

## **RICE: Remote Interaction, Consultation and Epidemiology**

### **Ground Truths: Northern Vietnam's Readiness for Use of Smartphones and Phase I of the RICE Project**

The purpose of my recent trip to Hanoi was to visit a number of medical institutions in the area in order to both present the RICE concept as well as to determine the feasibility and potential benefit of using the system at each of these facilities. More specifically I hoped to answer the following questions:

1. What kinds of cases are the providers seeing at each level of care?
2. What percentage of these cases can be handled at the local commune / district level?
3. What percentage of cases needs to be transported to a provincial or central hospital and on what time frame (hours, days, etc.)?
4. Are there any equipment needs or other resources that we could provide to the smaller, more rural facilities that would, in conjunction with the Smartphone system, allow them to do more locally? This could range from simple supplies like face masks to more technologically advanced equipment like a thermal cycler, the machine necessary to carry out a PCR for the detection and diagnosis of influenza.

When I first arrived in Hanoi, I met Dr. Lily Hue and her colleagues at the National Hospital of Pediatrics (NHP) to devise a schedule for my 3 week visit and figure out the best way to ascertain the above information. We decided that I would spend the first week at NHP, the second week traveling to several more remote sites with a team from NHP in order to present the RICE concept to them and discuss its implementation, and the third week back in Hanoi at NHP to recap and follow-up on any missing information.

#### **General Comments**

There are some things I learned throughout my time in Vietnam about the healthcare system in general that will make the rest of this make more sense. I should note first that Helen Parsons visited NHP last summer and figured out a fair amount about how NHP and the Vietnamese healthcare system in general operate. I used her notes as a starting point for my investigations (please see Helen Parsons's Notes below).

#### **Vietnamese Healthcare System**

Since a big part of the RICE project concerns consultations over cellular phones that could potentially prevent the unnecessary transfer of patients from a smaller district or provincial hospital to a central hospital, I tried to figure out how patients decide which hospital to go to. I found some contradicting answers.

One consistency I found is that healthcare is free for children under the age of 6. The government also helps pay at least in part for older patients and there does appear to be some insurance options as well, but neither Helen nor I were able to figure out this out completely. I was told that officially, in order for the government to pay for the cost of healthcare services, all patients must first present to their local commune health station. If the physician(s) there feel that the patient needs to be transferred to a larger facility, the patient is provided with a letter of invitation to the larger hospital. If a patient arrives at a higher level of care without this letter, the patient must pay out-of-pocket for any services they receive. Exceptions to this "letter of invitation" rule include neonates and the "very sick." It is unclear as to what qualifies under this or who decides what "very sick" means.

Despite this apparent system, according to what Helen found and what I saw while at NHP, there is no mention of these letters of invitation, and it appears that anyone can go to any hospital they want. This translates into a great number of patients bypassing the smaller institutions and going straight to central hospitals where they believe they will receive better care. This is more consistent with what many of the physicians I spoke with mentioned when discussing the issue of overcrowding at NHP (see below).

### National Hospital of Pediatrics

During my first week at NHP, I spent a fair amount of time in the General Planning Department. This office is responsible for keeping statistical and epidemiological data for the hospital. Dr. Hoc, the head of the department, provided me with the following information:

- Number of beds: 580
- Number of inpatients on a given day: 800-900
- Percent of patients unnecessarily being seen/treated at NHP (i.e. could have been treated locally): estimated at 30-50%
- Total number of inpatients/year: 40,000
- Total number of outpatients/year: 300,000
- Number of outpatients seen/day: 1,000-1,500
- Percent of outpatients admitted: 10-15%
- Leading causes of hospital admission:
  1. respiratory compromise
  2. infection/parasite
  3. congenital malformation / deformity
  4. digestive system disease
  5. disease originating in the perinatal period
- Average length of inpatient stay: 8 days
- Mortality Rate: 1.4% in 2004, down from 5.1% in 1995
  - o 25% of fatalities occur within the first 24 hours of admission
  - o Premature infants in the NICU account for 60% of all fatalities, with death usually secondary to hypothermia, hypoxemia, hypoglycemia
    - Transportation is a key issue in these cases
  - o 5 leading causes of mortality at NHP:
    1. perinatal disease
    2. circulatory system disease (including congenital heart defects)
    3. infection/parasite
    4. congenital malformation/deformity/chromosomal abnormality
    5. respiratory system disease
- Percentage of male and female patients (2003): M: 64.5%, F: 35.5%
  - o When asked about this, Dr. Hoc mentioned that as is true in many Asian countries, some families consider male children to be of greater import, and therefore go to great lengths to ensure their health

### Week 1 and Week 3: NHP

With Helen Parsons's work as a guide, I spent the first day at NHP familiarizing myself with the hospital system and taking a tour of the hospital. I spent the remainder of the week meeting with a number of the departments that will be involved with the remote consultations aspect of the project to discuss the use of the Smartphones, the kinds of cases that they will be most helpful for, and how the use of this system might change the way medicine is practiced within northern Vietnam.

### Outpatient Clinic and Emergency Room

One of the most overwhelming observations I made (and complaints I heard from the staff) is the issue of overcrowding at NHP. (This is also supported by the statistics listed above.) The outpatient department sees between 1,000 and 1,500 patients every day, only 26.8% of which are coming from Hanoi. The remainder of the patients travel from neighboring provinces, which may be as far as 200km away. This does not include the 75 patients (on average) that are seen in the Emergency Department each day, who may arrive by ambulance, taxi, or more often motorbike, from outside hospitals (OSH) or from their homes. The one thing that is consistent about patients arriving at the Emergency Department is that they almost always come without any advance notice. When discussing RICE with the ED physicians, they felt that the Smartphones would be incredibly helpful in this matter. If they were able to discuss the patients that were en route to NHP, they would be much better equipped to efficiently care for them on arrival, instead of starting from scratch as if they had not yet been seen by a physician. The ED docs also felt that the Smartphones would allow them to advise physicians at the OSH about anything more that can be done for the patient at the outside facility, how to best transport the patient, complications they might expect during transport, and what to do if these complications should arise.

### Neonatology

The next department I visited was the NICU – the department where overcrowding seems to be the biggest problem. While they have 50 beds in this department, on average they have between 80-120 patients admitted to the NICU. This means that many of the infants are going 2 or even 3 to a bed. The majority of the patients seen in the NICU at NHP are transferred there because they are jaundiced, septic, or premature, and require surfactant and / or mechanical ventilation. The majority of the hospitals throughout northern Vietnam are not equipped to handle most of these cases (both due to equipment issues and physician/staff training issues) and therefore all infants with these diseases are transferred to NHP. One issue that I found particularly striking was the number of infants with severe respiratory issues (due to both infectious etiologies and prematurity) requiring support from mechanical ventilators. NHP has a limited number of these machines, forcing some infants to be manually ventilated. This is far from ideal for many reasons: first, someone has to be responsible for ventilating the infant 24 hours a day, which is a huge strain on both the family and the nursing staff who alternate taking on this responsibility; second, given the technology that has been developed for the use of mechanical ventilators in terms of type/frequency of ventilation and composition of the gas used, manual ventilation is incredibly rudimentary and may even pose a risk to the infant. Clearly, overcrowding is taking a toll on the neonatology department.

But will RICE be able to diffuse any of these issues? I had a fair amount of time to discuss the RICE project with one of the neonatologists at NHP, Dr. Tuan, and he was extremely excited about the potential use of Smartphones in his department. First, as is true in the ED, Dr Tuan felt it would be quite helpful to have some advance notice of the arrival of a distressed neonate to his department so that they might be more prepared to care for this new infant. Additionally, Dr. Tuan was particularly enthusiastic about the potential educational role the Smartphones might have. Since caring for these infants can only be done at NHP, where they have both the necessary equipment as well as staff trained to handle these kinds of cases, primary prevention is a key issue in neonatology. Dr. Tuan hopes that with use of the Smartphones, he will be able to speak with midwives and physicians at both provincial and district level hospitals throughout the catchment area (all of northern Vietnam) in order to educate them about measures that can be taken to prevent mothers and infants from getting into situations that require their transfer to central hospitals. With improved knowledge out in the communities focused on healthy pregnancies, prevention of prematurity, and how to care for premature infants, there might be fewer infants that require transfer to NHP and therefore less overcrowding.

Dr. Tuan did cite one example of pathology that does not always need to be transferred to NHP, and that is the instance of neonatal jaundice. He said that many of the midwives/physicians at the smaller hospitals are not familiar with physiologic jaundice and as soon as any jaundice / Bilirubin

abnormality is noticed, the infants are sent to NHP. With the consultation aspect of RICE, Dr. Tuan felt that the unnecessary transfer of infants with physiologic or mild jaundice could be averted. Other than this though, the main uses of Smartphones in the NICU would be for notification of patient transfer and education.

#### Infectious Disease

I spoke briefly with Dr. Huy in ID. He stated that before 1987, when Vietnam's doors were closed to foreigners, the practice of infectious disease was quite simple. However, since that time with the influx of foreigners, there has also been a relatively rapid change in the number of infectious diseases seen. Because of this, many patients present with illnesses that cannot be properly diagnosed / treated at the local level and therefore require transfer to NHP. Dr. Huy also stated that opportunistic infections, especially in the face of the growing number of HIV/AIDS cases, have become a big problem. He said that he has often times contacted colleagues at other hospitals (often in other countries) when he has needed assistance with diagnosis/treatment plans, and sees how Smartphones would be a great help in doing this same thing within Vietnam. Some problems he mentioned, however, are that many of the necessary lab studies can only be done at the provincial level (or higher) and there are no PCR machines at the provincial or district level, so all patients (or at least samples) need to be sent to Hanoi. Dr. Huy felt that RICE would be very helpful to the ID department both for the ability to do consultations and also for epidemiologic surveillance, for example with TB and Avian Flu.

#### Gastroenterology

I spoke briefly with Dr. Do in the GI department. He stated that the majority of the cases they see in their department are acute diarrhea, jaundice, and abdominal pain. He felt that approximately 50% of the patients that come through their department could easily be cared for at the local level and are unnecessarily transferred to NHP. Unlike the situation with ID, the majority of the labs / studies that the GI department depends on for diagnosis and treatment can be done at both the provincial and district level. Thus, for GI, RICE would be quite helpful for consultations with the OSH to discuss the diagnosis and appropriate treatment for a great number of patients, therefore eliminating the unnecessary transfer of some patients to NHP.

#### Intensive Care Unit

The ICU at NHP has 25 beds and any where between 20-30 patients. The most common reasons for patients to be admitted to the ICU are serious infections (sepsis, meningitis, encephalitis), congenital heart disease, pneumonia/respiratory distress, and inborn errors of metabolism. NHP has been capable of performing open heart surgery to correct congenital heart disease for 2 years now. The ICU cares for a great number of children awaiting corrective cardiac surgery, for which the waiting list extends into 2008. I spoke with Dr. Phan in the ICU who told me that many of the ICU physicians already speak with colleagues at some of the provincial hospitals with whom they have a personal relationship, and that they do find this helpful, although these are not "official" consults.

Since most of the smaller hospitals are not equipped to take care of seriously ill children, once a child becomes critically ill, the only choice is to transfer. In my own opinion, the greatest use of Smartphones for the ICU would be in terms of education for the smaller hospitals and the potential for preventing patients from deteriorating to a level that requires transfer (similar to the situation in the NICU).

Dr. Phan did highlight one major problem with RICE in general (which was echoed by a number of other physicians throughout the hospital): patients want to come to NHP. Even if we could improve the communication between hospitals and the physicians at the smaller hospitals felt more comfortable

treating the patients, the patients would still want to come to NHP because they feel they will receive better care there. When discussing this, Dr. Phan mentioned that if patients have a lot of money, they will choose to go to Bangkok or Singapore for their care, but if not, they all come to NHP because it is "free." This is interesting in light of the "letter of invitation" rule I discussed earlier. Unfortunately, at the time I spoke with Dr. Phan, I had not yet heard of the invitation system, and so did not know to inquire more about what he meant that getting care at NHP was free.

### Radiology

The radiology department at NHP is also one of the more busy departments, and I was not able to spend very much time there. I did find out that the majority of the films taken are on actual film (and not digital). The only use of digital imaging is with the CT scanner (although film is also sometimes used for CT scans due to lack of sufficient memory in the computer system) and interventional procedures (cardiac catheterizations, procedures under fluoroscopy). There is no MRI machine at NHP.

The physicians I spoke with in this department felt that it would not be very difficult for them to assist with reading films from outside hospitals using Smartphones as they already often consult other physicians for help via email.

### Laboratory

There are both inpatient and outpatient laboratories at NHP. The outpatient lab is capable of running basic studies, while the inpatient lab quite sufficient. While some of the machines are on the older side, it seems that there are very few tests that cannot be done in house. From basic labs like chemistries or a CBC, to hemoglobin electrophoresis (thalassemia is common), immunophenotyping, tissue typing and molecular and cytogenetics, NHP is equipped. I was told that the virology department received and upgrade in 2004, supported by the EU, which resulted in the acquisition of new PCR and real time PCR machines. These have been critical not only for diagnosing H5N1 flu, but also other common viruses like RSV, HSV, CMV, etc. The labs at NHP do not usually process samples sent from other hospitals. Rather, these go to other hospitals in Hanoi or to the Institute of Hygiene and Epidemiology.

### Medical Records and Medisoft

My discussions with staff members in both Medical Records and the IT department are, for the most part, consistent with what Helen found last summer. Here is a brief review, for more details please see Helen's notes. The Medisoft program (basic EMR) is used only for administrative and financial purposes and contains patient name, address, ID number, admit date, discharge date, and ICD 10 code (I think). This program is used by the Ministry of Health to track number of beds, number of patients, mortality rates, and average length of stay data.

In addition to Medisoft, paper charts are also kept for all patients (in addition to the diagnosis booklet that is kept by the patient). The paper charts include the patient identifying information entered into Medisoft, as well as diagnosis, treatment plans, lab values, medications and procedures. The charts are kept on file for 10 years for general patients, 15 years for criminals, and 20 years if the patient dies while in the hospital. The charts are organized by symptom or ICD 10 code, not by patient, in order to facilitate hospital research which is usually in the form of cohort studies. Therefore, each patient may have several different charts. One further complicating factor is that each patient may have more than one medical record number. When a patient presents to the hospital, they are assigned an identification number during initial intake (as described in Helen's notes). If a patient has subsequent visits to the hospital and they do not have any of their previous information with them (e.g. their diagnosis booklet), they are simply assigned a new number when they arrive. Considering that part of

RICE is to have an EMR, the current system of record keeping would need a facelift of sorts in order to be compatible.

### Week 2: Remote Sites

During the second week of my stay in Vietnam, I traveled with two physicians, Dr. Tuan and Dr. Dung, and two members of the IT staff, Mr. Vinh and Mrs. Thuy, to Thai Nguyen Central General Hospital, Dong Hy District Hospital, Van Lang Commune Health Station, Tan Long Commune Health Station, and the Thai Nguyen Province Department of Health.

As this project is entirely dependent on use of the existing cell phone network infrastructure, it is important to note that at all the remote sites we visited, we were able to both send and receive calls on a cell phones that use either Vinaphone or Viettel service plans, although the Vinaphone signal was stronger. Apparently EVN phones also have excellent service, and this company also supports CDMA, however we did not have an EVN phone with us.

#### Thai Nguyen Central General Hospital

At Thai Nguyen, we took a tour of the hospital, visited and spoke with several of the departments that will be involved with RICE, and gave a formal presentation about the RICE project to approximately 30 physicians/hospital administrators. The departments I spoke with included Pediatrics, ICU, IT, ID, Radiology, and the Laboratory. In each department I tried to discuss what types of cases the department sees most often, which cases they are able to handle locally, and which/for what reason cases have to be sent to a central hospital.

#### *Pediatrics*

In this department, the most common reasons for transfer to NHP included hernia, intestinal occlusion, need for IV nutrition, and need for intubation. The hospital does not have the training or equipment necessary to place PICC or central lines (hence the need to transfer for parenteral nutrition) or the equipment for intubating smaller children and infants. When asked if there was any equipment that could help prevent transfer to NHP, they replied "air conditioning, and equipment for intubating small children/infants." The surgical patients all need to be transferred as there are no pediatric surgeons at Thai Nguyen. When discussing the Smartphones specifically, the Pediatricians mentioned that on occasion they were already using their personal cell phones to discuss cases with colleagues at NHP, and that having the Smartphones would be an excellent upgrade to what they are currently doing.

#### *Intensive Care*

Here I spoke with the head of the department, who stated that the most common cases seen in the ICU are stroke, poisoning (pesticide, medication, alcohol), severe hypertension, post-op patients, and head trauma. Reasons for needing transfer to a central hospital included MI and severe head trauma. He said that overcrowding is not much of a problem in the ICU and only rarely are there more patients than beds. When discussing RICE, he felt that the use of Smartphones could definitely decrease the number of patients they send to Hanoi, and would also be invaluable in helping manage the patients that are too sick to be transferred.

#### *Infectious Disease*

The most common diagnoses in this department are hepatitis A and B, and HIV patients with opportunistic infections. The patients that are most commonly transferred to Hanoi are those with severe infections or whose diagnosis is complicated / cannot be determined by ID physicians at Thai Nguyen. When asked about the existence of a tracking system for outbreaks of infectious diseases, the physician I was speaking with said that there was no formal system in place for such a situation. He did say that the hospital would quarantine patients diagnosed with Dengue, Rubella, or Flu, and that the quarantine for Flu was "special" but I was unable to get any further details about this. I did

learn that there is not a PCR machine in Thai Nguyen and that all samples must be sent to Hanoi for specific diagnosis, e.g. for H5N1 flu.

### *Radiology*

My questions for radiology were focused mainly on technology, as this would be the key component for compatibility with the Smartphones. Dr. Giang (both a radiologist and tour guide/interpreter for the day) told me that the CT scanner takes digital images and the radiologists use a program called Efilm to read / manipulate the images. Currently all plain films and ultrasound are taken with actual film, but the hospital plans to acquire a system for digitalizing plain films in the coming year. For now, if a radiologist wants to ask advice on a film reading, they take digital photos of the film or scan the ultrasound images, upload them onto a computer, and then email the images to a colleague for advice. Thus, the radiologist at Thai Nguyen already appear to be familiar with the system of remote consultation that RICE would be implementing on a more formal basis.

### *Laboratory*

Here I was mostly interested in talking with the pathologists, as specimens / slides would be the biggest issue in terms of consultation with central hospitals. (Comparatively, it would be relatively simply to enter a lab value in the system.) The pathologist said that currently they send whole slides to other institutions for assistance in making a diagnosis. It takes about 1 day for a slide to arrive at the OSH, and Thai Nguyen does this approximately 10 times a month. They do not have cameras installed in their microscopes. As an experiment, we tried taking a digital picture of a slide by putting the lens of a digital camera directly into the eyepiece of a microscope. The resulting image was of mediocre quality, and it is not clear if this would be sufficient for making a diagnosis. While simple lab values (chemistries, CBC, etc.) could definitely be entered into a Smartphone, I am not sure that pathology consultations would be possible with the current technology available at Thai Nguyen.

### *Information Technology*

All departments can connect to Medisoft using LAN connection. Some departments are able to connect to the internet, and they are working on setting up wireless connections in some areas of the hospital. They currently have a 3 GHz server, but will be getting a 3.2GHz processor soon. The physicians in the hospital all have basic computing skills and certainly are familiar with the use of cell phones.

### *Presentation*

With the help of Dr. Giang's translation, I was able to give a PowerPoint presentation to number of the Thai Nguyen physicians, including the Vice Director of the hospital / Head of the Department of Maxillofacial Surgery, Dr. Tran. In general the entire audience was quite excited and enthusiastic about the use of Smartphones in their hospital. They did, however, have a few reservations. First, they wanted to make sure that the software applications would be in Vietnamese, or at least would be compatible with typing in Vietnamese. They also wondered if the EMR on the Smartphone could be connected to the existing hospital database (which I took to mean Medisoft). Additionally they wanted to know how much this system would cost. They understood that Microsoft was involved, but surely this funding would not be indefinite – how much to keep the system running, how much to buy additional phones? Finally, they asked if the phones would have to be purchased from the United States or if a model would be available within Vietnam. To be honest, I didn't have the answer to most of these questions at the time, and told them that the team that would be coming in March would be able to give more definitive information.

### *Dong Hy District Hospital*

Dong Hy is a 100 bed hospital with 31 physicians and 32 nurses. There are 5 departments within the hospital: Pediatrics, Emergency, ID, Laboratory, and Outpatient. The Pediatrics department is not very developed and almost all pediatric patients are transferred to NHP. There are 2 ventilators in the

hospital, and minor surgeries such as appendectomies, caesarian sections, bone setting, and uncomplicated ENT and ophthalmologic procedures can be done on the premises. They also are able to take plain films and perform sonography, but there is no CT scanner. The laboratory is able to perform most basic studies (CBC, LFT's, BUN, creatinine, bilirubin, blood typing, hepatitis serology, TB testing, HIV ELISA, malaria diagnosis with blood smear) but not electrolytes or ABG.

Surprisingly, in addition to using Medisoft, Dong Hy District Hospital also has a basic EMR that logs both outpatients and inpatients. The inpatient section records basic patient information (name, address, etc.), the patient ID number (which is used for every patient visit, c.f. NHP system), medications, lab values, equipment used / procedures performed, and diagnosis. The IT department suggested that the reason they were capable of doing this (and the central hospitals are not) is because they have so many fewer patients and thus there is ample time to input all patient data into the computer system.

The most common illnesses seen at Dong Hy are pneumonia, childhood diarrhea and childhood kidney problems. They also see many newborns with issues related to prematurity such as asphyxia, pneumonia and sepsis. These patients are always sent to NHP. In general 20-30% of the patients that come through Dong Hy are transferred to Hanoi. The majority of these patients are pediatric and therefore sent to NHP. Transfer is either by motorbike, taxi or "emergency car" in which a nurse accompanies the patient and also has access to a bag-valve mask and oxygen. Regardless of mode of transportation, by the time the patients arrive in Hanoi, they are often in quite a critical condition.

As part of the RICE project aims at epidemiologic / outbreak surveillance, I tried to ask about any protocols they have in place if there was a suspected case of Avian Flu. I was told that the closest PCR machine is in Hanoi; therefore some cases might be diagnosed based on symptoms. If a patient is suspected of having Avian Flu, Dong Hy will send a team out the patient's commune in order to set up quarantine. Additionally, they will announce the suspected (or confirmed if PCR diagnosis is made) case to the National Institute of Hygiene and Epidemiology – something that was not mentioned when discussing this issue at Thai Nguyen Central General Hospital.

At Dong Hy we did not give the formal RICE presentation with PowerPoint, but instead the NHP team presented an overview of the RICE project. This presentation and discussion was entirely in Vietnamese so I am not clear as to what exactly was discussed. There was only one concern that came out of this discussion and it was put forward by the Director of the hospital. He was worried that it would be too difficult for the hospital staff to actual use the Smartphones. Considering that much of the staff is computer literate and almost all have personal cell phones, we reassured him that this was unlikely. Aside from this, the representatives of the hospital were definitely in support of the project.

#### Van Lang Commune Health Station

The Van Lang Commune is made up of 16 villages and has a population of 4,537. The health station consists of a small meeting room for the staff, a few exam/treatment rooms, a "pharmacy" (i.e. small room with one cabinet containing some basic antibiotics, vitamins and condoms) and a delivery room. They are unable to give supplemental oxygen or IV fluids / medications at the clinic. However, it did receive its standard of care license from the Ministry of Health for the first time last year, and although the importance of this license is not totally clear to me as the health station is allowed to see patients without it, they were quite proud that they did indeed have it.

The Van Lang health station is open every day and has 2 doctors, 2 assistant doctors, and 2 nurses. On average they see about 15 patients per day. The most common reasons for patient visits are pneumonia, diarrhea (especially in children), and digestive problems. They have about 6 births each month in the commune, 60% of which take place at the health station (and the remaining 40% occur in the home). Approximately 20% of all patients seen at the Van Lang health station are transferred to the district hospital (or another hospital), usually by taxi or motorbike. The cost of a taxi is about

300,000 VND. The most common reasons for a patient to be transferred are: age less 5 years, tumor (or some other condition requiring surgery), and cardiac issues. Once each month a doctor and/or nurse will travel to each village in order to administer vaccines, but I was told that some of the villages are quite far and difficult to reach and therefore there are definitely some children that do not get immunized. Also, the clinic does not have a working refrigerator so vaccines are kept in a box filled with ice.

I also asked about outbreak surveillance at the Van Lang health station using Avian Flu as an example. They told me that while they have never had a case of the H5N1 strain in their commune, they have been given documents on both how to recognize the signs and symptoms and what to do with a suspected case. If there is a suspected case, they are expected to transfer the patient to the district hospital. From this point, the district hospital is then responsible for initiating the quarantine and contacting the necessary officials. This is consistent with the system mentioned at the Dong Hy District Hospital.

We briefly discussed the RICE project with the two nurses and a representative from the Communist Party (the doctors were not available as they had gone to Thai Nguyen for a conference that day) and they were quite enthusiastic about it. Bits and pieces of the conversation were translated for me, and no major concerns were raised by the staff. They did comment that this system might be especially useful for the care of pediatric patients, expectant mothers (there are not many skilled midwives in the area) and newborns. Their interest in using the Smartphones (or at least a basic cell phone) for these types of patients makes the Van Lang Commune Health Station a good choice for the initial phase of RICE as the key central hospital on board is NHP.

#### Tan Lang Commune Health Station

Tan Lang, like Van Lang, is comprised of several villages and has a population of just over 5,000. The farthest village is 14km away from the health station and can only be reached by foot. The Tan Lang clinic is quite similar to that in Van Lang, but a bit smaller. In addition to the delivery room, treatment rooms, meeting room and pharmacy, Tan Lang also has a sizeable garden growing herbs and plants used in the practice of traditional medicine. It does not have the standard of care government certificate that Van Lang does, and it is also incapable of administering supplemental oxygen or IV fluids/medications.

The Tan Lang clinic has one doctor, 4 assistant doctors and 1 nurse. They see about 35 patients per day, 20% of which are sent to the district hospital for further care. The most common reasons for transfer are severe pneumonia, severe diarrhea (requiring IVF), cardiac issues, and expectant mothers with difficult deliveries or poor prognosis. Approximately 50% of the patients transferred are children and transportation is usually by taxi or motorbike. The cost is between 100,000 and 200,000 VND, depending on time of day, but some areas cannot be accessed at all, regardless of price. Immunizations seem to be a bit more difficult for this commune, given the remoteness of some of the villages. The doctor we were speaking with also said that due to the low education level, many parents do not understand the importance of having their children vaccinated. In total, she estimated that 30-40% of the children in Tan Lang commune are not fully immunized.

In regards to outbreak response and surveillance, the physician at the Tan Lang clinic spoke of the exact same protocols mentioned at the Van Lang clinic. She also said that they have never had a case of H5N1 in their commune.

After discussing the concept of RICE, the Tan Lang clinic physician stated that “with the Smartphones, I think we will be able to decrease the number of patients we have to transfer, and that way we will save money for everyone.”

#### Thai Nguyen Province Department of Health

The NHP team spent one afternoon discussing RICE with the Department of Health in Thai Nguyen Province. Due to the political situation in Vietnam, it is very important to the success of this project that we have the support of the government, and therefore it was critical that we have this discussion. While visiting the Department of Health, we gave the RICE PowerPoint presentation and discussed the project at length. Again, much of these discussions were held in Vietnamese so I am not sure about the details of what was said. I do know that the result of the meeting in general was that we not only have the support of the Department of Health (at least in Thai Nguyen) but that they are also quite excited to see how this project develops over the next several months.

### Conclusions

It is clear that there is universal support and excitement both about implementing the RICE concept in northern Vietnam as well as about the potential impact it could have on the way healthcare is practiced there. I think that the physicians at all of the institutions I visited have received adequate information about the project and are ready to begin using the Smartphones. The question that remains to be answered now is "how exactly do we do this?" Within this broad question, I see several categories that address the 4 major components of the RICE system: consultation, electronic medical record, knowledge, and epidemiology. Below I have also included my suggestions (where possible) on how to approach some of these issues, but by no means do I consider these the final solution.

### Logistics

I think it would be reasonable to start the project with communication just between NHP and Thai Nguyen. In the simplest paradigm, there could be one Smartphone at each hospital that is kept by either the General Planning Department or the Department for Outreach, Training and Research, as these departments have contact with all the clinical departments within the hospital. When a consult comes in, the central department will simply contact the necessary clinical department who could handle the consult from there. In the initial stages of implementation, the volume of consults is likely to be quite low, and therefore having a single Smartphone at each institution will likely be sufficient. As the project grows, more institutions are added, and the physicians involved become more comfortable with the system, additional Smartphones and cellular phones will obviously be necessary.

In terms of the epidemiologic surveillance component of the project, I think that we need to involve the National Institute of Hygiene and Epidemiology (NIHE). Although I did not visit this institute, it is my understanding that it is, at least in part, responsible for outbreak surveillance / disease tracking, and that it has played a major role in Vietnam's response to the emergence of the H5N1 Avian Flu. Perhaps during the March trip the NIHE can be contacted so that we can work with them in efforts to improve the response to potential outbreaks.

Finally, with respect to the EMR, one potential problem is that of the temporal and geographic tracking of patients. Not only does each hospital use a different system to organize their records, but patients receive different ID numbers from different hospitals and may even have several numbers from one hospital corresponding to different hospital visits. Vietnam does not have a social security number equivalent, which also makes patient identification more difficult. Perhaps a system specific to the EMR used for consultations could be devised using a combination of a patient's initials and their date of birth. For example, John Smith born January 1, 2000 would be JS010100.

### Hardware and Software Issues

As was mentioned in the "presentation" section at Thai Nguyen, it will be important for the software to be at least capable of typing in the Vietnamese alphabet and ideally to be written entirely in Vietnamese. Although many of the physicians do speak English (more so in Hanoi than in the surrounding areas), it is my opinion that using solely English would compromise the care of patients and diminish the educational efficacy of the project.

There was also a question about the ability of the RICE EMR to be compatible with the existing "hospital database." I do not have enough of an understanding of the technology to tackle this one, but it would be an interesting concept to look into for the future.

### Finances

The issue of both initial and upkeep costs of running the RICE system is something that has been raised by our Vietnamese colleagues and which I have been thinking about quite a bit. It is my understanding the Microsoft grant will be sufficient for covering the cost of at least one Smartphone and phone service plan for one year (as stated in the grant proposal), but certainly this is not adequate to get the system up and running (at least two Smartphones will be needed, and therefore two phone service plans). Even if the grant could cover 2 devices and accompanying plans, where will funding come from to continue and expand the system? The whole point of this project is that it is sustainable in country, but in order for that to be true, there has to be some source of internal (or other) funding on the long term.

During my travels, I had the luck of crossing paths with Dan Baker who works for Accenture Development Partnerships, and is currently stationed in Bangkok, Thailand. One of his current assignments is to help identify potential projects for GSM Association Development Fund to become involved with. This organization already seems to have an interest in the use of mobile phones for disease surveillance (see <http://www.gsmworld.com/developmentfund/index.shtml> for more information on this) and my contact Dan Baker thinks that this could be a good fit for us.

We might also consider that the RICE system will become an integral part of the health care system in Vietnam, and therefore will be included in the internal budget. I admit this is rather idealistic, especially considering the economic strain the system is already under, but once the system is up and running, the cost of a few Smartphones / service plans will surely be far less than caring for the 200 or 300 patients that exceed the hospital's capacity. That is, even without doing a formal cost/benefit analysis, it seems that it will be more cost efficient for the entire health care system to pay for the for Smartphones and service plans than to treat patients using the current system.

Even with all of these issues, I think there is tremendous potential for success with this project and I look forward to seeing how it all plays out over the next few months.

*Dr. Rosen and Eliot,*

*I hope this information is helpful. If there are any points that are confusing or that you would like to discuss further, please let me know. I would be very happy to continue to be a part of this project and help out in any way that I can.*

*Thanks,*

*Jenny*