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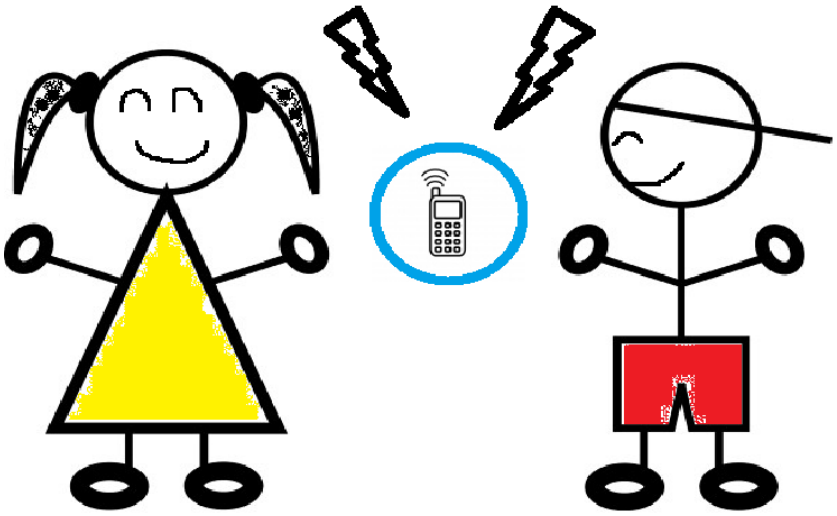
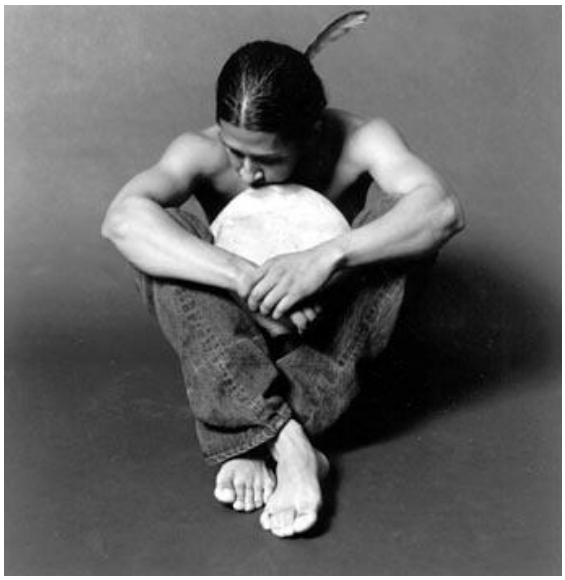


[DIABETEXTS – A NOVEL SOLUTION FOR RURAL AND REMOTE DIABETES HEALTH CARE]

The use of cellular technology as a medium for diabetes health care is a novel one. However, this unique health dissemination approach has not yet been explored in a rural and remote First Nations context, especially given the high prevalence of diabetes in First Nations populations. This AGFA proposal will outline a unique medical health informatics approach utilizing SMS Texting for education, patient communication, and electronic medical records.



Derek's Story

Derek* (identity protected), is a young man from a remote First Nations community in North-Western Ontario. Diagnosed with Type II diabetes mellitus at the age of 13, Derek is now 27 and his condition is nearly palliative. As a teenager, Derek felt fine and in the absence of consistent family support, and did not attend most of his diabetes education classes. He was also given the opportunity to attend education camps and counselling free of charge, but he did not take advantage. Five years later, at the age of 22, his high blood glucose control was impairing his ability to study. Unsure and uninformed, he irregularly took his insulin, Metformin and Glyburide causing gastrointestinal upset and diabetic foot ulcers. At 26, he began having blurred vision and missed his ophthalmology appointment. Eventually, Derek will have to be moved to Thunder Bay to facilitate dialysis, almost completely blind and unable to walk (1).

Derek is not alone – today, First Nations people in Canada experience a disproportionate burden of type 2 diabetes mellitus, especially in underserviced remote and rural regions (2). For a population who often live in rural, remote and/or isolated regions of the country, monitoring glycemic control can be extremely challenging for diabetics. In addition, for the First Nation populations, the onset of diabetes occurs at a much younger age and therefore, at a much greater risk of developing vascular disease earlier. Continuity of care and education by one healthcare professional is not always possible and ease of access to services as well as medication is extremely challenging – especially with minimal internet accessibility (under 56K, unstable, unable to send or download large files) and absence of 3G data networks. Furthermore, one model is not transposable to all communities – strategies must be culturally appropriate as well as partner with unique community strengths (3). Fundamental challenges in remote and rural First Nations diabetic patient-care include:

Education – How can community health workers provide information and support to a large number of diabetic patients and caregivers in a culturally appropriate, regular method with minimal internet access?

Patient Monitoring – How can community health workers monitor patient status and quickly identify/update patient records as well as quickly recognize high-risk patients with minimal internet access?

Accessibility of Information – How can doctors and other health-care professionals access and monitor diabetic patient information in remote and rural First Nations communities?

Community Adaptability – it has been shown that First Nations partnerships that engage community members is a sustainable method of program delivery. How can a system be designed that can easy to use, adapt and also explores unique ways of individual community involvement?

Continuity of Care – how does this proposed system meet the above challenges as well as create continuity of care between health care professionals and community members in remote and rural environments?

Introduction to DiabeTEXTs

As a student currently working in Northern Ontario with First Nations communities and organizations, I was prompted by the AGFA challenge to ask – is there a potential solution to meet these five fundamental expectations? With a mother with diabetes, I witnessed firsthand how living with diabetes makes great educational demands on a family – for children, parental support and involvement play a central role in management of the disease (4). However, this also creates special challenges relating to independence and opposition when children move into adolescence, such as Derek's tragic story above. Information and communication technology could provide the means for greater flexibility and independence. Diabetic patients also have to be active participants in their treatment, because they are inevitably responsible for their day to day care (4).

As the availability of mobile access advances rapidly, mobile phones are now widely available at a low cost (5). The potential in using mobile phones for supporting and educating diabetes patients is increasingly being recognized (4) (6) (7). However, this proposed service has not yet been explored in a Canadian First Nations community context, especially when First Nations people in Canada experience a disproportionate burden of Type 2 diabetes mellitus (2). With the establishment of Keewaytinook Mobile (KM) and Dryden Mobility (DMTS), local cellular services are becoming readily available to more First Nations communities across Northern Ontario. This provides a great opportunity to see if utilizing cell phones in a medical informatics systemfor First Nations diabetes patients and their caregivers can be an effective and long-term health care support strategy.

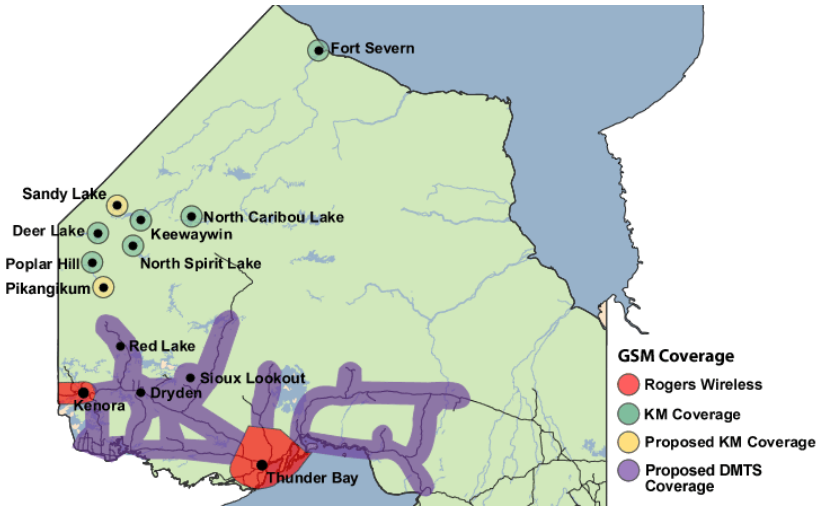


Figure 1: Community coverage map from KM. Please note that Pikangikum does have cellular services available now. (Keewaytinook Mobile, 2009)

Proposed Set-Up

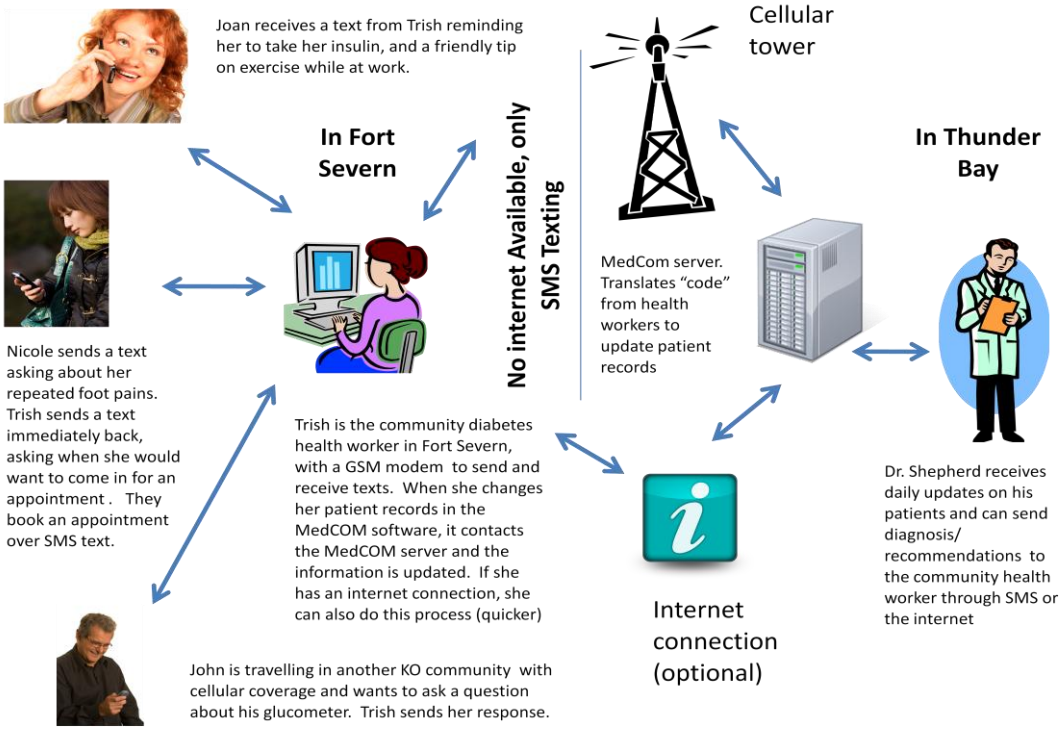


Figure 2: Proposed SMS texting set-up. Please note that the MedCOM software is completely fictional and part of my proposal.

This DiabeTEXTs project is a unique and innovative one, as it utilizes SMS texting in communication with a network server to provide education, patient monitoring, accessibility of information, and community adaptability. As the scenario diagram above explains, community health workers are consistently in touch with their patients by SMS texts through a computer software interface. Trish would have a laptop connected to a GSM USB modem, which acts as the "phone" to receive and send texts. When texts are received, they can be sorted by the software according to contact information (ex. Dr. Shepherd, Nurse Betty, or patients). Mass texts can also be sent from Trish to a number of patients or interested caregivers providing daily diabetes education tips, or Trish can send and answer individual texts from patients. Texts to and from Trish's number would be completely free, as an incentive to keep in communication with patients. Hence, Trish can educate, monitor and most importantly engage patients in their diabetes care. These texts could also be sent in syllabics in Oji-Cree, Cree, or Ojibway instead of English to deliver this service to a specific non-English literate First Nations clientele.

Table 1: Sample Educational Diabetes Texts

Message Categories	Example Messages
Insulin Injections	Don't 4get 2 inject!

Blood Glucose Testing	Why not try another BG meter-check out with the team next time ur in clinic?
Healthy eating	Fruit, celery or carrot sticks, pretzels, plain popcorn make healthy snax
Carbohydrate counting	Do you have any "carb counting" questions for the DiabTs doctors or dietician? Stp by da clinic!
Events	New recipes avilble at clinic – stp by to rcve FREE pkage!

This software interface would also be unique as it can **update patient EMR (Electronic Medical Records)** on a server through SMS. As the scenario diagram illustrates, a server would be connected to the communications tower to receive the "coded" information through SMS.

How does this code work? Something like this:

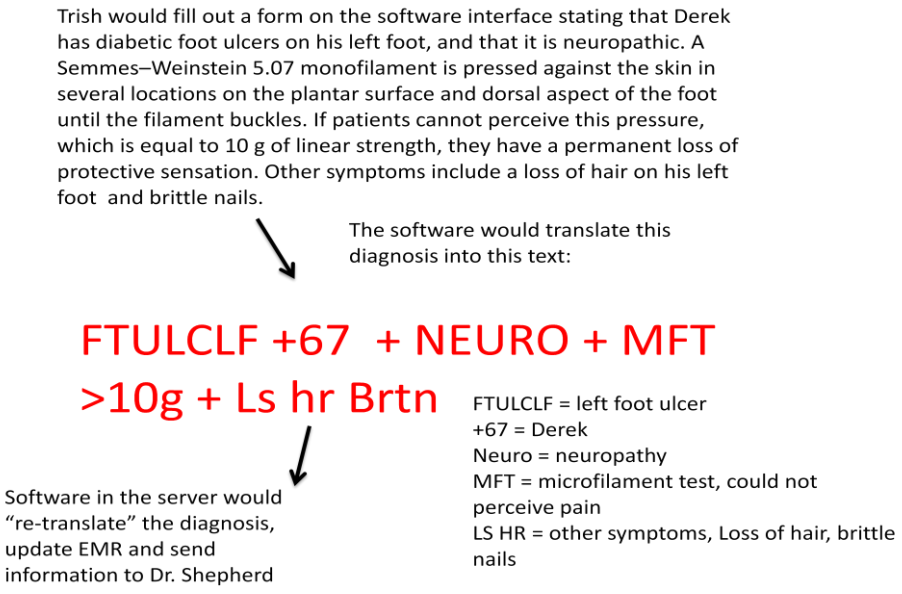


Figure 3: Updating EMR with coded SMS Text

As the above diagram illustrates, the diagnosis for Derek by Trish has been compressed into a compact text under 165 characters, which is usually the limit for most cellular services. The software "compresses" this by recognizing unique keywords and translating them into their respective keywords, including name to patient ID. Once received by the server, it would look up the attending physician for Derek and "re-translate" the SMS Text into an update on his EMR. Dr. Shepherd, in Thunder Bay, would then be notified of this update, and he can either reply by text or call Trish to provide instructions for treatment. The texts will always be saved to the server as part of the patient record. In addition, because the server has a unique "phone number" to text, it will only accept texts from registered numbers that the community health workers have. In the unlikely chance that the text is sent by the cellular provider to another number, the text is written in a way that would be mostly incomprehensible to the average non-health care professional. Thus, security and privacy is provided to some degree. Doctors and other health-care workers can access this information from the server at anytime, and it provides a communication avenue for continuity of care between clinics, hospitals, and travelling physicians and their remote and rural patients.

Health Surveys by SMS texting

One other advantage of this proposed system is that it can also allow medical surveys to be conducted through SMS texts. As the figure below exemplifies, community health workers can send individual questions to clients to receive feedback and other information:

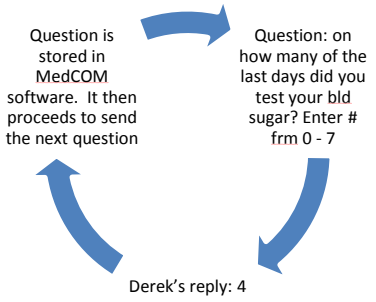


Figure 4: Medical Surveys through SMS texting

The MedCOM software will store the results, or can also forward the answers at the MedCOM server. The data then can be analysed by researchers by accessing the MedCOM server from an internet connection.

Patient Adoptability

Patients or their caregiver can easily register for the DiabeTEXTs service from their cell phones as a "code" as well. They would follow the example sequence below:

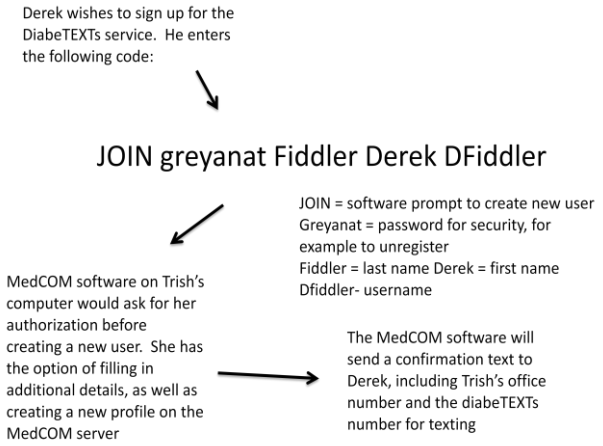


Figure 5: Registration service through SMS texting

In addition, they can also register in person to speaking with the community health worker. The SMS registration though,

What if patients don't have cell phones?

New emerging technologies by service providers such as Dryden Mobile which can convert SMS texts to voice over a landline (8). Clients can leave a reply to a toll-free voice mail, or simply call the community worker at a toll free number. In addition, this can be a good incentive to provide rebates for patients – especially when texts can be free to and from a community health worker.

Feasibility of solution

Many of the components of this proposed solution is quite affordable and available at the consumer level. Dedicated servers are being used in a variety of health-care settings to store and protect medical information. Cellular services are growing in rural and remote Ontario, and commercial grade GSM USB modems are available for a relatively low cost. For example, a Huawei GSM USB modem can be purchased at $70 (9) Laptops have significantly improved in portability while conserving processing power. Open source computer software interfaces to connect to GSM modems, such as Frontline SMS (10), is available for download and is being used by NGOs in Africa and other developing countries. What needs to be developed, perhaps with existing open source software as its base, is the unique MedCOM interface that can "code" diagnosis as well a server MedCOM version that can "retranslate" the code as well as act as an EMR.

A solution that grows

As faster and more reliable internet services become readily available to more and more Northern communities, this solution grows with it as well. Because this SMS "code" can be sent as extremely small packets of data over the internet, it requires very little bandwidth. With internet, messages and updates from MedCOM software can sync faster with the server, as well as be encrypted. Trish, for example, can now send her patient updates over the internet, while still being able to communicate with her patients through SMS. As more avenues of communication are opened by the internet, DiabeTEXTs stays and increases its effectiveness.

Conclusion: the start of DiabeTEXTs?

DiabeTEXTs is becoming a reality in the North. As part of my third year undergrad studies in Sioux Lookout - a small remote community in North-western Ontario, I developed a diabetes education initiative utilizing SMS texting in collaboration with K-NET, a First Nations telecommunications company. You can visit and learn more about this project at www.diabetexts.knet.ca . This AGFA proposal outlines my vision for the future - an effective, grassroots-empowering medical informatics system that can hopefully help minimize the gaps which many First Nations peoples, like Derek, have fallen through in Ontario's health care services. This proposal is not only cost effective, but meets the five fundamental challenges in remote and rural First Nations diabetic patient-care. With the help of companies like AGFA, I strongly believe that this proposal can evolve into a potential solution in the near future.

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