatment using these poor input devices to write down the SOAP information or to search patients. To solve this problem, the word completion method using a lexicon of medical words is well known and effective (Laird S. Cermak et al 1992, C. G. Chute et al 1999, Hiroyuki Komatsu et al 2001). However, the words used in medicine differ significantly among the different fields. In other words, using the same lexicon for all the different areas of medicine would be limiting and inadequate. For example, the phrase 'nephrotic syndrome' is often used by paediatricians, but is rarely used by ophthalmologists. Accordingly, we have optimized the lexicon for each field of medicine. Simply put, we changed the bias of the TRIE (Donald R. Morrison 1968) structure of the lexicon for each field. Then for each field, by summarizing and analyzing the most common inputs from doctors in a particular field, the system succeeded in improving the accuracy of word completion.

Adaptive event merge algorithm

The response speed of the system is a very important factor for deciding the system's usability. The advantage of the timeline interface is, as we described above, the ability to visualize the relationships among medical data by varying the time scales. If doctors want to look at data over a long period, they can expand the time scale as they wish. However, the system has to display a lot of data objects at once. On the other hand, in this system, since its client is a mobile device, the client only has narrow wireless communication bandwidth. In order to improve the response speed in this system, we implemented an Adaptive Event Merge algorithm. This algorithm is a function that merges neighbouring data objects adaptively.

When doctors expand the time scale, if the time gap of the neighbouring data objects is smaller than the threshold, the system merges the objects into one object. In this manner, the system can reduce the amount of data transmitted and improve the response speed and usability.

2.4.5 Conclusion

In this paper, we introduced an EMR system based on a new concept. This system has a significant advantage in that it is able to support doctors' understanding and medical analysis wherever they are. The system has the three features described below. With the timeline interface, doctors can look at and analyze medical data using various time scales. This is a significant help for doctors' understanding and analysis. Since its client is a mobile device, the system can support doctors wherever they are. In spite of using a mobile device as a client, the system can respond very quickly. In addition to the features described above, as the system is easy to use, there is a possibility that the doctors can use it as an educational tool.

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2.5 Japan: Case 4 – The Network of Perinatal Telemedicine

2.5.1 Introduction

[5]Our company has developed and sells mainly electronic medical records for perinatal care and other health care systems since 2002. Company name of MITLA is derived from the Medical information technology laboratory. The history of research in the field of medical information is new in Japan. The history of the medical technology system in Kagawa prefecture has developed according to the Japanese governments agenda. I can tell that we have traced the history in the world of medical IT. We will focus on following four main topics, as a case of the perinatal telemedicine between Tono city and the centre hospital.

Here perinatal refers to the period before and after childbirth. According to ICD-10, the perinatal period which is defined as less than seven days after birth from 22 weeks gestation.

2.5.2 Background and Issues

The medical IT system being triggered by Kagawa prefecture is the project of the perinatal electronic medical records network in 1998. Recently Kagawa prefecture is known to K-mix that is the remote diagnostic imaging system. Various medical IT systems were created around the electronic medical records. MITLA has developed a perinatal electronic medical record named Hello Baby Program. The other hand, the number of obstetricians and gynecologists has decreased from 1984 to 2006. This has caused many problems to some regions of Japan. The most common is the Tono city. There are no obstetricians in Tono city, Iwate Prefecture. Pregnant women need a prenatal check-up once a month or more. For this to occur there was a medical centre built called Net Yurikago in 2007 (4 year ago). Here pregnant women can have regular checkups from midwives. If the patients have any worries or concerns she can talk to a doctor via the internet.

2.5.3 Telemedicine System Configuration

There are 2 servers used at the data centre. There is a pc and cell phone at the hospital and mid wives centre. At the maternity centre there also is a mobile CTG also used. MILTA monitors the system daily so that no problems occur. You can see here a picture of the mobile CTG Monitor (Figure 23 **a**). As you can see it's small and very light. I like you'd be surprised how easy it is to use. The data taken using the CGT which was sent to the doctor's cell phone and computer. The above graph shows the baby's heart rate and the graph below shows the mother's contractions in the display. For the while the doctor can access the patient's monitored data through the Hello Baby program (Figure 23 **b**). The midwife in the maternity centre meet pregnant woman and input checkup data to the Hello Baby program. Doctors can monitor the patient's data during the whole perinatal period (10 months).

[5] Yhuko Ogata, MITLA Co., Japan. See document RGQ14.3.2-INF-0014

Figure 23: a) Mobile CTG monitor and b) Typical display of Hello Baby program

a) b)

How to Operate the Telemedicine System

The patient uses the CTG system at home, which gathers the baby's heart rate and mothers contractions then this data is sent to the midwives, which is then sent to the hospital where the doctors can see the gathered data. This is very convenient because the midwife and doctor can both share the data. The doctor can see all the data at a touch of a button. This also caught the eye of doctors in America and there was an article written in the New York Times.

Figure 24: The network of perinatal telemedicine

Application and Development

Babies who use this system will have their lives monitored to the end of life. In addition, Tono city staff members believe it is important to measure and confirm health data for all its citizens. This is an example of a child's case. The mother inputs the child's data once a week until the child graduates high. This slide shows the establishment of the telemedicine information network system. Before the patients had to travel far from rural towns to see a doctor but now they can now use telemedicine to communicate with from home.

Acknowledgement

We would express our thanks to Professor Hara Kazuhiro from Kagawa University, Ogasawara Toshihiro, Hospital Director of Ohfunato Prefectural Hospital in Iwate Prefecture and Tono city staff.

2.6 Japan: Case 5 – The Novel Mobile Telemedicine System for Real-time Transmission of 12-lead ECG Data and Live Video from Moving Ambulance to Hospital

2.6.1 Introduction

[6]In Japan, a telemedicine system utilizing a car phone was first made available in ambulances in the 1990s. The original analog car phone was later replaced with a digital mobile phone, enabling the transmission of 1- or 3-lead electrocardiogram (ECG) and heart rate (HR) data from the ambulance to the hospital. Consequently, a large number of ambulances in Japan were equipped with this telemedicine system.

However, despite the ready availability of the system, a large number of the devices were not used widely or effectively. One of the reasons for this was the presence of motion artifacts and other noise in the ECG data.

This mobile telemedicine system did, however, seem particularly applicable to emergency and disaster situations, where medical doctors wanted to use ambulances and temporary shelters as consultation rooms for the urgent diagnosis of heart disease. In the event of a disaster especially, it is necessary to diagnose victims in such settings over a period of several months since many victims fall ill due to stress.

Even though a large quantity of data was transmissible by the information communication technology (ICT) system developed, it was difficult for doctors in the hospital setting, separated from the patients, to reduce the frequency of misdiagnosis. In emergency and disaster medicine, misunderstanding the medical data provided can often make the situation graver.

The question then arose: Why could medical doctors not reduce the frequency of misdiagnosis? This was entirely due to the fact that the doctor and patient were in entirely different settings. The doctor expects to use stable data obtained in a static consultation room for diagnosis, but receives unstable data with motion artifacts and other noise under dynamic conditions in the ambulance or temporary shelter. Thus, it became necessary to find an effective solution that integrates the two different settings of the static hospital and the dynamic ambulance.

To this end, we realized the multi-functional electrocardiograph “Radarcirc”, which transmits the patient’s live image and vital signs, such as 12-lead ECG, the analyzed ECG data, blood pressure and oxygen saturation (SpO2) data, to the hospital in real-time [1]. The name “Radarcirc” is derived from the fact that the device can detect circulatory disease exactly as radar detects an airplane. The system enables the medical doctors in the hospital to remotely control the camera in the ambulance. The most important function of Radarcirc is that is makes the measurement and analysis of 12-lead ECG possible even in the case of severe motion artifacts and during cardiopulmonary resuscitation (CPR) [2].

In this study, the anti-artifact ability of Radarcirc was examined and the significance of Radarcirc for integrating the different medical settings is discussed.

2.6.2 Materials and Methods

12-Lead ECG, SpO2 and blood pressure were measured by the Radarcirc (Dainippon Sumitomo Pharma Co., Ltd.) and these data were transmitted by a mobile telemedicine system (Dainippon Sumitomo Pharma Co., Ltd. and NTT Comware Corp.) using a FOMA telephone (NTT DoCoMo, Inc.) (Figure 25).

The function of Radarcirc is based on adaptable filtering and weighted-mean technologies (Figure 26).

The artefact-resistant function of Radarcirc was examined using data simulation. The simulated sine waves were added to the lead-II waveform from the ECG checker (Nihon Kohden Corp.). The sine wave frequency was changed from 0 to 0.3 Hz and the sine wave voltage from 0 to 3.2 mV. Figure 27 shows an example ECG with 0.3 Hz noise and a 3.2 mv sine wave.

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[6] Masayuki Hashimoto, KDDI R&D Laboratories Inc., Japan. See document RGQ14.3.2-INF-0016

Moreover, a comparison was made of the automatic recognition by Radarcirc and manual recognition by 5 medical doctors of the points Pa, Pb, Pe, Qb, Stj, Ta, and Te for 30 beats in the following 20 files stored in the ECG database, QTDB: sel 100, 103, 4046, 16265, 16272, 16273, 16420, 16483, 16539, 16773, 16786, 16795, 17453, 230, 231, 32, 41, 803, 808 and 811. The representative values for the automated and manual recognition were calculated for each file by averaging the data for the 30 beats. The absolute values of the difference between the automated recognized point and the manually recognized point were analyzed statistically. Significant differences were evaluated using Dunnett's multiple-comparison test, with significance set at $P<0.01$ or $P<0.05$.

2.6.3 Results

The adaptive filtering and weighted-mean technology realized robust low-cut filtering without waveform distortion (Figs. 2 and 3). When the frequency change from 0 to 0.3 Hz and the voltage change from 0 to 1.5mV were added, the waveform distortion was less than 1% in every case (data not shown).

In the comparison of automated recognition with manual recognition by the 5 medical doctors, there were no significant differences between the two representative values for automation and manual recognition (Table 1).

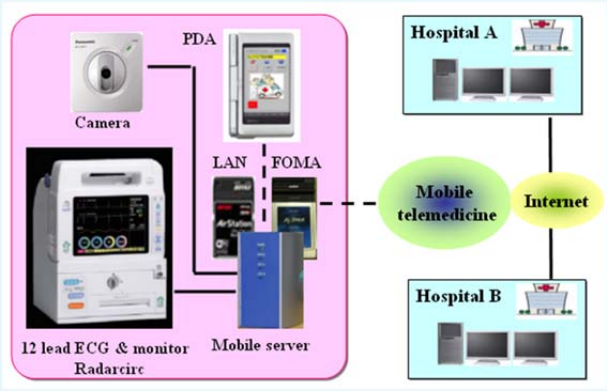
2.6.4 Discussion

The electrocardiograph and the electrocardiograph monitor are different devices. The electrocardiograph with its weak filters and low resistance to noise is used for the exact diagnosis of heart disease because there is no distortion of the ECG. The electrocardiograph monitor with its strong filters and high resistance to noise produces a distorted ECG and thus is used only for the monitoring of the patient's condition. Radarcirc technology realizes both functions – the electrocardiograph and the electrocardiograph monitor–simultaneously, enabling Radarcirc to analyze ECG during CPR [2]. This function is based on the adaptive filtering and weighted-mean technology.

The Radarcirc technology incorporated in the new device we examined here was born from FLUCLET technology [3]-[4], which was developed as an analysis system of heart rate and blood pressure fluctuations in animal and clinical experiments [3]-[6] through independent pharmacological research at Dainippon Sumitomo Pharma Co., Ltd. Thus, Radarcirc makes it possible to monitor and analyze every beat of the patient's heart even in the event of sudden external shocks and vibrations or in the presence of motion artifacts.

As mentioned above, communication between multiple persons in different circumstances in different settings can often result in misunderstandings, especially in emergencies involving doctors in the hospital (static setting) and emergency medical technicians in the ambulance or temporary shelter (dynamic setting). We aimed to solve the problems resulting from this separation by considering two important points. First, it is necessary for the medical doctor in the hospital to ascertain the patient's status in the dynamic setting freely. Second, it is necessary to convert the dynamic 1- or 3-lead ECG data with motion artifacts or other noise into static and detailed 12-lead ECG data without noise and distortion so it can be effectively used by the doctor.

Figure 25: Real-time mobile telemedicine system

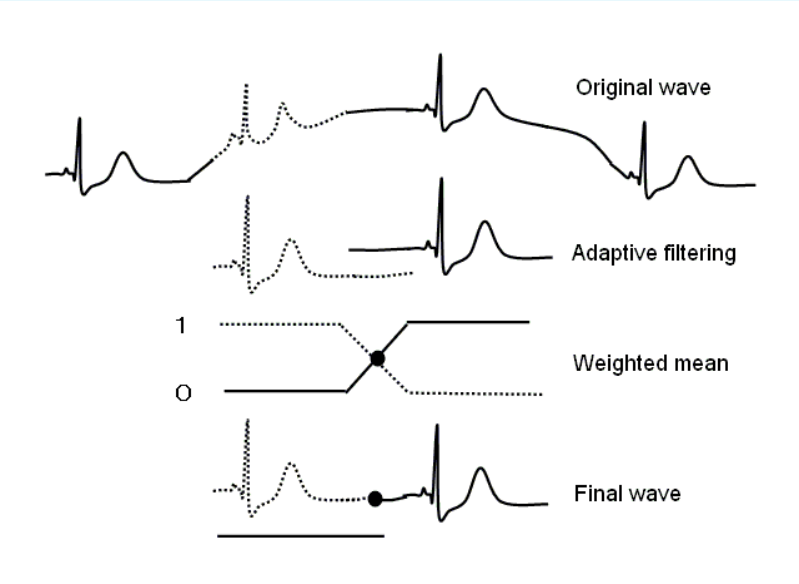


The breakthrough allowing us to address both these issues came in the form of progressing information technologies (IT) to advanced ICT. Advanced ICT meets the demands of practitioners to support communication and integrate information between different settings with practical meaning. In Japan, awareness of these issues was sparked by Kitaro Nishida in philosophical fields and are discussed and applied by Hiroshi Shimizu in scientific fields [7]. The integration of the different circumstances and settings is expressed in Japanese as the integration of “Ba”, a technical term that is now in frequent use worldwide.

The use of high-speed data communication alone is not sufficient to realize the integration of different “Ba” (i.e., the different circumstances and settings). Advanced ICT, however, seeks to employ an intelligence to integrate them. The integration of the different “Ba” by the combined technology of Radarcirc and the mobile telemedicine system provides a good example for the development of other advanced ICT systems in the future.

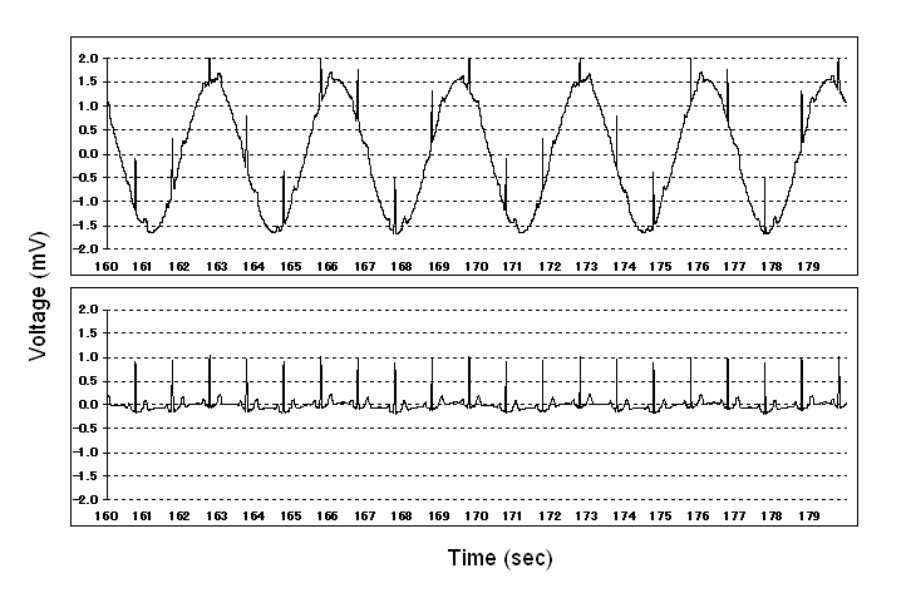
12-Lead ECG, SPO2, and blood pressure data are transmitted in real time by a FOMA mobile phone to the hospital servers via the internet.

Figure 26: Adaptive filter and weighted mean



An adaptive filter is used for each heartbeat. Each filtered ECG signal is connected smoothly at the point by the weighted mean method. For the final ECG signal, the ECG wave with a broken line is distorted compared to the other ECG waves.

Figure 27: Effects of adaptive filter and weighted mean for artificial noise



Upper panel shows ECG with artificial sine noise. The amplitude and frequency of the noise is 1.5 mV and 0.3 Hz, respectively. Bottom panel shows ECG after filtering by Radarcirc.

Table 1: Difference between automated and manual recognition for points in ECG database files

Recognized point of ECG	Pb	Pa	Pe	Qb	Stj	Ta	TE
Mean	2.2	1.8	4.7	2.5	0.2	1.3	0.9
S.E.	1.5	0.9	1.7	1.1	1.0	1.2	2.1
Statistical difference	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

At each recognized point, the absolute values of the difference between the automated recognized point and the manually recognized point were analyzed statistically (n=20).

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[7] H. Shimizu, "'Ba-Principle': new logic for the real-time emergence of information," Holonics, vol. 5(1), Aug.1995, pp. 67–79.

2.7 Japan: Case 6 – Telemetry for Wild Birds and Future Technical Expectations to Prevent Avian Influenza

2.7.1 History

[7]The ITU-D Study Group 2 Question 14 Rapporteur's Meeting for Telemedicine, hosted by the Ministry of Internal Affairs and Communications of Japan, was held at the Kokusai Bunka Kaikan in Tokyo on July 3–4, 2008. This meeting featured active discussions on the Statement of Appeal on an Integrated Information and Communications Network for Avian Influenza (commonly known as the Statement of Appeal on Avian Influenza), which was finally adopted after incorporating a wide range of suggestions and after repeated revisions and input, at the ITU-D Study Group 2 meeting in September of 2008.

The following actions relate to the application of telecommunication technologies to prevent and contain avian influenza, and for adoption and implementation of these actions under the Statement of Appeal on Avian Influenza.

[7] Masayuki Hashimoto, KDDI R&D Laboratories Inc., Japan. See document RGQ14.3.2-INF-0015

Summary of the Statement of Appeal on Avian Influenza (ITU-D Study Group 2 Question 14 Rapporteur's Meeting, Tokyo, July 2008).

2.7.2 Principle of Information Disclosure

Any governments and individuals involved must disclose information on avian influenza infection immediately upon its discovery.

2.7.3 Tracking Technologies

We ask ITU and associated governments and corporations to seek to develop technologies to track bird migrations, including nano telemetric devices, short- and long-distance RFID, data collection satellite systems, and so forth.

- Securing Radio Frequencies

The following tasks will be assigned during the implementation of tracking technologies:

- ITU-R: Priority utilization of frequency bands.
- ITU-T: Standardization of technologies.
- ITU-D: Provision of know-how free of charge to developing countries.

2.7.4 Integrated Information Network

ITU will work with WHO to create the Information and Communications Network for Avian Influenza, disseminating, to various nations, telecommunication technologies to prevent and contain outbreaks.

2.7.5 International Organizations

The relevant international organizations should work together with ITU to integrate various advanced ICT networks to prevent avian influenza outbreaks and to call on individual governments for participation in the network.

2.7.6 Establishment of Human Resource Training Programs

International organizations and governmental aid agencies are encouraged to provide educational materials, knowledge, and invitational programs to train specialists in related fields (telemedicine, especially for avian influenza tracking, information networks, etc.) in developing countries.

2.7.7 About Avian Influenza

Outbreaks of avian influenza caused by widespread transmission between birds, animals, and humans are believed to have inflicted a grave human toll from time to time, starting in ancient times.

The genes of the avian influenza virus are known to mutate rapidly, creating an obstacle to preventive strategies by hindering prompt identification of the respective antibodies for the antigen and vaccine preparation. Some researchers predict avian influenza may result in death rates of 50% in developing countries and 10% even in developed countries – alarmingly high compared to SARS, which recorded a death rate of 4%. The influenza viruses that cause epidemics today were once highly fatal to humans; however, their pathogenicity has decreased over time. Generally, mutations occurring in viruses found in carrier birds (geese, duck, sea swallows, etc.) during bird-to-bird transmission increase pathogenicity, producing new strains of avian influenza. The body temperature of the birds involved is considered to be one of the parameters affecting the process. The consensus view among experts is that it is simply a matter of time until bird-to-human transmission occurs from migratory birds carrying high-pathogenicity viruses. In nature, deaths among wild birds go unnoticed by human observation, and a major cause of such deaths may be the influenza virus.

Despite the importance of epidemiological monitoring in these biomes, no system has been established for real-time monitoring of avian influenza on a global scale. Such efforts would most likely fall under the

jurisdiction of WHO, but since they would require the development of new technologies and since the regulation of frequencies and standardization of technologies is primarily the duty of the ITU, cooperation between the two organizations is crucial.

2.7.8 Present Satellite Technology

ARGOS system (DCS)

Theme: The maximum weight of instruments that can be carried by wild birds is 4% of their body weight. This places significant constraints on antenna size and transmitter power source. The basic technologies used in the first-generation ARGOS system date from the 1960s and were designed for data collection from ocean buoys. Despite efforts to improve transmission rates to broadband levels for 3rd-generation transponders, the G/T (gain/temperature, -18dB/K) of receiving antennas remains inadequate. The ARGOS terminal's lifetime will be only a few months due to battery consumption. Therefore, the ARGOS terminal on the back carry harness shall be glued on the feathers. The heavy weight of the payload can cause birds to crash.

2.7.9 Expected Technology

- Long distance RFID (built-in battery type)

The operational life of a built-in battery type RFID is directly proportional to the size of the battery (including solar cells). The device will be larger and heavier than a battery less counterpart. Long-distance RFID systems on 2.4GHz find their ideal application with medium to large migratory birds that do not collect near specific feeding areas. The only method currently available for collecting ID data is to deploy an observer equipped with a ground unit. In theory, it should be possible to perform unmanned observations by installing a unit that scans the sky, like a radar unit, at lighthouses and breakwaters along migratory routes. However, such systems remain in the planning stages, and numerous technical issues remain to be resolved.

These systems operate on frequencies within the ISM (industrial, scientific, and medical) bands. One possible choice given the propagation distance required (300–500 m) is the microwave range. The high efficiency required for the power source could be achieved via an electric double-layer capacitor (EDLC), which physically adsorbs ions within the battery electrolyte to the surface of the activated carbon electrodes in the charge cycle, then desorbs them in the discharge cycle. Unlike other capacitors, the EDLC electrical accumulation device is not based on chemical reactions. Given the extreme light weight of EDLCs, combined use with micro solar cell units may lead to long-distance RFIDs with semi-permanent operating lives. In any event, actual implementation of long-distance RFID must await further progress in R&D in the related technologies.

- LEO with advanced DCS

We would like to propose the next generation digital transponder that is an advanced DCS with multibeam on S-band to perform the on-board processing (DCS and navigation system with Doppler shift). In the case of 38dBi antenna of the spacecraft, the ground terminal with 10dBm RF-output and –10dBi antenna can transmit up to 400 bps with BPSK. This terminal attached to the leg of a bird will be suitable for a dove or a gull in size. Comparison of the ARGOS system and proposed system, 2000 times of processing speeds are necessary at the baseband level of space craft.

However, advances in the processing speed of FPGA (Field Programmable Gate Array) that can be mounted should make the required processing possible. The near-future theme for study is the development of a mounted device that can calculate the Doppler shift by the least-squares method by base-band processing per beam area. Should unused payload space remain in low-orbiting satellites scheduled for launch, we encourage space development agencies to consider including advanced DCS (next-generation digital transponders).

- Geographical Information System (GIS)

It should be possible to visually grasp the approach of suspected carriers by compiling a species-by-species distribution map of migratory birds. For example, in the month of March, few migratory birds fly along the parallel from the Korean peninsula across the Sea of Japan, but two groups of yellowlegs that consistently migrate from Vietnam to Siberia have been confirmed: 1) a group passing through the Korean peninsula; 2) a group passing through the Japanese archipelago. If the DNA types of the virus collected from the dead bodies of affected wild birds (Whooper swan) in Korea and Japan are found to be identical, the avifauna would suggest the possibility that yellowlegs are carriers. Based on independent component analysis, *n* number of data sources can be estimated from *n* number of independent observation sites based on higher-order statistics. Comprised of the geographical distribution of migratory birds, virus identification and virus geographical distribution, and the geographical distribution of patients, the GIS should serve as an effective support system for epidemiological risk forecasting. We should be able to achieve the highest cost-benefit performance in preventive effects for the available medical budget by concentrating efforts on distributing antiseptics, vaccines, and medication to regions where suspect migratory birds are known to have arrived.

2.8 Japan: Case 7 – ViewSend Internet Communication Technology

2.8.1 Introduction

[8]ViewSend Co., Ltd. was founded in October 2000 as a software development and systems integration company. ViewSend's objective was to develop videoconferencing software that would exceed the highest industry standards and to integrate that software into a more affordable, user-friendly, PC-based multimedia videoconferencing system. In June of 2004, ViewSend purchased all assets of KLT Telecom, Inc. a well-known American company committed itself to telemedicine, tele-radiology, and videoconferencing challenges. ViewSend Server/RAD, ViewSend Online and ViewSend ReportSystem, the main products of ViewSend, were widely applied to the medicine area. The customers of ViewSend were in the United States, Japan, China and Indonesia.

ViewSend RAD provides a real-time 3-in-1 telemed solution for telemedicine, tele-radiology, and videoconferencing. This product is designed to be a real-time software solution – collaboration, consultation, or training.

ViewSend Online is a web-based videoconferencing system developed by ViewSend in 2007. It is an Internet service and provides telemedicine, tele-radiology, videoconferencing and document sharing.

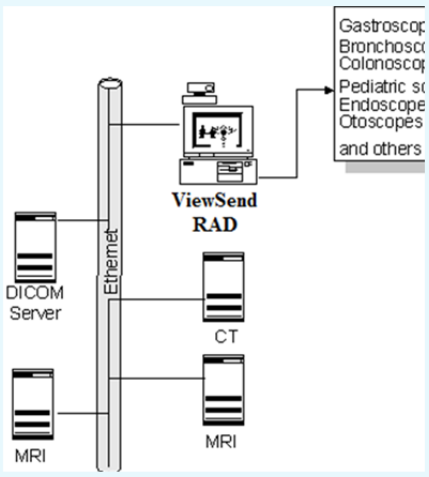
ViewSend Report System, a sub-system of ViewSend RAD, is non-real time software for tele-radiology. The report management and report format customization is available and enhanced in this software.

VIEWSEND Internet Communication Technology

- ViewSend RAD

[8] Kenei Shie, Guoliang Wang, Yang Yang, ViewSend ICT Co., Ltd., Tokyo Japan. See document RGQ14.3.2-INF-0017

Figure 28: ViewSend RAD



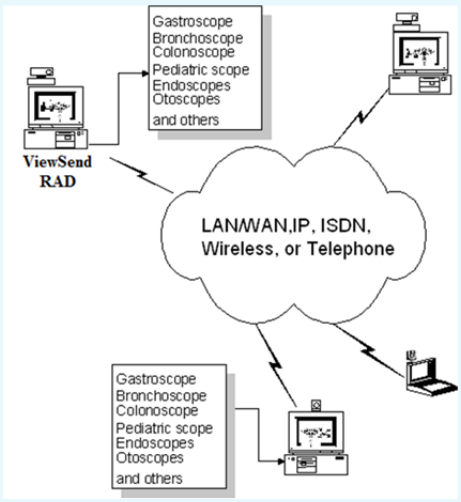
ViewSend RAD understands that the radiology workflow must be optimized for reading studies. There is no time to waste on DICOM querying, retrieving, historical information gathering. ViewSend RAD automatically pre-retrieves, organizes, and presents the data you will most often need.

Tele-radiology

ViewSend RAD is designed to be a fast, cost-effective way to retrieve your medical images/data and transmit them to remote locations. Whether the source image originates from a DICOM 3.0 modality, DICOM server, film, or medical device ViewSend RAD can prepare the series within a study and then transmit to the remote destination (Figure 28):

Telemedicine

Figure 29: ViewSend telemedicine



ViewSend RAD helps doctors increase the delivery quality of their care. Medical scoping devices can be connected to ViewSend systems through industry standard S-video or composite inputs. Digital images or video clips can be captured and transmitted in real-time to the specialist. Live video feeds can be used to enhance remote training, teaching, or telesurgery **(**Figure 29).

- Videoconferencing

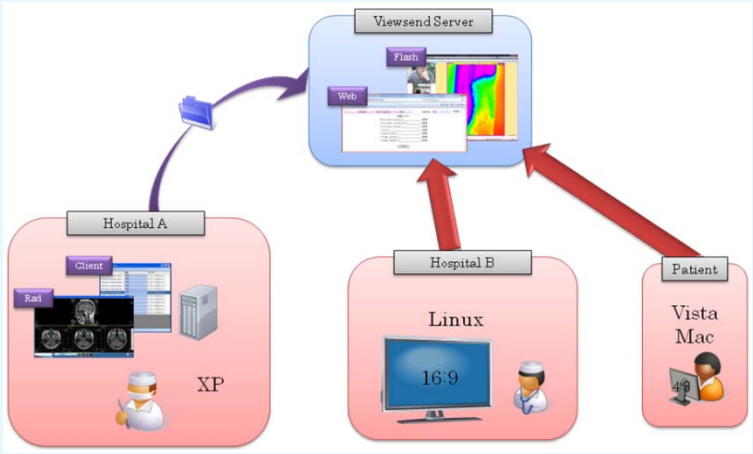
Figure 30: ViewSend videoconferencing

Rounding out the unique 3-in-1 solution, ViewSend leads the industry by providing business quality videoconferencing. Whether over ISDN (H.320) or IP (H.323), ViewSend provides a full featured video capable software solution for point to point or multipoint conferencing. Consults, second opinions, live video feeds, CME, training, teaching or telesurgery are all enhanced by integrated videoconferencing (Figure 30).

- ViewSend Online

Dicom image data are uploaded to ViewSend Online Server by ViewSend RAD to share with all users in the same group. The users login to the ViewSend Online Server by username and password to access these images. By the web service, the users can access the server by all terminal devices which support the web browser. This makes home healthcare possible (Figure 31).

Figure 31: ViewSend Oneline



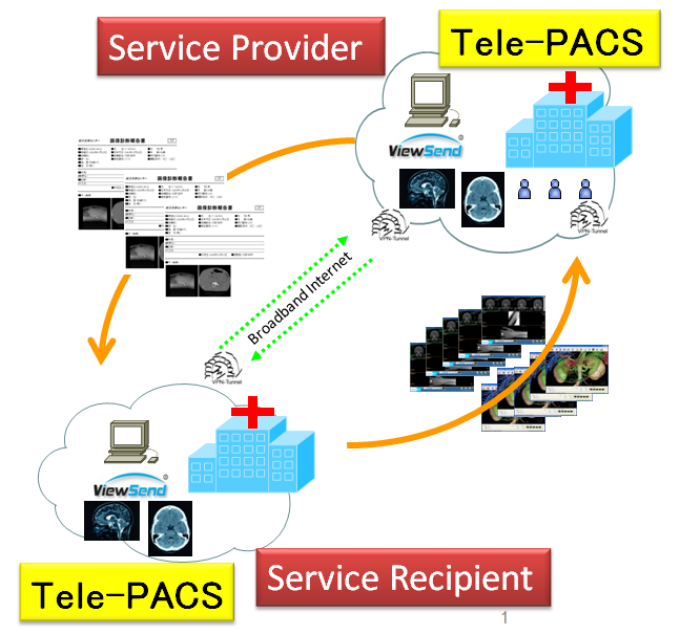
- ViewSend Report System

ViewSend Report System is a sub-system to enhance tele-radiology by the customization of report management and report format (Figure 32).

The requirement of report management differs between hospitals. The management project, work list and report format of ViewSend Report System can be modified by the XML files for the users. The medical

image data and medical records can be transmitted to the Service Provider, and the report with key image can be reply to the Service Recipient as shown in Figure 32.

Figure 32: ViewSend Report System



- Application examples

Tone Numata telemedicine network (TN-2).

There is a good example of viewsend internet communication technology at Tone Numata. In the case of emergency, video conference consultation is used and it is habitually used for medical image sharing.

2.9 Japan: Case 8 – Remote and Mobile Healthcare ICT Trials in Japan

2.9.1 Introduction

[9]In most countries, the number of elderly people is increasing recent years. Especially, Japan has faced super-ageing society. An aging society needs much higher medical cost, and it has been increasing year by year. At the same time, the number of patients suffering from life style-related diseases such as diabetes is also increasing, which is another factor to increase medical expenditure.

It is very important and is a common global challenge to support elderly people's healthcare from the view point of the Quality of Life. To solve those issues, Japanese government announced a policy to use ICT effectively, and has been putting the model projects into practice and collecting evidences in order to promote remote health care services.

In this contribution, three trial services related to remote and mobile healthcare by using ICT are introduced as examples examined in Japanese model projects. Then, this contribution proposes potential

[9] Ms Mayumi Yamauchi, Ministry of Internal Affairs and Communications, Japan and Mr Hideo Imanaka, NTT, Japan. See document 2/207

standardization items regarding remote and mobile healthcare ICT by taking account lessons from Japanese healthcare ICT trials led by Ministry of Internal Affairs and Communications (MIC), Japan.

2.9.2 Country Overview

According to recent research results, the number of senior citizens in Japan, aged over 65 years old, is 23.1%, and 20% of households are elderly people living alone in 2011. An aging society needs much higher medical cost, and in practice, the total health expenditure reached 460 billion US dollars in 2010, which has been increasing year by year. Accordingly, Japan becomes the first nation in the world facing with difficult challenges caused by super-aging society.

Such a situation happens not only in Japan, but also in other countries. In some researches, the elderly ratio of Asian countries such as South Korea and Singapore follows Japan 10 years behind. In other Asian countries, speed of super ageing is more rapid than Japan. For example, the elderly ratio will reach 20% in China and India soon. This brings tremendous number of aged people, around 5 billion, which is 4 times larger than the current total population in Japan.

2.9.3 Objectives and Strategies

Objectives: to reduce medical cost and to improve Quality of Life

Strategies: to exploit remote and mobile healthcare by using ICT

1 Activities Implemented

Three cases of remote healthcare ICT and mobile healthcare ICT are introduced as the trials in Japan.

a) Remote healthcare for monitoring after discharging, an MIC model project.

- Purpose: to provide healthcare service for Homecare Patients after discharging from hospital.
- Service: A Homecare patient is monitored its vital data such as blood pressure, heart late and pulse by a doctor who is in the hospital. Doctors and nurses visit patient on a regular basis, for example once or twice a week, to provide adequate medical treatment based on the knowledge as to how the patients have been between their visits.

b) Remote healthcare promotion for elderly, an MIC model project.

- Purpose: to promote healthcare for elderly people especially in rural area.
- Service: It shares vital data of elderly people with doctors and public health nurses, and provide remote consultation over video phone. Doctors in the city and public health nurses and elderly people in the local area share healthcare related data. Elderly people visits a community center regularly to have their physical condition checked by public health nurses and to consult with doctors in the hospital. Public health nurses will assist elderly people to use devices and internet.

c) Mobile healthcare for Post Disaster, in Fukushima after the great East-Japan earthquake.

- Purpose: to provide medical services in shelters after disaster.
- Service: After the disaster, evacuees who lost their houses and stayed in shelters for long time needed medical services, and many medical professionals came to the disaster struck area to response to evacuee's need. In order to allow for common use of medical records by these medical professionals, medical record sharing system was offered to Fukushima Prefectural University Hospital Medical team.

2 Technologies and Solutions Deployed

a) Remote healthcare for monitoring after discharging, an MIC model project.

- Remote data monitoring service using vital sensors:

- Remote consultations with doctors over video phone.
- HPKI for user authentication.
- Continua Health Alliance based video phone and vital sensors.

b) Remote healthcare promotion for elderly, an MIC model project:

- HPKI for user authentication.
- Continua Health Alliance based video phone and vital sensors.

c) Mobile healthcare for Post Disaster, in Fukushima after the great East-Japan earthquake:

- On Demand VPN service for secure network over the Internet.
- HL7 based healthcare data.

3 Changes and Outcomes Achieved

a) Remote healthcare for monitoring after discharging, an MIC model project:

- It reduces patients' physical burden to visit hospital regularly.
- It is possible to receive patient's data and to diagnose immediately, that would enable doctors to detect diseases earlier.
- Patient and their family feel safe since they can consult with medical professionals whenever they want.

b) Remote healthcare promotion for elderly, an MIC model project:

- The number of people who has disease from 6 to 1. That means 83% of improvement was achieved by this service.
- Some local governments continue to use this service after the model project has finished.

c) Mobile healthcare for Post Disaster, in Fukushima after the great East-Japan earthquake:

- What they need most was checking the patient's past medical records on site.
- Patients' medical record should be protected as much as possible even at the emergency.

4 Challenges and Success Factors

Challenges: Changing the way of doctors work.

Success Factors: Collaboration with medical doctors and their understanding to use of ICT.

5 Lessons Learned and Next Steps

Remote Healthcare and Remote Health promotion are relatively easy to start-up in technical sense. People are able to send their vital data and receive advice from doctors at any time and any place. They are also able to be consulted by doctors when they need. Doctors can check patients' condition with their own eyes through TV phone. If all devices are based on global standards, healthcare ICT will be easy to start-up and will be cost effective. Remote healthcare ICT and mobile healthcare ICT are really effective to provide better healthcare service outside hospitals.

The next step of healthcare ICT is to discuss standardization of security and interoperability with healthcare devices. The trials mentioned in this contribution adopted "on demand VPN" service for ensuring security and privacy, and specification of "Continua Health Alliance" for communicating vital data between health devices and servers in telecommunication networks. In conclusion, it is needed to discuss the standardization in ITU considering of unique colors and real-time capability in medical services continuously.

2.10 Report of ITU Workshop on e-Health Services in Low-resource Settings in Japan

2.10.1 Introduction

[10]In developed countries including Japan, the aging society problem is causing a chronic shortage of doctors. Meanwhile, developing countries also have a chronic shortage of doctors but for a different reason, namely the limited availability of medical services.

Tele-medicine and e-Health are being studied as one solution for these problems, and ITU-T SG16 and ITU-D SG2 study standardizations on e-Health technologies and deploy it widely in developing countries. In November 2012, the ITU and WHO launched a partnership called the m-Health initiative, which aims to use mobile phones to deliver e-Health services to combat non-infectious illnesses. Since April 2012, the ITU-T focus group on machine-to-machine (M2M) service layer called FG-M2M has been studying the standardization of e-Health as an M2M application.

With the aim of ensuring that e-Health standardization proceeds smoothly in the future, the ITU-D and ITU-T held a joint e-Health workshop to provide a place for dialogue and the exchange of information between each of their members. In this way, it was expected to clarify the special requirements of developing countries, and to specify the items for future standardization towards the implementation of e-Health using advanced technology.

This contribution covers brief results of the workshop, and proposes future activities for progressing towards the standardization work and deployment in developing countries on e-Health services.

Photo 1: Opening speech from Vice- Minister of Japan

2.10.2 Overview of the Workshop

Opening speeches were made by Mr Eiichi Tanaka, vice-Minister for Policy Coordination in Ministry of Internal Affairs and Communications, MIC, Japan (Photo 1), and by Mr Sameer Sharma of the ITU Asia-Pacific regional office on behalf of the ITU Secretary-General. These were followed by keynote speeches from Mr Tetsushi Sakamoto, the State Secretary for MIC, Japan, on the subject of Japan's e-Health policies, and Prof. Kiyoshi Kurokawa of the National Graduate Institute for Policy Studies, who gave a presentation under the title of "Global Agenda in Post Fukushima" in which he raised issues that should be addressed not just by Japan but by the whole world in the wake of the Great East Japan Earthquake. Mr Mark Landry of Pacific regional office of World Health Organization, WHO, gave a speech on behalf of WHO in which he

[10] See document RGQ14.3.2-C-0024

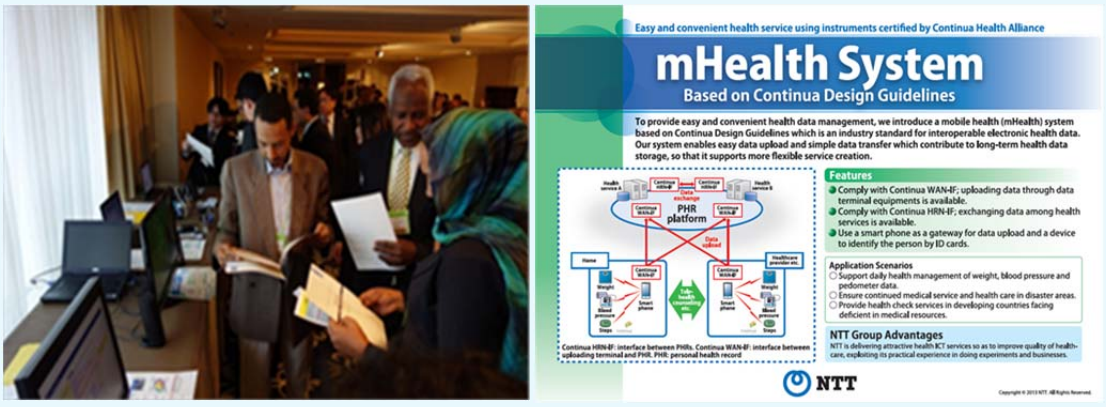
described some examples of e-Health policies across Asia, and the current status of cooperation with WHO (Photo 2).

Photo 2: Workshop

2.10.3 Requirements for Low-resource Settings

On the theme of implementing e-Health with low-resources, representatives from India, Sudan, Uganda, Algeria, the United Arab Emirates, Bangladesh, Vietnam and Myanmar gave presentations on the current situation of e-Health in each country, the issues that need to be addressed, and requirements in each case. The requirements of developing countries are characterized by delayed development of infrastructure, not only for medical care but also for insurance, sanitation and health management, and a shortage of healthcare workers coupled to a poor educational environment. Instead of the advanced e-Health systems that are being considered in developed countries, these presentations introduced solutions such as Web-based sharing and education of medical information, using video conferencing to facilitate collaboration between medical workers including doctors, and using mobile phones for medical consultation (m-Health), whereby e-Health is expected to provide a broad range of benefits.

Photo 3: Demonstrations on m-Health



2.10.4 Items for Standardization

Representatives from Japan, South Korea, Singapore, and the United States introduced some advanced examples of e-Health initiatives, and discussed the challenges of implementing e-Health. NTT Data gave a presentation introducing cases of Personal Health Record, called PHR, management and monitoring as

examples of m-Health services in Japan, and stressed the importance of security and privacy protection. The representative from Singapore introduced a Smart TV health management system based on ITU standards, and showed that interactive e-Health using TV sets and remote control devices may be suitable for an aging society since these devices can be easily used even by elderly people. Also, the US representative introduced the importance of considering e-Health for people with disabilities; NICT introduced the possibility of a body area network (BAN) that people can wear in order to connect to healthcare equipment; and Fujitsu introduced the possibility of a heart simulator that aims to improve healthcare technology. These presentations highlighted the need for standardization of the data structures and protocols required for the transmission of PHR and other data, of the application interfaces and transmission methods used between medical/healthcare devices and telecommunication networks, wireless devices and fixed devices, and of security, which is essential when exchanging PHR data.

2.10.5 e-Health in the Event of Disaster

Experiences from the Great East Japan Earthquake with regard to the use of e-Health in disaster situations were introduced. A&D made a presentation about a monitoring system for information such as blood pressure for health management of people affected by disasters, which was actually put to use after the Great East Japan Earthquake. Professor Isao Nakajima of Tokai University – the vice rapporteur of ITU-D Q14/2 and co-chairman of this workshop – described items that need to be studied in e-Health and radiation related disasters in relation to the nuclear power plant incident. These presentations demonstrated the usefulness of e-Health in the event of disaster, and made a case for the importance of preserving two-way communications.

2.10.6 Future Direction for ITU Work

Mr. Masahito Kawamori of NTT - the rapporteur of ITU-T Q28/16 and co-chairman of this workshop, drew up the following summary of the results of the workshop and the future direction of e-Health standardization at the ITU.

- To promote the spread of e-Health, it is important to provide education in order to eliminate misconceptions about the circumstances of developing countries.
- From the viewpoint of standardization, to establish cooperation between requirements, terminology definitions, data sets/applications, and related organizations.
- In particular, to make a terminology database, since the technical terminology relating to e-Health covers many fields including medicine, healthcare and ICT.
- For e-Health related regions, to study the application of this technology as related to the elderly, stranded people, and disabled people.
- In the future, to supply information to the ITU website including the content of speeches given at this workshop, and to hold an enlightenment event in cooperation with WHO.

2.10.7 Other Related Events

Alongside the workshop, there were also demonstrations from NTT Laboratories related to m-Health (photo 3). A simple health management system was introduced where healthcare equipment including blood pressure gauges and SMS text messaging is used to implement m-Health with low initial investment. In this exhibition, it was found that there are many different opinions regarding this technology.

2.10.8 Conclusion

Over 130 persons from 20 countries attended this workshop (photo 4), since e-Health has been globally recognized as important by developing and developed countries alike. It is expected that this field will continue to grow in the future. For its efficient global development, international standards, with appropriate consideration of the regional characteristics and environmental conditions of each country, are essential.

This contribution proposes to continue dialogue between ITU-T and ITU-D members by using workshop since this kind of workshop is expected to contribute to the expansion of developing countries, which is the scope of ITU-D, as well as the further development of ICT standardization, which is the scope of ITU-T. Furthermore, this contribution also proposes to collaborate with WHO for deployment m-Health solutions to developing countries, along with an MoU signed by ITU and WHO.

To access presentations delivered at the workshop, please visit: http://www.itu.int/en/ITU-T/Workshops-and-Seminars/e-Health/201302/Pages/default.aspx

Photo 4: Demonstrations

2.11 Korea (Rep. of): Case of SK Telecom – SNUH (Seoul National University Hospital) HealthConnect Services

2.11.1 Introduction

[11]Since healthcare costs are rising dramatically due to the aging of population, it can possibly become a huge national burden without a proper preparation. The official launch of HealthConnect marks a good starting point that will lead to the development of a future convergence healthcare technology and innovative medical services. Looking ahead, SK Telecom (incumbent private telecommunication operator) and SNUH (Korea's first national hospital) will work together to research and develop future healthcare models so as to offer the most reliable medical services for the next-generation, increase healthcare consumer satisfaction, and strengthen Korea's national competitiveness in healthcare.

In this case study, information on the joint venture firm between SK Telecom and Seoul National University Hospital is shared.

2.11.2 Stakeholders

The name "HealthConnect" represents convergence between core capabilities of the two companies: SK Telecom's strength in ICT and network operation and SNUH's expertise in medical technology. SK Telecom and SNUH signed a strategic partnership agreement in April 2011 to share their capabilities in healthcare ICT business, to identify specific areas of cooperation, and to develop innovative joint business models by

[11] Contribution: Lim Hyoung-Do, SK Telecom, Korea (Rep. of). See document 2/175

devise measures. After signing the joint venture agreement in October 2011, SK Telecom and SNUH have completed creating the organizational structure such as business, technology, strategy, and new business development of the joint venture firm and recruited necessary employees in just three months. The joint venture is established with a capital of KRW 20 billion or USD 17.6 million. SK Telecom holds 49.5 percent of the stake in the joint venture, while SNUH holds the remaining 50.5 percent.

2.11.3 Main Characteristics of the Services

HealthConnect moves toward the direction of 'disease prevention and health management' and will lead changes through ICT-based innovations. HealthConnect business is defined as three main services: Development of a self-health management service, development of smart hospital solutions to enhance doctor & patient productivity and satisfaction, and establishment of an integrated R&D system for the advancement of the Korean healthcare industry.

First, the development of a self-health management service that links prevention, diagnosis, treatment and management will lead to the provision of truly personalized healthcare service based on one's medical information;

- Seamless Management using Medical Check-up
  - Personalized program based on medical check-up data.
  - Program result analysis.
- ICT based Personalized Service
  - Activity tracker measuring daily activity.
  - Aerobic/muscle motion data gathering at in-company fitness club.
  - Diet calorie measurement at cafeteria.
- Health-tainment
  - Ranking/Incentive to motivate participation.
  - SNS to encourage family/colleague activity.

HealthConnect plans to develop a health management service model centered on wellness in 2012, followed by a pilot service conducted jointly between SK Telecom and SNUH within the same year.

- Pilot Test Summary
  - Participants: SKT Employees (30 members).
  - Selection Criteria: BMI.
  - Duration: Starting in May 2012 (3 months).
  - Measurement: Comparison of medical check-up data and Satisfaction Index before/after pilot test.

Second, HealthConnect aims to develop smart hospital solutions to level up hospital productivity and patient- friendly environment. For instance, plans are ahead for HealthConnect to create a patient-oriented environment by building smart ICT system within hospitals in 2012.

- Smart Reception & Clinic Information
  - Automatic registration of medical treatment for out-patients.
  - Providing medical exam/treatment information based on the clinical pathway and medical contents.
- Smart Payment
  - Payment of small medical bills through NFC enabled smart phones, payment apps and iosk program.

- Smart Indoor Navigation
  - Guide routes to personal destination inside hospital using smart phones and Kiosks.

Besides development of the health management services, SK Telecom and SNUH co-developed Mobile EMR (Electronic Medical Record) and medical self-diagnosis applications in 2011 to accelerate the realization and export of 'Smart Hospital.'

Moreover, the M-prescription application was launched by SK Telecom for mobile healthcare services. M-prescription is expected to significantly enhance patients' convenience by allowing them to store and manage prescriptions on their smart phones and access detailed information on the prescribed medicine including effects, side-effects, dosage and frequency of administration. M-prescription will also help hospitals and pharmacies provide better services and care for patients. Main features of M-prescription include:

- Prescription History.
- Real-time Access to Medication Information & Medication Guide.
- Medication Reminder.
- Search Nearby Hospital/Clinics & Navigation Service.
- General Information on Medicine.

By offering mobile healthcare services that systematically manage an individual's daily amount of physical activity and biometric information, HealthConnect plans to open an era in which individuals are able to manage their own health via mobile phones.

2.11.4 Conclusion

HealthConnect holds a significant meaning in terms of the public healthcare, as it includes services for the medically deprived people and areas. By offering ICT-based healthcare services, HealthConnect will allow people to prevent diseases and manage their health, which will contribute to the overall reduction in social cost and the betterment of national welfare. Furthermore, a portion of its profits will be donated or invested to enhance public healthcare in Korea.

As the pace of adoption of IT in the medical industry has been slower than that of other industries, the combination of SK Telecom's world's top level ICT and SNUH's medical technology and knowhow will develop the next generation healthcare model that connects prevention, diagnosis, treatment and management; promote the export of ICT-based medical services or so-called 'digital hospital'; and enhance Korea's national competitiveness in medical technology and services.

2.12 Singapore: Singapore's e-Healthcare Programmes

2.12.1 Introduction

[12]Singapore experienced rapid population growth in recent years, with the population exceeding five million. This had put a strain on its infrastructure and services. At the same time, Singapore is also facing the prospect of an ageing population where one in five will be over 65 years old by 2030. The national healthcare expenditure is expected to increase and a different pattern of healthcare is necessary; one which features an integrated healthcare delivery system with "right-sited" care, better allocation of resources and more cost-effective treatment and care.

[12] Contribution: Government ICT Strategy and Performance Management (ISPM), Infocomm Development Authority of Singapore (IDA), Singapore. See document RGQ14.3.2-C-0018

2.12.2 Country Overview

Public healthcare in Singapore is governed by the Ministry of Health (MOH). Institutions that deliver subsidised healthcare are publicly funded through subventions and include 7 acute general hospitals and 6 national specialty centres for cancer, cardiac, eye, skin, neuroscience and dental care. In addition, there are 18 polyclinics located throughout the island that provide subsidised outpatient medical care, health screening and pharmacy services. In the next 4 years, there will be 2 new public hospitals providing additional 1000 beds.

The Intermediate and Long Term Care is provided by residential and communities which are mostly outside the public healthcare system though some facilities receive government subsidies.

In 2000, WHO ranked Singapore's healthcare system ranked first in Asia and sixth in the world. IMD (2007) ranked Singapore's health infrastructure third out of 55 countries. These accolades were achieved on a prudent national healthcare expenditure that is within 4% of Singapore's GDP (a low figure among developed countries)

2.12.3 Objectives and Strategies

There had been a shift in focus from episodic care to developing holistic care to patient. The vision is to have "Hospital without walls" where the healthcare team will comprise GPs, nurses, physiotherapists beside the hospital staff. The team will deliver patient centric care through greater collaboration and partnership. Patients can be decanted more effectively in the healthcare system through the "team based care" so that acute hospitals can cater to severe cases and refer patients in recovery to step down care. This will address the capacity issues of acute hospitals especially in the context of an ageing population.

The National Health Informatics Strategy was conceptualized in 2008 with the goal of achieving greater coordination of healthcare across different providers for patients, higher adoption of Electronic Medical Record systems (EMR) amongst healthcare providers and integrating these EMRs to achieve a vision of "one patient, one medical record" in Singapore. A key part of this strategy is to develop a shared Electronic Health Record which makes available summaries of clinically relevant patient information to healthcare providers to improve the overall quality of care rendered to patients when they seek healthcare services at different points of care throughout their lives. National Electronic Health Record (NEHR) Phase 1 was implemented by 2011 as one of the key guideposts for Singapore's longer term "One Patient – One Medical Record" vision. More capabilities to support clinician collaboration across care setting, harness the power of data via analytics as well as expansion of NEHR adoption across the entire healthcare continuum will be the focus from 2012 to 2016.

In addition, the iN2015 Masterplan by the Infocomm Development Authority (IDA) set out a 10-year plan to utilize infocomm technologies to establish a well connected society. For the healthcare sector, personalized healthcare delivery was a future envisioned to be enabled by infocomm to achieve high quality clinical care, service excellence, cost-effectiveness and strong clinical research.

2.12.4 Activities Implemented

MOH did a review of healthcare landscape and had implemented a concept known as Regional Health System (RHS). There are six RHS formed to serve the different geographic locations in Singapore. The RHS realised the vision of "Hospital without Walls" by providing integrated care to patients. The RHS will involve an acute hospital as anchor to work closely with key healthcare providers in the region i.e. General Practitioners and step down care providers such as community hospitals, nursing homes and hospices. Together, the institutions were to take a patient-centric approach, as opposed to the traditional institution-centric approach. To support the RHS concept, there will be a need to improve the healthcare ICT capability especially in the area of connectivity between institutions. NEHR will be used as a common reference to Patient Record.

2.12.5 Technologies and Solutions Deployed

National Electronic Health Record (NEHR)

To improve healthcare quality for all residents, increase patient safety, lower healthcare costs and develop more effective health policies, Singapore's Ministry of Health (MOH) created the National Electronic Health Record (NEHR) vision – "One Singaporean, One Health Record".

The NEHR extracts and consolidates in one record all clinically relevant information from the patient's encounters across the healthcare system throughout his/her life. It allows for data sharing, making it accessible to authorised healthcare providers, across the continuum of care throughout the country.

With the NEHR, healthcare teams would be better equipped to provide more effective care as the system will enable more timely access to health records including diagnoses, prescriptions and allergies. This will help reduce medication errors and adverse drug events. There will also be cost savings as healthcare staff will be able to obtain a more complete and accurate picture of the patient's health history and therefore avoid ordering duplicate or unnecessary tests.

Integrated Clinical Management System (CMS)

Launched in 2006, the Integrated Clinic Management Systems (CMS) program aims to encourage GP clinics to adopt and leverage on infocomm technologies to facilitate operations and clinical improvements in their patient care. The integrated CMS facilitates scalability of the GP infrastructure by enabling consistent and standards based interface with different healthcare provider systems. Secured and seamless information flow will allow GPs to plan the patient's treatment in an integrated and coordinated manner with other hospitals and step-down care providers. Through this program, GPs will have the capability to easily plug into the national healthcare network and achieve MOH's "One Singaporean, One Electronic Medical Record" vision.

GP-IT Enablement Programme

Building on the momentum of the CMS Program which has resulted in most GPs having some form of IT system in place, the GP-IT Enablement Program was conceptualized in 2010 as the next phase of GP IT adoption. It aims to support more sophisticated IT usage for GPs through introduction of an IT-enabled clinical foundation that contains linkages to the National Electronic Health Record (NEHR) and care services such as laboratory and diagnostic radiology results. GPs currently participating in the CMS Program will be transited to the IT-enabled clinical foundation when the system is implemented.

Intermediate and Long-Term Care (ITLC) IT Enablement Programme

The ILTC sector comprises residential and community-based services and is currently managed mostly (approximately 70%) by voluntary welfare organisations (VWOs), where resources are usually stretched, clinical documentation capability or management is limited, IT usage is minimal and IT expertise a scarce occurrence. To address these issues, the ILTC Programme consists of an IT strategic framework that aims to establish the core foundation for the use of technology across ILTC settings, for operational efficiency, and subsequent electronic exchange of information between care settings within the ILTC sector and nationally to the National Electronic Health Record (NEHR). In addition, an ILTC IT Adoption Model will be developed to categorise the IT adoption of different care facilities, to allow policy planning to better develop specific programmes to meet the needs of care facilities with similar maturity levels, and to increase industry interest in the ILTC sector to explore more innovative & sustainable solutions and develop more targeted products and services for the care providers and care givers.

Telehealth Programme

With the increasing challenges of the healthcare sector, Singapore needs to explore more innovative ways to deliver healthcare services, and Telehealth is one such area. Telehealth is an area where ICT can improve the delivery of healthcare services and where the ability of patients to be more proactive in their health management can be enhanced, thereby increasing care accessibility, enhancing care quality and

delivery, and bring more affordable care through greater operation efficiency. It aims to empower patients to better self-manage their health while collaborating with healthcare providers to ensure care continual.

The Telehealth Programme has been formulated to identify and develop remote healthcare services via ICT including mobile technologies in an affordable and sustainable manner for both patients and healthcare providers. Through this programme, it aims to increase greater Telehealth adoption through more coordinated efforts and optimized investment across the entire healthcare ecosystem.

The programme will drive the development of a Telehealth framework which will establish a tripartite relationship between the patients (with their care givers), healthcare providers, and technology as the necessary bridging platform, with an overarching governance to provide implementation guidance and oversight. It includes development of needs assessment and implementation guidelines, thus aligning and synergizing the various initiatives across the healthcare sector including institutions, government agencies and industry.

2.12.6 Changes and Outcomes Achieved

National Electronic Health Record (NEHR)

Phase 1 of NEHR completed in Jul 2012 with common patient records available to all public acute care hospitals, specialist clinics, polyclinics, selected GP clinics, five community hospitals, two nursing homes, one hospice and supporting organizations like Agency for Integrated Care (AIC), Health Promotion Board (HPB) and Singapore Armed Forces medical corps. Phase 2 of the NEHR will provide additional features and functionalities to support patient care and data analyses.

GP-IT Enablement Programme

CLEO (Clinic Electronic Medical Record and Operations), a national system developed for the primary care will comprise of an EMR and an integrated CMS (clinic management system). Phased rollout is expected to begin from 2013.

IDA had awarded a grant to Quest Laboratories to develop a system that delivers secured, electronic lab results online and to NEHR (via the General Practitioner Clinic Electronic Health Record and Operations or CLEO) that comply to the Singapore HL7 standards for messaging and LOINC international standards for diagnostic results. The system will transform a traditional, paper-based process of GP practice to one that is IT-enabled, offering timely and comprehensive electronic documentation of a patient's health condition when integrated with NEHR. It will also leapfrog Singapore's status as one of the few countries in the world with such high level of IT sophistication in pathology services. The system will be completed by March 2013.

Telehealth Programme

MOH Holdings (MOHH) had established a programme office (Consumer Health Office) to oversee the programme. As part of the programme, Integrated Health Information Systems (IHIS), a subsidiary under MOHH, had also established a Telehealth Technology Office (TTO). The TTO will build (when necessary), implement, operate and support Telehealth solutions. By aligning and consolidating potential Telehealth initiatives across the clusters and community, TTO will assist institutions to achieve economies of scale through consolidated procurement, therefore optimising the limited manpower and financial resources.

MOHH has recently completed a local landscape study of Telehealth implementations by the different healthcare institutions. The study seeks to understand the major pain points and barriers to adoption of Telehealth. The results of the study will help to guide the programme office in developing the framework for assessing and regulating Telehealth.

IDA had launched the Telehealth Call For Collaboration (CFC) earlier in March 2012 to invite the industry to develop new models of distance care for the elderly - at home, within the community or at institutions such as nursing homes - assisted by ICT. Launched in collaboration with the Ministry of Health, it is hoped

that the CFC will encourage healthcare providers to review existing care models and care processes, to ensure sustainability through appropriate change management, manpower training and benefits measurement and demonstrate viable business models for longer terms deployment of Telehealth services. It is predicted that Telehealth will be a key enabler behind strategies that are being adopted to enable "ageing-in-place" as Singapore prepares itself for a rapidly ageing population. Results of the CFC will be announced in early 2013.

2.12.7 Challenges and Success Factors

National Electronic Health Record (NEHR)

As there are six clusters and over 30 institutions in Singapore, it is a challenge to take in the data, process and display accurate and meaningful data. The implementation of the NEHR system has provided an even stronger spotlight on issues such as standards and data quality, as previously unknown inconsistencies and data defects from a variety of catchments flow into a unified record. The data includes information which is non-clinical such as information used to identify people, organizations, locations and departments etc. A national strategy was developed to govern the creation, implementation and management of standards in health information exchange.

The journey and results of any delivery are predictable if the challenges ahead were identified and dealt with. When deploying the NEHR to new institutions, the project team was able to re-use product, process and people, supported by tried and trusted methods.

Telehealth Programme

There were a number of telehealth projects led by the various health institutions. These initiatives include; National Healthcare Group (NHG) Diagnostic's remote radiology reading service, and Khoo Teck Puat Hospital (KTPH) nursing home-geriatrician video-consultation initiative. These projects demonstrate that effective and clinically-led sustainable Telehealth is possible in Singapore. There was however challenges that will need to be tackled such as lack of sustainable business models, clinician support being hampered by liability. Other concerns such as lack of IT infrastructure, patient billing, provider reimbursement issues, security and privacy concerns, and lack of standards will need to be addressed as well.

The challenges will be systematically addressed by the MOHH Consumer Health Office. For example, to address the business model and sustainability issues, the project assessment criteria will include the presence of a viable and validated business model.

Unlike other countries where telecommunication infrastructure is a key barrier, Singapore is well equipped for adoption of Telehealth given our high mobile penetration, excellent network connectivity and high speed broadband, and increasingly empowered population. Coupled with clinical leadership and commitment, Singapore can push towards greater Telehealth adoption across the care continuum and position as a Telehealth thought-leader within Asia Pacific.

2.12.8 Lessons Learned and Next Steps

NEHR

The full implementation of NEHR is an iterative one and will take years to complete, allowing each deployment cycle to refine and improve on the previous one.

Singapore's adoption of the NEHR will change the healthcare landscape in the country for the better. The NEHR is a journey to transform the mindset of healthcare providers and patients, so as to bring about better quality care. Once the NEHR is fully implemented, the possibilities of future development in areas of prevention and treatment are vast. In addition to contributing to high quality care and service excellence, the NEHR will bring us closer to achieving our vision of "One Singaporean, One Health Record".

NEHR Beyond Acute Hospitals

IT implementation and adoption strategies for the intermediate and long term care (ILTC) and primary care sectors are being developed. While the IT adoption rate is still low at the primary care level, IT enablement among GP practices and Community Hospitals will progress with linkages to the NEHR.

The use of IT will enable patients' critical medical information flow from the acute hospitals to the primary and intermediate long term care sectors. There will be support for Community Hospitals (rehabilitation hospitals) to modernise patient administrative, pharmacy and clinical systems. Upgrading, enhancing and improving of systems in nursing homes, day rehabilitation centres and home nursing providers are also underway.

In the long run, healthcare providers will be able to better develop, integrate and coordinate shared care plans to provide better quality care. The end goal is for patients to enjoy a hassle-free healthcare delivery service, with fewer repeat tests and reduced medication errors when they move from one care setting to another, with the NEHR linking up providers in the community who currently do not have electronic access to patients' medical records.

For patients, it means better prescribing practices, reduced waiting times and better management of the quality and cost of healthcare by ensuring the most appropriate care setting for their conditions.

Telehealth Programme

Over the past few years, there have been multiple efforts in Telehealth exploration by various healthcare institutions and government agencies; with varying results. These range from government-funding programmes such as IDA Yr 2006 CFC to ground-up institutional initiatives such as video conferencing partnerships. However, these efforts are largely sporadic and relatively unsustainable. One key factor was an overall lack of coordination in pushing forward the adoption and innovative use of Telehealth in Singapore. As such, it is hoped that the establishment of a Telehealth framework will help coordinate the various Telehealth efforts and guide its implementation.

The Telehealth Framework aims to identify services that will deliver remote healthcare services via ICT including mobile technologies in an affordable and sustainable manner for both patients and healthcare providers. Through this framework, it will set the directions for Singapore Telehealth adoption across the entire healthcare ecosystem and identify low-hanging or high-potential areas to which more coordinated efforts and investment can be delivered.

This will also establish a consistent assessment framework for Telehealth efforts, thus aligning and synergizing the various initiatives across the healthcare sector including institutions, government agencies and industry. As part of the framework, a set of implementation principles will be developed to help guide the implementations and facilitate subsequent best practices sharing.

2.13 China: Perspective for e-Health Using Satellites

1 Concept of e-Health Using Satellites

[13] E-health is medical activity by cooperation of medical institutes in different areas, which is realized by computer technology and telecommunication technology. Typical solution of e-health is by satellite communications system, ISDN or telephone facilities. In an e-health system using satellite, the communication links are realized by satellites, in despite of the disadvantage of e-health using terrestrial facilities. Typically, an e-health system using satellite is comprised of a telecommunication satellite, main teleport, a quantity of terminals, related software and protocols.

[13] See document 2/332

2 Advantages of e-health using satellites

- Larger service area: Satellite communications system could provide large coverage that even rural and wild areas can be included, so the problem of sharing and equity of health resources in developing and developed areas are easier to resolve.
- Wide bandwidth: Until now, the bandwidth of one channel of broad band telecommunication satellite could reach as much as 200 MHz, it is a big advantage comparing to the bandwidth of terrestrial communication systems, especially in developing countries.
- Flexibility and extensibility: No matter it is in deserts, oceans, mountains, or hills, an e-health system is possible to be operated if it's in the service area of a satellite.
- Hard to break down: Terrestrial communication systems are always destroyed when disasters such as earthquake or tsunami happens. At this time, e-health systems based on satellites is the only communication way for rescue and rebuilding in disaster area.
- Cheaper, shorter construction period: Compared to other communication system, the prices of system infrastructure and user terminal are cheaper, the constructing is easier and its period is shorter.

3 Application Scenarios of e-Health using Satellites

3.1 Point-to-Point Health Service

In a point-to-point health service, experts could use health data collecting and diagnosing devices, such as digital imaging instrument, ultrasonic detection automatic recording instrument, to collect high resolution CT scanning figures, X-ray images. In the diagnosing process, real-time telecommunication is feasible. Despite of remote diagnosing, doctors could use remote control system to operate mechanic arms to conduct a surgery, in which the communication link is built by satellites.

Once consultation is needed, video conference may be supported by the point-to-point health system. Using satellites communication links, any terminal could be used as the main terminal and the other terminals are used as sub-terminals. Any links between different terminals are in two-direction pattern. Real-time connection is realized between them and in this way medical institutes in different sites could deal with business simultaneously.

3.2 Education for e-Health

In disaster or epidemic areas, an e-health system by satellites could improve the medical level much rapidly. For example, one expert provides lectures at the main terminal and other people could receive information and reply by their local terminals. By this way, some emergent knowledge about first aid and epidemic prevention is transmitted and broadcasted.

3.3 Data and Information Sharing for e-Health

In every dispersive area, hospitals can found local information centre and expert database, collect local health requirements and upload them to expert service centre of e-health system. The expert service centre of e-health system could provide proposals and methods according to the requirements and realize the sharing of software and data through health information broadcasting by satellites.

3.4 Proposal

Huge investment is needed for any space telecommunication system, and permanent maintenance is also necessary. For a developing country with limited financial ability, it's a good way to build up its e-health system using satellite according to the specified situation in this country.

In primary phase, it's better to build up an e-health system by renting transponders of civil or other countries' satellite. When the requirements are mature and the fund is sufficient, one country can build up a new satellite system aimed at public service, in which e-health is one of the main purposes.

The scale of satellite multimedia service is increasing all over the world, so are the user's requirements. Under this situation, broad band satellites technology is becoming one of the trends of satellite telecommunication in the future. By the way, it's necessary to consider the compatibility between current satellite facilities and the future satellite system, such as the broad band satellite system.

It is suggested to conduct the satellite hardware construction, the telecommunication system research, and business mode exploring synchronously.

2.14 India: Setting up of Rural Tele-medicine Network in Developing Countries

[14] The contribution is a case on implementation of Tele-Medicine project through Pan – African E-Network Project by M/s Telecom Consultants of India Limited, a Government of India Enterprise. The project has been very successful and won several awards for innovation. This model could be used as an example for providing Health services through ICTs in the developing countries.

1 Introduction/Background: TCIL Experience of Design, Development and Operations of Tele-medicine Networks

TCIL has implemented and operating Tele-education and Tele-medicine network projects of pan African e-Network Project, wherein 5 reputed Indian universities and 12 Indian super specialty hospitals are connected to 48 of the 54 member countries of African union for providing Tele-education and Tele-medicine. TCIL is implementing agency on turnkey basis covering design, development, supply, installation, commissioning and operations of the network.

The network is operating for more than 5 years and African countries have benefitted from the medical expertise and know how in India via this network. The CME sessions conducted from India on daily basis have helped the medical professionals in education and sharing of experiences. TCIL is implementing agency on turnkey basis covering design, development, supply, installation, commissioning and operations of the network including providing education and medical services through the Indian universities and hospitals. TCIL has also implemented SAARC telemedicine network spread across for the SAARC nations.

Pan African e-Network Project has been awarded of "Best Development Initiative in Africa – 2009" and "Hermes International Award for Innovation".

2 TCIL Proposal

The aim of this service is to provide health checkups and diagnosis for non-emergency medical conditions and thus eliminating the need to travel to cities for treatment of minor ailments. This service would enable the rural population to demand medical services at their door steps. A medical call center would be established which can be contacted over a toll free number. This service would bridge the gap between the rural population and specialty medical care and thus benefitting both.

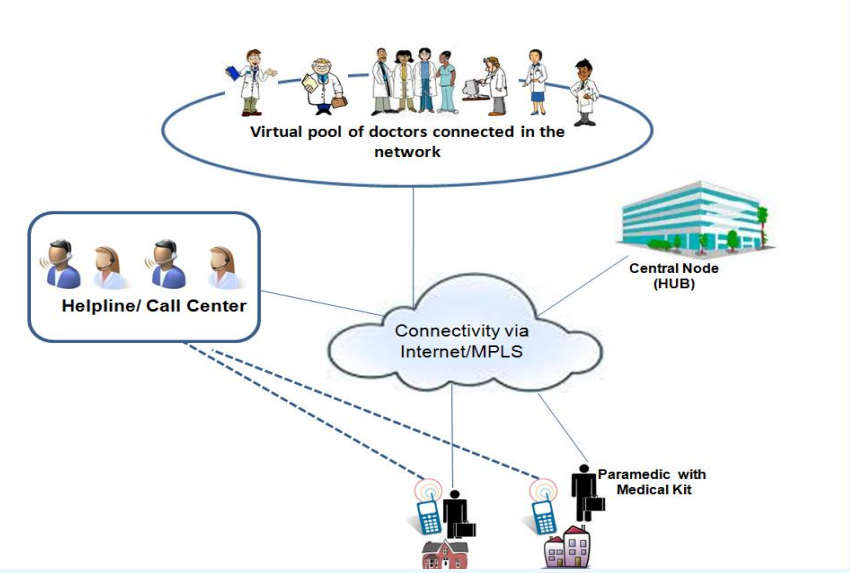
These services would be provided either through paramedics or general practitioners. Medical Diagnostic kit can help in providing the Frontline Health worker to perform diagnostics tests and then employ decision support system to offer care to all primary care patients. In the case of emergency or situations where further consults are required, the medical officer can use the Satellite or Broadband connectivity to offer telemedicine facility.

Paramedics are one of the first points of contact for many populations. Empowering them with Medical Diagnostic Kit, the on-the-spot recommendation system and guidance by physicians through the phone/videoconferencing will allow them to monitor patient health and also identify high risk cases which

[14] See document 2/INF/87

need immediate care by physicians. In this way, such a system could help better care delivery and a more efficient system for rural population.

Figure 33: Rural tele-medicine network



Workflow of the rural tele-health services

1 Services shall operate through the call center for providing the medical assistance to the patients in the rural areas.

2 Call Center would be equipped to receive the help calls by following means:

a. Helpline telephone numbers;

b. Web-based access.

3 Residents can register their requests for medical services by approaching the call center by available communication means.

4 The call center shall alert the paramedic near to the location of the caller or service seeker and forward him the request details for attending the patient.

5 Paramedic is equipped with sufficient diagnostic equipment to examine the patient.

6 Paramedic on examining of the patient shall report the details through internet and seek an appointment with a doctor from Primary Health Centers (PHCs).

7 PHCs doctor list and contact details would be available in the data base and paramedic can contact the doctor of the particular PHC for getting medical support.

8 The entire diagnosis and medical history shall be available to the doctor by accessing the central server.

9 Doctor shall provide the necessary prescription online into the system which shall also be available to paramedic for handing over the same to the patient.

10 The medicine shall be arranged by the patient separately from PHCs or chemists.

11 The Call Center and Data Center would be located at a mutually agreed upon location.

3 Proposed Technical Solution

Components of the rural tele-medicine solutions and their roles for delivery of rural tele-medicine services:

a) Role and responsibilities of 24X7 Toll free Helpline/call center

i. The patients from rural areas can call the helpline for immediate medical assistance for an emergency or to request for a health checkup. Depending on the call it may be forwarded directly to a physician for immediate advice.

ii. Initially a call center with a staff of 5 agents and 2 doctors may be setup for the pilot project. The call center's call handling capacity would be increased as per the increase in the call traffic.

iii. The call center would inform the callers about the schedule for paramedic staff visiting their area and also accept request for health checkup.

b) Role and responsibilities of paramedic staff

i. Paramedics would be hired to travel to various regions of the targeted area to provide health check up and medical assistance. Paramedics would be equipped with a medical diagnostic kit and medical vehicle to carry the patient to a Specialty Hospitals if required.

ii. As per the requests for health check up received, a paramedic staff would visit the concerned patient.

iii. The paramedic visiting a patient would prepare and upload the EMR online on the central server.

iv. The paramedic would also transfer the medical reports generated over the medical kit to the centralized server.

v. The paramedic can also communicate with a specialist using the medical kit's Video Conferencing facility.

vi. Paramedic staff would be provided with a mobile phone with GPS facility.

c) Role and responsibilities of primary healthcare centres

i. Primary health centers may play a key role in this network. They may also initiate a call to the call center for tele-consultation with a specialist as needed. They may also act as the health checkup center when the paramedic with medical diagnostic kit arrives in that area.

ii. Primary Health Centres may also appoint doctors to take calls from Paramedic Staff and to assist them remotely.

d) Role and responsibilities of doctors in the virtual pool

i. A pool of doctors from various Primary Health Centres would be enabled to connect in the network over internet.

ii. These doctors would help the paramedic personnel in the rural area visiting the patient and give a prescription.

iii. The doctors would be able to see the Patient record online from login into the Central Server.

e) Medical kit

The medical kit is a revolutionary device that enables remote diagnostics and care employing state of the art mobile system. It would allow any Android Phone or Tablet to perform following diagnostics tests:

i. Blood Pressure.

ii. Blood Sugar.

iii. Heart Rate and Heart Rate Variability.

iv. ECG.

v. Urine Protein.

vi. Urine Sugar.

vii. Blood Hemoglobin.

viii. Body Temperature.

4 Stakeholders

– ITU.

– Participating interested countries.

– TCIL as implementing agency for the project.

– Participating Hospitals for delivery of Tele-medicine sessions and CME programs.

– Beneficiaries patients.

5 Approach for Project Implementation

Approach and methodology:

After intent of countries to implement Rural Tele-medicine network, TCIL shall carry out detailed meetings into the country for implementation of the Rural Tele-medicine solutions whereby it will do the following:

– TCIL shall identify in association with stake holders the Medical treatments at site to be covered, identification and finalization of Super Specialty Hospitals, Primary Health Centres etc. for delivery of Tele-medicine services.

– TCIL shall carry out a sample survey of few locations.

– TCIL shall design the network for setting up the required infrastructure.

– TCIL shall finalise Bill of Materials (BoM), Bill of Quantities (BoQ), availability/ coverage of public network etc.

– TCIL shall develop the framework of implementations of Tele-medicine as per the countries requirements.

– TCIL shall train the countries' manpower for operations & management of the network.

– A project monitoring team will monitor the different activities of the project.

Responsibility of countries:

– Network for Tele-medicine such a leased lines, internet, MPLS shall be provided by the interested country.

– Space, power/electricity shall be provided by respective countries.

– Site preparation shall be provided by the respective country.

– Man power for operation and maintenance shall be provided by the respective countries.

– Any other local assistance regarding clearance, Visa, survey etc.

– Exemptions such as taxes, custom duties will be provided by the country.

– Day to day Consumables at respective sites will be provided the respective country.

About TCIL

TCIL, **Telecommunications Consultants India Limited,** a prime engineering and consultancy company, is a wholly owned Government of India Public Sector Enterprise under the administrative control of the

Department of Telecommunications (DOT), Ministry of Communications and Information Technology, Government of India. TCIL was set up in 1978 for providing Indian telecom expertise in all fields of telecom, Civil and IT to developing countries around the world. Company's core competence is in the fields of Switching, Transmission Systems, Cellular services, Rural Telecommunication, Optical fibre based backbone transmission systems, IT & Networking Solutions, Application Software, e-Governance, 3G Network, WIMAX Technology and also Civil construction projects. http://www.tcil-india.com/new/

For more details on Pan African E Network Project: http://www.panafricanenetwork.com/

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Annex III: Compendium of e-Health Projects for RMNCH Implemented in CoIA Countries

	e-Health project	Description	ICT application	Country
1	**e-Districts Project for services of births and deaths registration in district of Kapurthala, India**	**Integrated electronic service** supported by automation workflow, backend computerization, and data digitalization. The objective is to ensure that the defined process of service delivery of birth/death certificates is adequately and timely followed. http://pbhealth.gov.in/e-district.crs.pdf	Civil Registration Health Management Information System (HMIS)	India
2	**MAMA**	**Mobile-based information** to new and expectant mothers. http://www.babycenter.com/mama	SMS-based Public Health Information and Education	Bangladesh South Africa India
3	**MOVE IT**	**Mobile-based registering** of pregnancies, recording of births, deaths and cause-of-death, using **text messaging** system. http://www.who.int/healthmetrics/news/MOVE_IT_Africa_Board_Paper_21.2.12.pdf	Civil Registration	Ghana
4	**Project Mwana**	**Mobile application** based on RapidSMS, used by community health workers (CHWs) to register new births and monitor community health events related to malaria, diarrhoea, and immunizations in children under five years old and expectant mothers. http://projectmwana.posterous.com/	Civil Registration	Malawi
5	**Universal Birth Registration**	**Mobile birth registration system** focused on informing and educating the public about the birth registration processes. http://plan-international.org/birthregistration	Civil Registration	Liberia
6	**Aceh Besar midwives**	**Mobile phones** to improve the quality of health services and reinforce positive health behaviour change, such as child spacing. http://www.mobileactive.org/files/file_uploads/final-paper_chib.pdf	SMS health education	Indonesia
7	**AMUA**	**SMS** is used to send monthly service reports for 12 services in a single text, using a numeric code. Data can be viewed on a **Web-based real time reporting system**, and exported as PDF or CSV files. http://mariestopes.org/ShowContent.aspx?id=430	Health Management Information System (HMIS)	India

	e-Health project	Description	ICT application	Country
8	**ChildCount+**	**Mobile application** based on **RapidSMS** to monitor children under five years old. http://www.childcount.org/	m-Health for data collection Community-based healthcare delivery	Kenya
9	**CycleTel: Family Planning via Mobile Phones**	**Standard Days Method** (SDM) displayed directly to a user's **cell phone**. SDM is a fertility awareness-based method that requires the user to avoid unprotected sex during days 8-19 of her menstrual cycle. http://www.coregroup.org/storage/CycleTel_mHealth_WG_Jan2011-1.pdf	SMS-based Public Health Information and Education	India
10	**e-IMCI**	**Electronic job aid on PDA** to improve adherence to the Integrated Management of childhood Illness (IMCI) protocols. http://www.d-tree.org/our-projects/imci-tanzania/	Point-of-care support and diagnosis	Tanzania
11	**mCare**	**Mobile phone** and **database technologies** used to improve registration and monitoring of pregnancies, as well as neonatal and post-partum care. http://www.mobileaware.com/solutions/mobile-self-service/	m-Health for Data collection Community-based healthcare	Bangladesh
12	**M-CHANJO**	**Mobile health application** that seeks to reduce the rate of child mortality. The system works by sending automated reminders via **SMS** to parents to keep them informed on any future immunization dates and appointments for their children. http://mchanjo.org/	Child Death Surveillance SMS health education and reminder	Kenya
13	**Medic mobile (Frontline SMS)**	**Mobile-based technology** to bridge between patients and physician, mainly for family planning and maternal and child care services. http://medic.frontlinesms.com/	Patient monitoring	Bangladesh
14	**mUbuzima**	**Cell phones** are used to enable community health workers (CHWs) to provide real-time data concerning community health indicators. http://mubuzima.gov.rw	Data collection	Rwanda
15	**SMS alerts for Infant vaccinations**	**e-Vaccination Alert System** connected to 'Hospital Kiosks' where parents register the birth of their child. Alerts on vaccination dates and details on their importance will be automatically sent to the **mobile phone** numbers of parents. http://www.healthunbound.org/content/sms-alerts-infant-vaccinations	SMS health education Point-of-care support	India

	e-Health project	Description	ICT application	Country
16	**AMANECE**	**Mobile phones** are used to detect warning signs and typical symptoms of high-risk pregnancies, to support primary health workers in providing monitoring and follow-up for high-risk pregnancy cases, and to ensure timely obstetric and newborn care interventions. http://www.salud.carlosslim.org/SoluInte/amanece/Paginas/AMANECE.aspx	Patient monitoring Point-of-care support and diagnosis	Mexico
17	**ASARA-HMRI**	**Telemedicine** pilot project aimed at reducing maternal mortality among remote tribal women. http://www.hmri.in/oursolutions-telemedicine.html	Remote monitoring Diagnosis and treatment support	Kenya
18	**BabySMS**	**Free SMS**-based pregnancy advice service to help raise awareness and encourage expectant mothers to attend clinic visits regularly. http://babysms.mobi/index.php	SMS health education SMS reminder	South Africa
19	**Cellphone4HIV**	**SMS** is used to expand the uptake of HIV testing and follow-up in PMTCT. http://www.cell-life.org/	Patient monitoring and support SMS health education	South Africa
20	**Changamka Medical Smart Card**	**Smart Card** provides sustainable financing for delivery, and post-natal services at participating facilities. http://changamka.co.ke/	Mobile financial services	Kenya
21	**CommCare**	CHWs use **electronic forms** to access real-time guidance through key counselling points, decision support, and simple referral algorithms. http://www.CommCareHQ.org	Health Management Information System (HMIS) Patient monitoring Point-of-care support and diagnosis	17 countries in Africa, Asia, and America
22	**CliniPak**	**Automatic text message reminders** for patients receiving ongoing treatment and for mothers requiring post-natal care for themselves and their infants. http://www.vecnacares.org/technology/index.shtml	Point-of-care support and diagnosis Medication reminder	Kenya
23	**E-HealthPoint**	**Tele-medical services** providing referrals to district-based hospitals for situations like childbirth, acute trauma, heart attack, cancer, and accident related emergencies. http://www.ehealthpoint.com/	Patient monitoring Point-of-care support and diagnosis	India
24	**FANC**	**Short Messaging Service (SMS) platform** that allows for two-way exchange of key FANC messages between health personnel and pregnant women. http://www.fanc-africa.org/	SMS health education	Kenya
25	**GlobalMama**	**Blog** dedicated to maternal health. http://blogs.medscape.com/mhtfglobal	Health education	Global

	e-Health project	Description	ICT application	Country
		mama		
26	**HealthLine**	**Toll-free number** for health workers to learn about a variety of topics through audio transmission in native language. http://www.cs.cmu.edu/~healthline/	Health helplines	Pakistan
27	**Health Systems 20/20**	**Mobile based financial services** for interventions in financing, governance, operations, and capacity building to strengthen health systems. http://www.healthsystems2020.org/	Mobile financial services	Global
28	**inSCALE**	**Mobile based system** to improve support supervision, data submission with automated individual feedback and regular motivational messages on how to improve performance and appropriate treatment of children. http://www.malariaconsortium.org/inscale/pages/implementation-sites/uganda	Health education	Uganda Mozambique
29	**Jaroka Tele-Health care Services for Lady Health Workers**	Mobile platforms to extend (1) tele-healthcare based services including **SMS**, **MMS**, **GPRS/Edge** and **VSAT**, (2) medical advice to LHW in the field by connecting them to a network of specialists. http://tele-healthcare.org/implementation/jaroka-tele-healthcare-in-rural-mardan/	Telemedicine Point-of-care support and diagnosis e-Diagnosis	Pakistan
30	**KimMNCHip**	**Mobile** health initiative to offer pregnant women in Kenya more choice, control and care during their pregnancy, and improved medical care for women and their babies during and after delivery. http://www.ghf12.org/?p=2154	Patient monitoring Point-of-care support and diagnosis Maternal and Child Death Surveillance	Kenya
31	**mDhil**	Health information via **SMS** as well as original health **videos** viewable on mobile phones, including maternal health. http://www.mdhil.com/	SMS health education	India
32	**MoTech**	**Mobile based health system** improving management patient data, improving worker performance, and providing last-mile supply chain and patient adherence. http://www.grameenfoundation.org/what-we-do/technology/mobile-health	m-Health for CHW Training Data collection Diagnosis and treatment support	Ghana
33	**Pesinet**	**Mobile phone**-based system monitoring information on mother and child health. http://www.pesinet.org/	Maternal and Child death surveillance Monitoring and evaluation	Mali

	e-Health project	Description	ICT application	Country
34	**RAFT**	**Tele-expertise, ultrasonography** with remote supervision by specialists, particularly for supporting diagnosis for pregnant woman, and collaborative development of educational on-line material. http://raft.hcuge.ch/	Remote monitoring e-Diagnosis Patient monitoring and support Monitoring and evaluation Health Education Point-of-care support	Congo-Brazzaville + 17 countries in Africa
35	**RapidSMS**	**SMS** based system to track pregnancies and support maternal, neonatal and early child health. http://rapidsms.moh.gov.rw/	Monitoring and evaluation SMS reminder	Rwanda
36	**RHEA**	**Health information system** to improve maternal and child care in Rwanda at health centre level. http://rhea.jembi.org	Monitoring and evaluation	Rwanda
37	**SHINE**	**Web and mobile-based** system addressing the data management needs of doctors, nurses, midwives and allied health professionals. https://www.shine.ph/	Data collection Health Information System	Philippines
38	**SMART**	**Small battery-operated printers** program to receive and print early infant diagnosis test results to strengthen early infant diagnosis services by speeding up results delivery and treatment eligibility. http://www.sms2printer.co.uk/pages.php?pageref=clinton-foundation_3	Diagnosis for treatment support Monitoring and evaluation	Mozambique Papua New Guinea Cameroon Zimbabwe Tanzania Ethiopia Malawi Kenya Uganda
39	**SMS Tech for Health txt4Enat**	**Mobile based system** to inform women about pregnancy and collect information transmitted via the handsets to a **central computer system.** https://smsinaction.crowdmap.com/reports/view/162	Point-of-care support Monitoring and evaluation	Ethiopia
40	**Text4baby**	**SMS** based system providing new and expectant mothers with information. http://text4baby.org	SMS health education	Global
41	**TulaSalud**	**Telemedicine and mobile phones** for remote diagnostic and decision-making support from physicians in urban centre and receive calls from people in communities seeking for care. http://www.tulasalud.org	Telemedicine m-Health for CHW Training	Guatemala
42	**UNICEF Reminder Mother System**	**Mobile phones** to increase antenatal care and prevention of mother to child transmission by educating communities. http://www.texttochange.com	Health education SMS reminder	Uganda

	e-Health project	Description	ICT application	Country
43	**Wawared**	**Mobile technology solutions** to support maternal and child care by improving access to health services for low-income pregnant women. http://www.wawared.andeanquipu.org/	Diagnosis and point-of-care support Monitoring and evaluation	Peru
44	**Wazazi Nipendeni**	**Free SMS service** for expectant mothers and families that provides appointment reminders and tips on keeping mothers and newborns healthy. http://www.texttochange.org	SMS Health education SMS reminder	Tanzania
45	**Wired Mothers**	**SMS** reminders to pregnant women for care appointments. http://www.enrecahealth.dk/archive/ffuproposal09wiredmothers.doc/	SMS reminder m-Health for CHW Training	Tanzania

Annex IV:Composition of the Rapporteur Group for Question 14-3/2

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	Vice-Rapporteur	Mr Arikan Dalkiliç, Türk Telekom Group, Turkey	
	Vice-Rapporteur	Mr Turhan Muluk, Intel Corporation, United States of America	

Annex V: Glossary

EC – European Commission

EU – European Union

GDP – Gross Domestic Product

GNI – Gross National Income

ICT – Information and Communication technology

IMF – International Monetary Fund

IT – Information Technology

ITU – International telecommunication Union

ROI – Return of Investment

TSA – Telecare Services Association

UN – United Nations

UNDP – United Nations Development Programme

WHO – World Health Organization

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