PAN ASIA ICT R&D Grants Programme

Final Report

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DEVELOPMENT OF ICT-BASED TELEMEDICINE SYSTEM FOR PRIMARY COMMUNITY HEALTH-CARE IN INDONESIA

The Asian Media Information and Communication Centre (AMIC)

Represented the Sponsors:

- The International Development Research Centre (IDRC)
- Asia-Pacific Development Information Programme (APDIP)
- The Asia-Pacific Network Information Center (APNIC)

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SYNTHESIS

The Final Project Report is our completion report on the "Development of ICT-Based Telemedicine System for Primary Community Health Care in Indonesia" project being carried out from November 2002 to June 2004. As mentioned in our Interim Report (December 2003), in the first few months of the project implementation, we faced unforeseen difficult problems particularly in convincing the medical personnel and to start the collaboration with various target institutions, namely Bandung Health Office, Referral Hospitals, and the existing 70 Community Health Centres in Bandung area.

Finally, we managed to achieve the targeted objectives, although unavoidable delays occurred on certain aspects. The ICT-based Telemedicine System for Primary Community Health-Care covers: a health office, a referral maternity hospital, and a number of selected Community Health Centres in Bandung. The associated software modules are to provide the following main telemedicine applications: medicine data recording & reporting, patients' data recording & reporting, tele-coordination, community health education, and limited tele-consultation.

Significant improvements in day-to-day health care services have shown in some *Puskesmas* (Community Health Centre), especially due to the "Medicine Data Recording & Reporting Software Package", and the "Patient Data Recording & Reporting Software Package" provided free of charge by the project. We are ready to offer installation and training of both software packages to more Community Health Centres.

We also found that human resource training, familiarization and socialization of the "computer & telemedicine" needed significantly more time than our expectation.
-The project has shown its significant roles in the human resource development for the community health care. Further supports in HRD aspects have been planned for sustainable implementation of the ICT-based Telemedicine System for Primary Community Health Care
-The project has also provided considerable supports to the academic activities through giving the opportunity to the students to face the real challenges in improving the community health care in Indonesia.

The results of the project activities have shown (in part), and are expected to demonstrate further benefits of the ICT-based telemedicine system to the Indonesian Community Health Care. Further supports from the Government, related health institutions and other organizations are therefore expected.

As the project has shown its encouraging results, we propose that the AMIC, IDRC, APDIP and APNIC could provide their political supports to promote and enhance the application of Internet & Communication Technology for the benefit of Community Health Care and Education in Indonesia. The financial supports for further implementations of the ICT-based Telemedicine System for Community Health Care in this country are also very much expected and appreciated.

RESEARCH PROBLEM

In this project, the fundamental problem of the Primary Community Health Care in Indonesia is how to overcome the relatively high Maternal Mortality Rate (MMR), as well as Children Mortality Rate (CMR). It is expected that the ultimate goal of the activities will be in continuously decreasing both the MMR and CMR. A number of different solutions have been proposed by various groups in the country, and our Research Group on Biomedical Engineering has been focusing on the development of ICT-based Telemedicine System.

In Indonesia, there are more than 7600 (seven thousand and six hundred) Community Health Centres (CHCs, *Puskesmas*) to serve more than half the total population of about 220 million. Due to the shortage of human-resources in health care, the primary health care system operates on "referral system" which relies on communication and transportation infrastructure. In the city of Bandung, about 5000 patients per day are being served by 70 (seventy) Community Health Centres.

RESEARCH FINDINGS

A number of research findings obtained in the 20 month period of the project are as follows:

- An ICT-based Telemedicine System for Primary Community Health-Care has been designed. The system prototype covers: a health office, a referral maternity hospital, and a number of selected Community Health Centres in Bandung.
- Associated software modules have been designed and realized to provide the following main telemedicine applications: medicine data recording & reporting, patients' data recording & reporting, tele-coordination, community health education, and limited tele-consultation. Further applications are also anticipated in the future.
- The existing Internet and Telecommunication infrastructure (in Bandung area) has sufficient flexibility to implement the prototype of our "ICT-based Telemedicine System for Primary Community Health-Care".

FULFILLMENT OF OBJECTIVES

As mentioned in the proposal, the <u>original project objectives</u> are as follows:

(1).Develop a Recommendation to Reform the ICT Policy in Indonesia, specifically on the Socio-equities and Communities-sustainability on the use of internet networking for Social & Community application, with emphasis on <u>health related activities</u>.
(2).Develop, implement, install & conduct a trial run of 6 *Puskesmas* medical stations (*Puskesmas* = Community Health Centre = CHC)

(3).Establish a Pilot network of "Primary Community Health Centre Internet-based Telemedicine System" consisting of: 6 Puskesmas stations, 1 health office, and 1 referral hospital, in selected under-served urban & rural areas of Bandung/its suburbs.
(4).Implementing a Pilot Internet-based Digital Healthcare Infrastructure (by linking Community Health Centres, Health Office, & Referral Hospital).
(5).Enhancing day-to-day Primary Community health-care delivery
(6).Assist in decreasing the MMR (Maternal Mortality Rate) in Indonesia.

During the duration of the project (November 2002 to June 2004), the following project objectives and additional objectives have been achieved:

(1).In general, our recommendation strongly suggest that the Indonesian Government, ICT related organizations/institutions/companies, and the whole community to actively promote and to provide full supports on the use of ICT for Educational & Health Care applications. More specific recommendations can be stated, which include:

- The Department of Health, Department of Education, and Department of Communication & Information are suggested to take necessary supports and actions to enhance the use of ICT for Educational & Health Care applications in Indonesia.
- Related organizations/institutions/companies, (for example: PT Telkom, PT Indosat and other telecommunication/internet service providers) to provide necessary actions (which include: special reduced rate, and/or free service if necessary) for enhancing the applications of ICT for Education & Health Care in Indonesia.
- Further derived suggestions which directly or indirectly could provide beneficial supports on the use of ICT for Educational & Health Care applications.

(2).PC-based Medical Stations with their associated Software Modules have been installed in the following 12 (twelve) Community Health Centres (*Puskesmas*):
-Puter CHC, M. Ramdhan CHC, Talagabodas CHC, Garuda CHC, Sukapakir CHC, Pasundan CHC, Cipadung CHC, Cibiru CHC, Pasirkaliki CHC, Babatan CHC, Tamblong CHC, and Gumuruh CHC.
For those Community Health Centres (*Puskesmas*), software installation and on-site users' training have also been conducted.

*PC-based Medical Stations with their associated Software Module(s) have also been installed in Bandung Health Office (*Dinas Kesehatan Kodya* Bandung) and Astana-Anyar Maternity Hospital.

(3).A Pilot Network of "Primary Community Health Centre Internet-based Telemedicine System" using Wireless LAN technology has been completed at the end of December 2003. The pilot network covers: Bandung Health Office (*DKK* Bandung), Puter Community Health Centre (*Puskesmas* Puter), Astana-Anyar Maternity Hospital (*Rumahsakit Bersalin* Astana-Anyar), and Biomedical Engineering Laboratory (BME ITB). Internet connection is provided through the BME ITB node.

*Additionally, Bandung Health Office and Talagabodas CHC can also have their internet connections through "dial-up" (using Public Switched Telephone Network = PSTN telephone), for example through "TelkomNet-Instant" (phone number: 0809 8 9999).

(4).A Pilot Internet-based Digital Healthcare Infrastructure has been completely implemented, covering: Bandung Health Office, Puter Community Health Centre, Astana-Anyar Maternity Hospital, Talagabodas Community Health Centre, and Biomedical Engineering Laboratory (BME ITB).
The software installation and on-site users' training for all the "nodes" and the total 12 CHCs have been completed.
Further additional Community Health Centres are in the process of software installation and on-site users' training; these activities are beyond the original project objectives.

(5).Day-to-day Primary Community health-care activities (especially medicine & patient data recording and reporting) have shown significant improvements through the use of telemedicine technology. Technical supports are provided by the team members periodically to a number of "nodes" (Community Health Centres, Health Office, and Hospital). These aspects (continuous HRD & technical supports) are very important for a sustainable operation of the Community Health Care Telemedicine System.

(6).Since the use of telemedicine technology involves only a relatively small number of CHCs (12 units out of the existing 70 CHCs), health office, and hospital, and the experiments have been conducted only for relatively short period, there is NO significant Maternal Mortality Rate decrease YET. But in the near future, when more and more CHCs, health offices, and referral hospitals involved in the Telemedicine System, community health care services will be gradually improved. Therefore, we certainly expect that in the future, Maternal Mortality Rate and Children Mortality Rate will decrease more significantly.

(7).In addition to the above mentioned objectives, the websites of the above mentioned 12 (twelve) Community Health Centres (*puskesmas*) have been initially developed and posted. Moreover, "website templates" for the rest of 48 *puskesmas* in Bandung have been prepared and made available to be completed by the respected CHC personnel. The completion and update of each website template can be done "on-line" from remote location.

(8).Beside the above mentioned 6 objectives, the project has also achieved additional but beneficially important achievements, which were NOT previously planned. Among others:

- Web-based Community Health Care Information System (*SIPKM = Sistem Informasi Pelayanan Kesehatan Masyarakat*) which is presented in *Bahasa Indonesia*, and consists of various information, which include: community health centres (*puskesmas*), medical doctors, clinical laboratories, and pharmacies located in Bandung. All the web-based information can be accessed through the internet, as well as through the SMS (short messaging service) of the mobile phone.
- The *SIPKM* can also be used for delivering various specific information to a number of registered mobile phone users and/or to a number of registered e-mail addresses.
- Biometrics/Fingerprint Identification system for Community Health Care applications has been designed in response to the requirements of community health centres with relatively large number of patients (i.e. more than 100 patients per day). When later

implemented, the Biometrics/Fingerprint Patient Identification System will also be able to support patients data recording, retrieving and reporting system.

PROJECT DESIGN AND IMPLEMENTATION

In this final report (for the period of November 2002 to June 2004), the following Project Design and Implementation activities can be reported:

- We have produced a system design of the "ICT-Based Telemedicine System for Primary Community Health Care", as shown in Fig. 1. The original system design consisted of 6 (six) Community Health Centres, Bandung Health Office, and Astana-Anyar Maternity Hospital. We also utilize the following existing telecommunication & internet infrastructures: Wired PSTN (Public Switched Telephone Network), Wireless/microwave LAN (Local Area Network), Mobile Wireless Network (GSM & CDMA operators), and Fixed Wireless Network (CDMA). The wireless alternatives have specially been designed for areas where PSTN connections are not available, or for specific purpose (i.e. mobile CHCs).

- The project has completed the following software design and implementation activities:
  -Medicine Data recording & reporting software module, and its users' manual.
  -Patient Data recording & reporting software module
  -Web-based community health education has been designed and implemented in a number of CHCs

- Further re-design and implementation activities have been completed:
  -Changes on the reporting formats of the Medicine Software Module and the Patient Software Module requested by the Community Health Centres, have forced us to do further software re-design and modification activities.
  -We have also completed the implementation of Web-based programming for the software modules, so that they will be almost platform independent.

- The project has also completed the Design & Implementation of Fixed Wireless (Microwave LAN) Network for Telemedicine System covering 4 nodes: Puter CHC (located 1**.**4 km from BME-ITB), Bandung Health Office (located 2 km from BME-ITB), Astana-Anyar Maternity Hospital (RSB-AA, located 4**.**7 km from BME-ITB), and Biomedical Engineering Laboratory ITB (BME-ITB). The implementation activities were divided into some parts: Equipment procurement phase-1, laboratory testing, sites survey, equipment procurement phase-2, and Installation & Field testing.

- During the project implementation phase, we have solved the following significant problems, among others:
  - Users (or potential users) were in general very difficult to be convinced about "the new" (telemedicine) system and its benefits. To solve the problem, the team members had to provide more than allocated time and efforts for this

purpose. Formal and non-formal meetings, presentations and discussions had been conducted.
  - Users' requirements significantly changed from time to time, thus software re-design had to be done frequently.
  - Human resource training, familiarization and socialization of the "computer & telemedicine" needed relatively much more time than our expectation. The training workshops had been conducted four times during the project.
  - Project management problems arising from the above mentioned points have also been overcome
  - Two additional CHCs without telephone (PSTN) access were requested to be included in the project. The technical problems were challenging, but needed more time & efforts.

- On the Gender issues related to the project activities, we note the following points:
  - 62.5% of the 12 participating Community Health Centres (CHCs) are headed by female Medical Doctors.
  - 35% female participants (out of the total 20 participants) attended the Tele-medicine training workshop conducted on the 11 – 15 August 2003.
  - 95% female medical doctors (out of the total 40 participants) attended the Telemedicine training workshop conducted on the 9 – 16 February and 18 – 26 February 2004
  - 65% female participants (out of the total 20 participants) attended the Tele-medicine training workshop conducted on the 18 – 26 June 2004
  - 60% female staff members and students have been participating actively in the project.

PROJECT OUTPUTS AND DISSEMINATION

Project Outputs :

-System Design of the "ICT-Based Telemedicine System for Primary Community Health Care". The system prototype consists of 6 (six) Community Health Centres (CHCs, *puskesmas*), Bandung Health Office (*DKK = Dinas Kesehatan Kotamadya* Bandung), and Astana-Anyar Maternity Hospital (*Rumahsakit Bersalin* Astana-Anyar = *RSBAA*). Figure-1 shows the simplified block diagram of the ICT-Based Telemedicine System for Primary Community Health Care. The 6 CHCs (number 1 to number 6) were selected among the existing 70 (seventy) CHCs in Bandung area.
The Bandung Health Office later requested two additional CHCs (number 7 and 8) to be included in the telemedicine project; since wireless mobile system were used, the design can also be implemented for mobile CHCs.

Recently, during the final stage, four additional CHCs (number 9 to 12) have been included in the telemedicine project, as requested by the Bandung Health Office.

Software packages have been installed and on-site users training have also been conducted. Therefore, at the final stage, the Telemedicine system consists of 12 CHCs.

-Software packages (modules):
-Medicine Data Recording & Reporting Software Package (Module), and Users' Manual of the software module, written in *Bahasa Indonesia* (Indonesian language).
-Patient Data Recording & Reporting Software Package (Module).
-Patient Data Acquisition & Processing Package, installed and tested in Bandung Health Office (*DKK* Bandung)

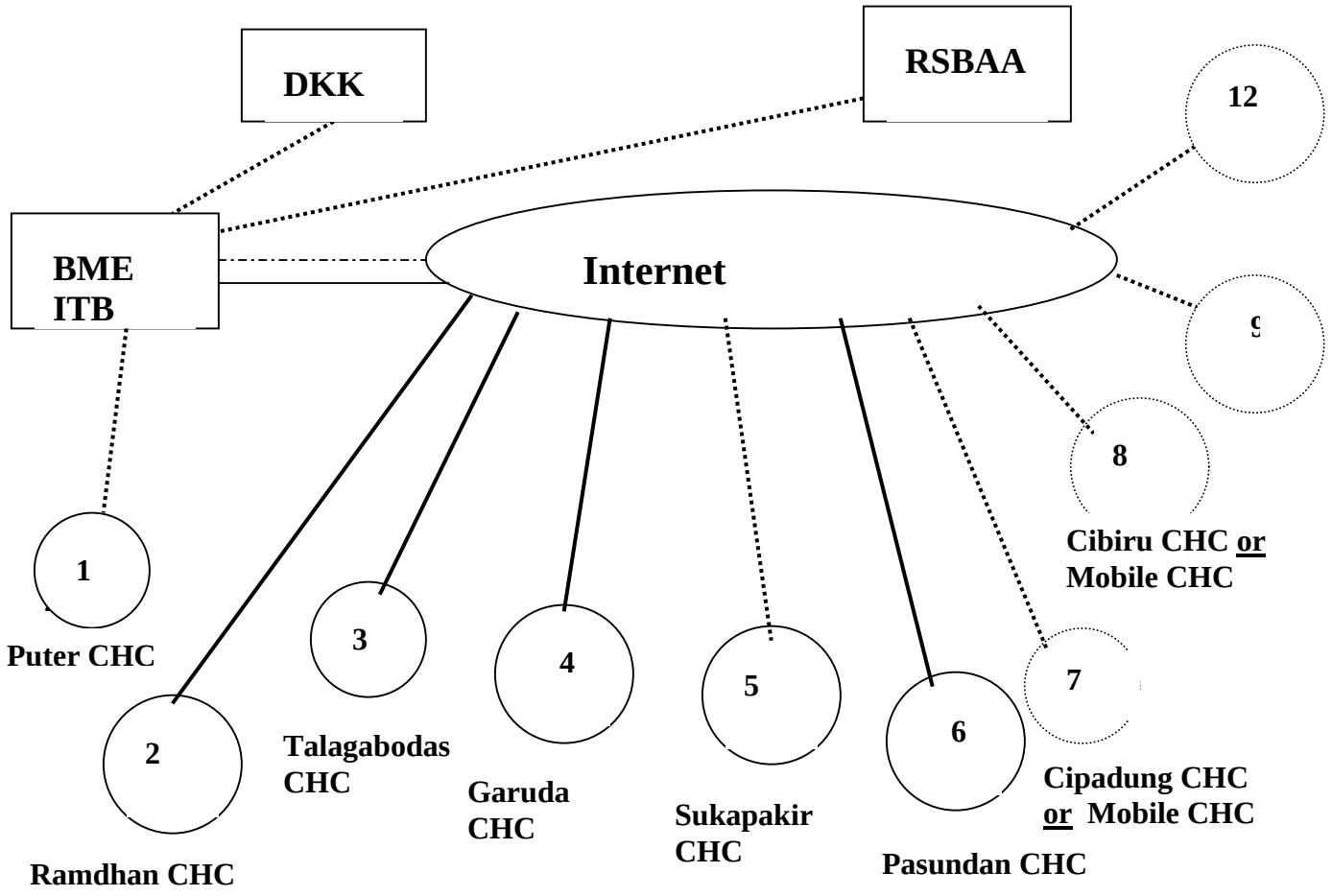

Figure 1. Simplified Block Diagram of the ICT-Based Telemedicine System for Primary Community Health Care [Final Stage]

-Published websites
-A number of prototype Websites have been prepared and published for evaluation purposes. The published prototype websites are as follows:

- Puter CHC (*Puskesmas* Puter): since January 2003
- Talagabodas CHC (*Puskesmas* Talagabodas: since March 2003
- Bandung Health Office (*Dinas Kesehatan* Kodya Bandung): since April 2003

- Ramdhan CHC (*Puskesmas* M. Ramdhan): since September 2003
- Astana-Anyar Maternity Hospital (*Rumahsakit Bersalin* Astana-Anyar): since September 2003.

Based on various feedbacks and comments received, we have been designing and implementing new websites for the Community Health Office, Community Health Centres, and Hospitals.

The new ("blank") "website templates" have been completed and made available in February 2004. The websites of the above mentioned 12 (twelve) Community Health Centres (*puskesmas*) have been initially developed and posted, based on the templates. Moreover, website templates for the rest of 48 *puskesmas* in Bandung have been prepared and made available to be completed by the respected CHC personnel (the completion of each website template can be done "on-line" from remote location).
Additional new materials and information up-dates have been agreed to be added/keyed-in by the assigned personnel from the respective Community Health Office, Community Health Centres, and Hospitals.

Table - 1
List of Project Output

No	Title/Name of Project Output	Date	Place	Description
1	Telemedicine System Design (for 6 CHCs)	2003	6 CHCs in Bandung	implemented
2	Telemedicine System Design (for 8 to 12 CHCs)	2003	12 CHCs in Bandung	implemented
3	Microwave LAN/Fixed Wireless 4 Node Network	2003, December	1 CHC, DKK, RSBAA in Bandung	implemented
4	GSM/CDMA Mobile Telemedicine Station for Mobile CHC	2004, April	2 CHCs in Bandung	implemented
5	GSM/CDMA Fixed Wireless Telemedicine Station for Remote CHC	2004, April	2 CHCs in Bandung	implemented
6	Field strength Measurements & medical information transfer experiments through the internet & GSM/CDMA mobile phones	2004, Jan - June	70 CHCs in Bandung	completed

-Training Workshop for Users/Operators

-"Workshop on Introduction to Computer and Telemedicine": the first workshop of the series was conducted in ITB (Bandung) on 11 – 15 August 2003, and attended by 20 paramedics and administrative personnel. They were selected from the existing 70 Community Health Centres (*Puskesmas*) and Community Health Office in Bandung. The hands – on activities in the workshop were enthusiastically followed by all the attendee.
-Two consecutive training Workshops on Introduction to Computer and Telemedicine, have been conducted on 9 – 16 February and on 18 - 26 February 2004. Both workshops are improved versions of the previous one, and were attended by medical doctors from 40 different community health centres (CHCs) in Bandung. Since each of the participants

was the person in-charge for each respected CHC, the workshops are indeed very important.
-"Workshop on Introduction to Computer and Telemedicine": conducted on 18 – 26 June 2004 attended by 20 paramedics and/or administrative personnel.
In total, all the training workshops have been attended by 80 participants from 53 different community health centres (CHCs). Therefore, only 17 CHCs (out of the existing 70 CHCs in Bandung) that have not sent their staff to attend the training workshop.
-Moreover all the training workshops can also serve as project dissemination activities.

Table – 2
List of Training Workshops

No	Title of Workshop	Date	Place	Nb of Participants
1	Workshop on Introduction to Computer and Telemedicine	11 – 15 Aug 2003	BME ITB	20 paramedics/ admin personnel
2	Workshop on Introduction to Computer and Telemedicine	9 – 16 Feb 2004	BME ITB	20 medical doctors
3	Workshop on Introduction to Computer and Telemedicine	18 – 26 Feb 2004	BME ITB	20 medical doctors
4	Workshop on Introduction to Computer and Telemedicine	31 May – 5 June 2004	BME ITB	20 paramedics/ admin personnel

Project Disseminations:

To promote the activities and results of our project on "ICT-Based Telemedicine for Primary Community Health Care", in addition to the training workshops, the following activities have been conducted:

- A formal meeting with the key personnel in the Bandung Health Office was conducted, followed by a number of follow-up discussions, formal & non-formal meetings and presentations, and organizing of "Introduction to Telemedicine Seminars" for medical doctors (responsible person of the Community Health Centres in Bandung area).
- A number of Technical Meetings were also conducted with key personnel in different community health care institutions/units, namely: Bandung Health Office, Astana-Anyar Maternity Hospitals, Puter CHC, Talagabodas CHC, Ramdhan CHC, and some other CHCs.
- Invited Interview in TV-7 (Local TV Station, based in Jakarta): Topics on Telemedicine System for Community Health Centre, Jakarta, 2 August 2003.
- Invited Presentation in Telemedicine Seminar, Jakarta 9 August 2003, organized by Faculty of Medicine, University of Indonesia. Our presentation (in Bahasa Indonesia), on "Introduction to Telemedicine & Its Application in Community Health Care" was

one of the invited paper presentation. Simulations (demo) & discussions on the "Tele-consultation system" have also been conducted.

- Paper presentation on Telemedicine System for Community Health Care, in World Congress on Medical Physics & Biomedical Engineering, Sydney, 24 – 29 August 2003. A paper entitled "Development of An Internet-Based Tele-consultation Facilities for Community Telemedicine System in Indonesia" was presented. At the conference, we had both formal & non-formal fruitful discussions on Telemedicine activities and exchange of experience with international participants involved in this field.
- Invited Presentation in Telemedicine Seminar, Bandung 8 October 2003, organized by Faculty of Medicine, University of Padjadjaran Bandung. We presented an invited paper in Bahasa Indonesia, on Telemedicine System for Community Health Care. A short demo on Telemedicine & Tele-consultation System was also conducted, followed by interactive discussions.

Table – 3
List of Project Dissemination

No	Title of Seminar/Conference	Date	Place	Description
1	Seminar on Introduction to Telemedicine	2003	DKK Bandung	For MDs & Paramedics
2	Invited Interview on "Telemedicine"	2 August 2003	TV 7 (local TV station)	General audience
3	Telemedicine Seminar: Invited presentation on "Introduction to Telemedicine & Its Application in Community Health Care"	9 August 2003	Jakarta (University of Indonesia)	Medical Fac Staff & students + General
4	Telemedicine Seminar: Invited presentation on "Telemedicine System for Community Health Care"	8 October 2003	Bandung (University of Padjadjaran)	Medical Fac Staff & students
5	Seminar on Introduction to Telemedicine	27 January 2004	DKK Bandung	For MDs & Paramedics
6	Biomedical Engineering Seminar	21-22 June 2004	BME ITB	General audience
7	Telemedicine Symposium: Invited presentation on "Telemedicine & Tele-education	10 July 2004	Yogyakarta (Univ of Muhammadyah)	Medical Fac Staff & students

CAPACITY BUILDING

- An Operator Training (training workshop) on "Introduction to Computer and Telemedicine" for paramedics & operators in both Bandung Community Health Office and Community Health Centers has been organized in BME – ITB (Bandung), on the 11 – 15 August 2003. Twenty personnel from more than 13 Community Health Centres in Bandung had successfully completed the training. The workshop emphasized hands-on experience, beside providing the necessary basic information on computer and telemedicine.

- Since human resource development is an important aspect for the success of the project, we have also conducted three Improved Users' Trainings on "Introduction to Computer and Telemedicine" on the following period:
    - 9 – 16 February 2004: during this period, 20 (twenty) medical doctors enthusiastically attended the hands-on training. All of them were female doctors and they completed the training program successfully.
    - 18 – 26 February 2004: another 20 (twenty) medical doctors attended the hands-on training and completed the whole program successfully.
    - 31 May – 5 June 2004: the training workshop was attended by 20 (twenty) paramedics and administrative personnel from various Community Health Centres.

  In total, during the four training workshops mentioned above, 80 (eighty) medical doctors/paramedics and administrative personnel from 53 (fifty three) Community Health Centers in Bandung had successfully completed the training.
- A number of new graduates (masters and engineers on Biomedical Engineering) with special interests in Telemedicine system for Community Health Care had been graduated.
    - In the period of April 2003 to June 2004, the graduates were: Diana L., Ivan Mulyana, Zainur Budi Akbari, Rendo A. Wibawa, Wahyu T. Adiyasa, Hamdani S., Agus Komarudin, Ansor Usman.

  They have had beneficial opportunity in working and supporting the project implementations and related telemedicine subjects.
- Internal Training for Telemedicine Developers have been (and will be continuously) conducted during the course of the project.
- The project has received interests and various positive responses from the Bandung Community Health Office, some Referral Hospitals and more and more Community Health Centres. Further promotions are required, to extend the telemedicine activities beyond the targeted Community Health Centres.
- The Department of Electrical Engineering ITB donated 4 (four) sets of PC to be used in the laboratory for the telemedicine development purposes.
- The Bandung Health Office and more Community Health Centres have decided to join the "ICT-Based Telemedicine System" developed by the project, and are preparing their own budget & support for financing at least part of their computers (PCs).
- The Bandung Health Office and more Community Health Centres have planned to send their Medical Doctors/Paramedics/Administrative Staff to future training courses on Computers and Telemedicine.

PROJECT MANAGEMENT

At the embarking stage, the project had to solve a number of technical & management related problems that influenced the overall schedule of the project. Through continuous coordination and efforts, especially with the Bandung Health Office and CHCs personnel, the problems had been gradually solved. Most of the targeted objectives had been achieved, although some unavoidable delays were occurred.

The Overall Project Management as well as the Project Time-line had to be modified and adjusted. Since some targets were completed behind schedule, in the last few months the activities had been accelerated.
Finally, at the end of the project, all the targeted objectives have been achieved. The number of Community Health Centres joining the project are even doubled (the targeted number of CHCs was 6, while the achieved number of CHCs is 12).

IMPACTS

At the end of the project, we have noted a number of direct and indirect impacts. Some of the impacts were expected and to be part of the project objectives, but there are also some interesting and beneficial impacts which were not foreseen at the beginning of the project.
Both types of project impacts will be described in the following points:

- After a number of presentations and discussions conducted with medical professionals (mostly medical doctors), as well as encouraging preliminary experimental results, the awareness on the use of PCs in the target Community Health Centers, Health Office, and Referral Hospital have increased significantly.
- Increase Awareness on the application and benefit of PC for the improvement of community health care services and management was noted. We found that more and more Community Health Centres tried or made their efforts to purchase/obtain their own PCs.
- Increase interests on the applications of PC-based Telemedicine System for Community Health Care were also noted. More and more *Puskesmas* (Community Health Centers) have shown their interest in joining the Telemedicine program. Due to the limited resources and time, the team members have to do selection and prioritizing on the scope/coverage of the project. The Biomedical Engineering Program ITB has decided to continue and support further development of the ICT-based Telemedicine System for Community Health Care in Indonesia.
- To obtain even greater and significant impacts, various dissemination activities should be conducted continuously in the near future and to cover larger group of target audience. The activities are also necessary to obtain further political and moral supports, as well as financial and other supports from the government and related organizations.
- Development of Community Health Care Information System (*SIPKM = Sistem Informasi Pelayanan Kesehatan Masyarakat*): This Web-based Community Health Care Information System is a “by product” resulted from the implementation of the project. The Community Health Care Information System is presented in Bahasa Indonesia, and consists of various information, which include: community health centres (puskesmas), medical doctors (general practitioners, medical specialists, dentists), clinical laboratories, and pharmacies located in Bandung, as well as other related information. All the web-based information can be accessed through the internet, as well as through the SMS (short messaging service) of the mobile phone. The *SIPKM* can also be used for delivering various specific/limited information to a

number of registered mobile phone users and/or to a number of registered e-mail addresses. The system is currently under continuous development and is expected to be soft-launched by the end of August 2004.

- Development of Biometrics/Fingerprint Identification system for Community Health Care applications: The system has been designed and developed in response to the requirements of community health centres with relatively large number of patients (i.e. more than 100 patients per day). The Biometrics/Fingerprint Patient Identification System will be able to support patients data recording, retrieving and reporting system.

OVERALL ASSESSMENT

In general, with regard to the overall assessment, the following points are noted:

- The overall system design of the "ICT-Based Telemedicine System for Primary Community Health Care" has been completed. The system prototype consists of: Bandung Health Office, Astana-Anyar Maternity Hospital, and 12 (twelve) Community Health Centres in Bandung area, as well as BME ITB.
- The Software packages for Medicine & Patient Data Recording and Reporting have been completed, and installed in 12 (twelve) Community Health Centres.
- The Design & Implementation of the Fixed Wireless (Microwave LAN) Network for Telemedicine System has been completed. The four nodes covered by the wireless system are: Bandung Health Office, Astana-Anyar Maternity Hospital, Puter CHC, and BME – ITB.
- Four different training workshop on "Introduction to Computer and Telemedicine" have been completed and were attended by 80 (eighty) medical doctors and paramedics/administrative personnel.
- On-site installation and training activities have been completed in 12 (twelve) Community Health Centres. Continuous telemedicine system day-to-day applications are conducted.
- Although some unavoidable delays were noted, accelerated improvement activities had been conducted. Completion of the originally targeted objectives on the expected time had been achieved. The number of Community Health Centres joining the telemedicine system is even doubled the targeted value.
- Although the official project has been completed, the "telemedicine team members" are still available and ready to provide continuous supports for the telemedicine activities conducted in the respected community health centres, Bandung Health Office, and some hospitals.

RECOMMENDATIONS

After completing the project successfully, and noting the fore-mentioned fulfillment of objectives, project outputs, project impacts, and overall assessment, the team members proposed the following recommendations:

- In general, our recommendation strongly suggest that the Indonesian Government, ICT related organizations/institutions/companies, and the whole community to actively promote and to provide full supports on the use of ICT for Educational & Health Care applications. Moreover, the following specific recommendations can also be stated, which include:
    - The Department of Health, Department of Education, and Department of Communication & Information are suggested to take necessary supports and actions to enhance the use of ICT for Educational & Health Care applications in Indonesia.
    - Related organizations/institutions/companies, (for example: PT Telkom, PT Indosat and other telecommunication/internet service providers) to provide necessary actions (which include: special reduced rate, and/or free service if necessary) for enhancing the applications of ICT for Education & Health Care in Indonesia.
    - Further related suggestions which directly or indirectly will provide beneficial supports on the use of ICT for Educational & Health Care applications.

- After conducting a number of training workshops, dissemination presentations, and on-site Telemedicine System demo/experiments, more and more *Puskesmas* (Community Health Centres) in Bandung area have shown their interests in joining the Telemedicine program. But due to the current limited resources and time, we can only cover relatively small percentage (e.g. 12/70 = 17.14 %) of the CHCs in Bandung area, or only about 0.158% of the number of CHCs in Indonesia. Therefore, it is expected that PAN ASIA ICT R & D Grants Programme (and/or other organizations) could continue to support further implementations of the ICT-based Telemedicine System for Community Health Care in Indonesia.

- The AMIC, IDRC, APDIP and APNIC are also requested to be able to provide political supports to promote and enhance the application of Internet & Communication Technology for the benefit of Community Health Care and Education in Indonesia.

FINANCIAL REPORT

The following three Annexes describe the financial matters concerning the project and its activities:

- Annex A – Financial Report Form 1 (Cash Summary)
- Annex A – Financial Report Form 2 (Statement of Expenses)
- Annex A – Financial Report Form 3 (Statement of Estimated Expenses)

DEVELOPMENT OF ICT-BASED TELEMEDICINE SYSTEM FOR PRIMARY COMMUNITY HEALTH-CARE IN INDONESIA

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