

## A Medical Office Visit Odyssey: 2017 KQI, 2016

This is a short story of a new medical system and a family who has routine health problems. This new healthcare delivery system is unique and offers benefits that have not been available in the past. It uses a digital assistant, just like Siri, to help navigate and process medical issues so that you, the patient, can have the best possible care with the least amount of delay and expense. It also will be telling the story of a new medical record and office system that has support for the physician and his practice.

In this story, the doctor will also get a new digital physician's assistant that handles his paperwork and protects his practice. The goal of this brief story is to lay the foundation for the release of this new technology.

### The Story

It all started with a trip to the store. Sarah was doing the usual shopping to prepare for dinner and then it happened. She stepped off the curb and suddenly there was severe pain and twisting in the right knee. Sarah is an athletic woman in her late thirties and has never had a knee problem before. This is suddenly a large inconvenience as she struggles to the car with her cart. Being aware of her pain, she tries to position her leg so she can drive and run the throttle with her foot. She settles for a two-foot approach with the left foot to do the braking and the right foot to control the gas.

On her way home she activates her car phone with a voice command and is connected to her personal digital assistant, "Dina". She tells "Dina" about her knee and asks to make an appointment with her doctor as soon as possible. She also asks to be connected to her husband. As soon as he is on the line he begins asking questions about her knee and the wisdom of her driving home without help. She assures him that she is doing fine and will be home soon. As she arrives home and parks the car, her husband meets her at the car and helps her into the house. She finds it difficult to sit and is finally able to take the pressure off her knee. They both agree that the knee looks swollen and they decide to apply ice packs to see if the swelling will go down.

The consensus is that she needs to be seen the next day by her physician. The process of scheduling has already begun when "Dina" used the doctor's private scheduling email address for access to the physician's online scheduler. After entering Sarah's patient codes for her, "Dina" now contacts Sarah to complete the transaction. Sarah is asked if she wants a next day visit, an ER visit, or a routine visit in several days. Because the pain is not getting better, she selects the next day option. Dr. Carl is Sarah's family physician and his online scheduling system has open times set aside for walk-in patients. She selects a time of 10AM for the next

day. As soon as the appointment has been booked by “Dina”, Sarah receives an email with her preliminary chart and the tools to begin the office visit preparation process. She logs in and is asked the reason for the visit. She dictates her answer by describing her knee pain along with a brief explanation about what has occurred. The system then asks if she can photograph her knee and send it to her cloud-based medical record. Sarah then takes her smart phone and takes a picture of both knees side-by-side for comparison. The picture is captured by Dr. Carl’s intelligent EMR and is stored in her chart for the next day’s visit. Now the system begins preparing for her visit by reviewing her current medications and noting any problems or changes. Sarah then reviews her allergy list making sure that every item is correct. Then comes the short form of all her current problems and their status. She notes she is being treated for asthma and hypertension that are all under control. Her complete problem list is followed by a review of all her basic body systems to make sure that the knee is the only acute issue for evaluation. This is mixed with her past medical history and her list of recent procedures. She remembers she had a PAP smear six months ago but had forgotten to report that procedure. To update her chart, she asks “Dina” for the date and location of the lab doing the analysis. “Dina” has her calendar and all her critical information including her medical record. The date and lab are recorded in her EMR (electronic medical record) and “Dina” logs off the system.

Within a short period of time, her phone rings and it is the office nurse calling to confirm the appointment. The nurse wants to be sure this is not an emergency that needs to be seen tonight. The call ends with medical advice for the night that includes: leg elevation, an analgesic, crutches or walker, an ace bandage wrap and no weight bearing. All these recommendations are posted to her cloud-based multimedia medial record.

After a painful night with leg elevation, Sarah is driven to Dr. Carl’s office for her arrival time set for 10 AM. The nurse greets her at the reception desk and takes her back to get her vital signs and update any changes since yesterday. Dr. Carl has already seen her knee photo and has been given an audible and visual review of her chart by “Ave”, his digital medical assistant. Sarah is taken to Dr. Carl’s new exam room which has been prepared for her. The exam room is different from other facilities because Dr. Carl is using the new intelligent EMR. The exam room is larger than other doctor’s office exam rooms. It has the traditional exam table on one end with a curtain for privacy. On the other end of the room is a small visual studio with four chairs and a command console. The chairs and command console are all facing a large wall screen projection system. Her husband is asked to be seated in the studio while his wife is positioned on the exam table so that her knee can be tested. Dr. Carl arrives with his smart touch screen pad and “Ave”. He quickly reviews all the chart documents and goes over her problem list to see if anything needs to be updated or changed. He then has the opportunity to address her knee pain and perform a complete stability test on her right knee. He notes a serious pain along the medial aspect of the knee and a large joint effusion. There is also a test he does for cruciate ligament tears and it appears positive. He notes a sliding motion to the joint

and is able to photograph this slight deformity with his smart phone and directly load that picture into the chart. Based on his preliminary exam, this is an orthopedic problem that will need consultation and expert handling. Once the medical exam is complete, the nurse helps Sarah down from the exam table and they all go to the studio for a medical conference. The doctor asks "Ave" to bring up Sarah's medial record on the large screen so that Sarah and her husband are totally involved in the process. They are all looking together at the same screen. The doctor at his console with "Ave's" support is now able to access all the aspects of her chart and enter his findings and his preliminary diagnosis. He can use the system graphics to show the knee anatomy and what has happened. Dr. Carl suspects a medial collateral ligament tear and also damage to the anterior cruciate ligament. As he selects these diagnostic items on the chart, he is prompted with the complete set of symptoms and findings that should be found in these conditions. The chart documentation provides a brief description of each diagnosis and this is reviewed with Sarah and her husband. There is no data entry required. Each symptom has interpretative comments so the patient and physician can go over each item and explain their significance. Any additional items are entered by simple keystrokes or voice dictation and the preliminary documentation is completed. The process only takes a few minutes and the physical exam is stored with all the appropriate items covered plus all the photos. There is also a list of common lab test and procedures ordered for each condition. Dr. Carl asks "Ave" to schedule a visit with his orthopedic consultant (Dr. Morgan) who has a similar system in his office. Dr. Morgan is sent the entire medical record including pictures. His scheduling system is opened by "Ave" so that Dr. Carl and Sarah are now able to select an office visit date from Dr. Morgan's scheduler. Since the system has the recommended testing procedures already prompted on the screen, Sarah is given an order to go to the orthopedic center for stress films on her right knee. The MRI is delayed so that Dr. Morgan can make the final decision after seeing the standard x-rays.

As the treatment plan is being completed, a medication is selected by Dr. Carl and the prescription is processed by "Ave" who sends it to her pharmacy. The diagnostic codes are all stored in "Ave" and the final procedure codes are now assigned. As a final step, "Ave" does an analysis of the patient findings and symptoms with his complete library of medical information. This analysis looks at similar diseases and anything that could be missed in this patient-physician encounter. The program notes that meniscus tears could also be a consideration and these should be included in the knee x-ray series. These changes are noted and the patient is now ready for discharge. As a final note, Dr. Carl tells Sarah to go home and access her chart and also the diagnostic support system that she has on her home computer. This will describe the x-ray series to be done and also the detailed information about her diagnoses. This teaching material will include things she might want to look for in the coming days.

Comments-

The merging of humans and machines is here. Our cars are rolling high tech platforms where speech, video and data are integrated into the control panel. As this process matures, we are all going to have a digital assistant that knows what we like and all our critical numbers which we so easily forget. The ability to tap into this digital assistant to do clerical work and help with our decision-making is just beginning.

This is going to be of great importance in the medical arena where we are facing an explosion of new information that does impact our daily delivery of care. It would be a great relief to most doctors to have a really intelligent assistant follow his every decision and help confirm his plans and procedures. If this assistant was initiated in medical school, then it would have the experience of learning and growing with the doctor as he matures. The core programs of the digital assistant are all resident in the intelligent engine that drives this technology. The customization of this relationship is what will make each assistant unique and personal.

Do we have the technology and the tools to build these systems today or is this just science fiction and something for the movies?

The answer to these questions is the quest for singularity. Can a man-machine interface be so natural that the machine is considered humanoid?

Our company says: "yes". These systems exist today and can be swiftly moved into a clinical setting if there is demand from the public and a cooperative spirit from the physicians. Changing systems is like changing culture. Doing new things is hard when you have the traditional approach as part of your life. The process we are describing is not science fiction but can be demonstrated by using our current technology and tools.

Our companies goal is to stimulate the general publics perception of what the future will look like and prepare the way for significant change. The physicians have already begun their journey by being forced to embrace the electronic medical record. This existing software has minimal intelligence and has no "Ave" to help with clerical support or do case analysis tasks. This new clerical burden must be lifted and new technology installed so that productivity and creativity can return to medical practice.

The story is not over because there is more to this system to explore.

Six months later with Sarah' knee fully healed, her son, Chuck, is calling from his new summer job in the Berkshire mountains of Massachusetts. The job was a gift from a family friend who knew about their son's talent and accomplishments as a tennis player.

He was offered a camp counselor position for junior tennis players looking to increase their skills and play competitive tennis. It was a fantastic adventure for a high school senior from Florida.

Two weeks after Chuck arrived at camp he called home because he had been sick for three days and was feeling weak and nauseous. Sarah listened to her son describe what has been going on and the timetable of events. The camp physician had seen Chuck yesterday and felt he had a bad case of the flu and should be getting better soon. He had been given some anti-nausea medication and an antibiotic for his sore throat.

Sarah took notes as her son described his symptoms and she made a list for her further evaluation. She wrote: not hungry, arm and leg joints ache, nodes swelling in the neck (the camp doctor had noted these), cough, fever, headache, nausea, vomiting.

Sarah said she would start her own investigation and would call Chuck in the morning. Putting the phone down she reviewed her notes with her husband and they discussed sending Chuck home for a family physician evaluation.

Sarah had seen a teaching video about the new diagnostic program that was part of her new digital healthcare assistant system. The system appeared rather easy to use and only required the listing of symptoms that were noted in the patient. Sarah and her husband decided to give the digital assistant a chance to see what it would say about their son's health problem.

Sarah called for her digital health assistant, "Dina", who was instantly available on her smart phone. Sarah asked "Dina" to retrieve her son's medical record and start a new evaluation using the onboard diagnosis program. Sarah dictated her son's problem to "Dina" and the computer translated these items into medical language. She started with the first item: "not hungry". "Dina" then entered that into the system as "anorexia". The next term was "joint pains" which was translated by "Dina" as "arthralgias" or "pain, joint". Neck node swelling was translated as "lymphadenopathy, cervical". The rest of the terms were easy: "fever, nausea, vomiting, cough, headache". Dina knows all the search strategies of the computer and makes the language changes needed to operate the intelligent medical system.

Once the eight terms were entered it only took a few seconds for "Dina" to reply. She said: "There are several ways to analyze Chuck's symptoms. If we use the symptoms we have there is a list of 10 items that have a perfect fit for this situation: influenza; avian flu; hepatitis A, B, C, D, E; tularemia; and psittacosis. All these diseases have a perfect match but we can eliminate some by looking at Chuck's medical record and getting some additional information. Please call Chuck and ask him about any abdominal pain or right upper abdominal tenderness. Just have him press under the right rib cage to see if it is tender."

The call was made and Chuck was not better but able to respond. He noted minimal abdominal pain but some tenderness in the liver area on the right side.

“Dina” then checked Chuck’s medical record to see if he had been vaccinated for hepatitis B. He had not had that immunization.

“Dina” also noted that Chuck had been treated in the doctor’s office for facial lacerations about three months ago. It seems that the tennis team had been in the locker room with football players and there had been some pushing and a fight broke out. Chuck had been hit in the mouth and had bleed profusely. The other boy had injured his hand on Chuck’s tooth and also had been taken in for suturing.

Dina was able to establish a plausible diagnosis, but testing would be needed for confirmation. The potential existed for hepatitis B. The contact with blood is an open channel for hepatitis if the other party is infected or a carrier. This could explain the long delay in symptoms since it can take months for hepatitis B to express itself once infected.

Sarah called the camp and asked that the camp physician to review her medical record evaluation and said that “Dina” had contacted the local lab and had scheduled a blood drawing session that afternoon. The lab was selected by its location and price which were all available on the web. The tests that “Dina” recommended were designed to confirm an early diagnosis of hepatitis B.

Next morning Chuck called his mom and said his urine had turned dark and he appeared to have a yellow tinge to his skin.

The summer camp was now over for Chuck, but his parents had proven that their new system was working and that “Dina” had more than adequately advised the family on the right course of action.

When this story was spread to family and friends, they were amazed that a computer could be so smart to know how to handle all the symptoms and provide the proper tools for diagnosis. This is not Google or Apple or IBM, but a new diagnostic system that has been in development for-physicians by-physicians.

Medical specialists in all fields read and digest the best professional information on each disease and store that in the computer so that the machine can make this available to everyone. This is not just for doctors, but it is also for you, the patient. If you want to be your own proactive diagnostician and health advocate, now you have a powerful tool that can assist in every level of the process.

Chuck was seen by his doctor when he returned to Florida and it took several months for this disease to resolve. He has been under his doctor’s care throughout the recovery process so his records are complete and include “Dina’s” workup that started the ball

rolling. Sarah and “Dina” had taken the initiative to be proactive for their family and used this new technology to take responsibility for their own health and that of their family.

### The Future is Now Here

The knowledge of this new system comes from medical doctors and the structured content used to make this tool a medical diagnostic “Expert System”. Every fact in the system has a direct reference to a major source of accepted clinical experience that is resident in peer-reviewed medical textbooks and clinical research publications from organizations like the CDC, NIH and WHO. This knowledge is now available 24 hours a day and only a keystroke or verbal command away.

There is so much more that could be discussed about this new patient-physician interface, but the real test will come when it actually appears on your computer or in your doctor’s office. Our emerging technologies are about to do some really great things to help us cope with today’s healthcare issues, but it will take those with a vision to make this a reality.