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Health Care in 2020

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Abstract. While this case study uses an example of a home health team, it is meant to describe a system in which clinicians and healthcare organizations specialize and develop expertise by performing a large volume of specific services, procedures for given medical conditions or diagnoses. We introduce the concept of “consumer as a direct employer” of healthcare services. In this model, nurses may work as independent contractors, or as a member of a team contracting out as a unit, as in our example of the Rhine Home Health Team. Nurses also may work as employees to healthcare organizations as they do today.

Keywords. Nursing informatics, future, nurse role, healthcare models

Introduction: Case Study

The year is 2020. Mr. Schultz is an elderly gentleman who lives alone in Hamburg, Germany. He has reached the point with his congestive heart failure that he is having difficulty caring for himself, managing his kitchen, climbing the stairs in his home, and having the energy to clean, cook and maintain his home. In making the decision that he needs to engage a home health team, Mr. Schultz first checks the Internet for the home health services available in his locale. He views the published quality and cost metrics for each team’s services, as well as the number of cases that they care for with congestive heart failure conditions similar to his. Based on this data of specialization volume, quality metrics and costs, Mr. Schultz selects a home service team with the highest quality outcomes and lowest costs. This team is made up of an architect, occupational therapist, dietitian, home health nurse, and geriatric physician who work as a unit specializing in the elderly with debilitating chronic diseases, such as congestive heart failure.

In doing the initial assessment visit, the Rhine Home Health team determines Mr. Schultz could benefit from having a “safe home and monitoring system” installed, and design changes to his house allowing Mr. Schultz to navigate easier and remain self sufficient. The team presents their recommendations to Mr. Schultz with the benefits focused on home safety, optimum maintenance of his health functioning, and keeping him independent in his own home. The

costs are presented along with the recommended interventions and projected measurable outcomes.

Safe Home and Monitoring System Described

The “Safe Home and Monitoring System” includes an integrated personal health record; device monitoring; and surveillance solution. The client engages with the PHR system using voice commands. The system, named “Anna”, answers interactively and displays the client’s inputs or requested results on a wall mounted LCD screen. The mobility devices used in the system include a bed for detecting sleep patterns, daily weights, sleep apnoea, and getting out of bed; and a motorized chair that captures time in chair, skin pressure points, and weight. Other devices in the “Safe Home” system are, steady gait detectors in the flooring, a blood pressure reader, glucometer, pulse oximeter, and a toilet that can perform fluid balance, urinalysis, and stool sampling. These device readings are sent to Mr. Schultz’s PHR/ EMR. In addition, linked to the Rhine Home Health team is a health population management service providing monitoring and surveillance for medical condition specific communities. An individual’s PHR/EMR data is uploaded to a Community Health Record (CHR) with access granted by the individual to clinical providers. A “virtual nurse” service is offered with the “safe home and monitoring system”. The “virtual nurse” provides a 24/7 surveillance and monitoring function via Internet connectivity into the Mr. Schultz’s PHR record based on the monitoring data from the device recordings and personal health record entries. Results exceeding protocol limits are pushed in real-time to the virtual nurse as an alert requiring evaluation and timely intervention either via referral to the home health team or to the primary care clinician. Mr. Schultz can request to “speak” to the virtual nurse at any time of day through a voice activated command to his home monitoring system. The virtual nurse displays on Mr. Schultz’ LCD screen and can use a robotic camera device to view Mr. Schultz if he requests, or if an urgent assessment is needed. Messaging from the virtual nurse to the home health team can occur in real time over secure messaging to their Internet connected PC/phone device. The virtual nurse is actually a series of offices in different parts of the world networked to provide the 24/7 surveillance function.

The virtual nurse can choose to communicate directly with the patient in response to results showing weight gain, elevated blood pressure readings, imbalance in intake and output. The virtual nurse may also evaluate the results against the individual’s medication adherence and answer any questions the person might have in understanding the action of their medications to their disease management. It is the timeliness of the virtual nurse’s ability to assess and appropriately intervene, which results in avoiding complications. It is often these complications that cause patients to visit their doctor, or worse to present to the Accident and Emergency Department with hospital admission and readmissions as an outcome.

After listening to the Rhine Home Health team’s recommendations, Mr. Schultz decides to accept some but not all of their recommended interventions. As a full and equal partner in his care decision making and management, he decides his condition does not yet warrant the cost of the monitoring bed. Instead he suggests using the Personal Health Record (PHR) his country makes available to every citizen by the Internet to record his daily weight. This will also allow him to see the daily results recorded in his EMR from the other home devices. With an agreed plan, the architect and occupational therapist design changes to the kitchen, bathroom and house entry to allow Mr. Schultz

to move safely about his home, to cook, and to do laundry. The option to move about in a motorized cart is built in to allow him to stay mobile even after he is too tired to walk. The physician and nurse review Mr. Schultz's current medications and make adjustments based on doing a physical exam. The modifications to his medication orders update his EMR and send the script to his local pharmacy for home delivery. The home health nurse works with Mr. Schultz over the next few weeks to learn about his new medication regime and relate them to his daily measurements of weight, fluid balance, O₂ levels, and blood pressure. Mr. Schultz practices entering his daily medications and weights in his Personal Health Record and communicating with the "virtual nurse". The dietitian member of the team works with Mr. Schultz over the ensuing months to order home delivery groceries and convert to a simpler diet with minimal cooking effort and plenty of fresh fruits and vegetables. The architect and occupational therapist members support Mr. Schultz in learning to navigate his modified surroundings and using his new motorized chair. In addition, the occupational health team member ensures Mr. Schultz is registered for transportation to the local senior community center for the weekly activities that he enjoys.

The Rhine Home Health Team's quality metrics are generated from the national HER database by the National Health Quality data center for all providers and organizations on a quarterly basis. These metrics include the following items: patient satisfaction, health functioning, physiologic measurement, length of stay at home; number of Emergency visits, number of hospitalizations and number of re-admissions, and patient healthcare resource utilization costs. The Rhine Home Health team directly bills payers at all levels, individual, health plans, regional and national governments. The team services are contracted for by calls from individuals, health organizations, health plans and government agencies requesting their services.

While this case study uses an example of a home health team, it is meant to describe a system in which clinicians and healthcare organizations specialize and develop expertise by performing a large volume of specific services, procedures for given medical conditions or diagnoses. Performing and delivering a large volume specialty care services builds expertise, team efficiencies and allows for best practices with the best outcomes at lowest costs [1]. This model for health care is premised on patient-centered care with the individual as a partner in their care decision making [2]. It also introduces competition for business based on clinician and organizational ability to deliver patient value and quality at lowest costs [3]. The assumption built into this model is that the highest quality healthcare uses the least resources and thus costs the least [1,3]. We are also expanding the "monitoring and surveillance" function in acute care nursing into the community/home venue [4]. As research shows it is this 24/7 surveillance by a professional nurse with well-developed critical thinking skills in the acute care settings that plays a critical role in preventing "failure to rescue" mortality and morbidity outcomes in hospitalized patients. [5–9] Also, the

virtual nurse in this scenario reflects the future role of clinical knowledge worker that we describe below.

We introduce the concept of “consumer as a direct employer” of healthcare services. This means that when a person needs to have a specific type of brain surgery, the patient and or family members can go to a site showing all the providers who perform this procedure as well as listing the number of like procedures performed per year, quality outcomes and costs. Hospitals provide the infrastructure for these “employed” practitioners to perform their care delivery. So similarly, hospital organizations are also ranked by performance and quality metrics, and a clinician’s choice of facility is also based on these published quality metrics.

In this model, nurses may work as independent contractors, or as a member of a team contracting out as a unit, as in our example of the Rhine Home Health Team. Nurses also may work as employees to healthcare organizations as they do today. In extrapolating the knowledge, skills and critical thinking required in this 2020 future healthcare system we clearly identified a chasm between current educational tracks for nurses and the skills required of anyone carrying the “nurse” title. Given the increasing number of the international nurse workforce being prepared at the technical degree level [10] we chose to define a new type of nurse clinician, termed: *the clinical knowledge worker*.

Consumer as Employer

Industrialized nations, in general, are shifting towards a health model of consumer empowerment and away from a provider as gatekeeper framework [11–12]. Extrapolating this shift to its logical consequences reveals a conclusion where the power to “hire and fire” care providers is now placed with the consumer and away from the provider. Over time this shift means consumers become increasingly educated and active participants in their care decisions and wellness management [13–14]). This ‘educated consumer’ requires a wide choice of providers based on quality benchmarks. As the employer, consumers will contract with care providers as necessary and or as needed. Contracts will range from brief intervals (such as temporary wound care) to ‘womb-to-tomb’ care (e.g. a General Practitioner, Physician Assistant or Nurse Practitioner Care Coordinator). However, the consumer is more than just an individual. As an entity, “consumer” might also be an agency or other organization able to contract with care providers for care services. The conditions required to drive this shift to consumer as a direct purchaser of healthcare are: 1) a restructuring of healthcare systems to focus on specialization and caring for the complete cycle of a medical condition [3]; public listing of quality and costs metrics by provider and or organization and for this data to be presented in simple understandable formats to the lay public [2]; and, 3) standards development to allow for universal ubiquity in health IT solutions and devices.

Globally, current healthcare systems are just beginning to link care and safety with quality benchmarks (3,15). The proposed, re-defined health system of 2020 is based on the ability of the educated consumer to contract with care providers based on their quality benchmarks or report cards. Access to benchmarks is not dependent on location, time and or space. Access will be ubiquitous, via Internet sites available anywhere anytime to both consumer and provider. Included in these benchmarks will be aspects of care such as quality, safety, regulatory, client/patient satisfaction and financial metrics, of which some of these components are even now beginning to impact care (15). The model offered in this paper, “consumer as employer”, compels more favorable financial outcomes by way of improved quality of care.

Care Setting Descriptions

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In the above case scenario, the environment for care provision is envisioned as having a strong focus on the patient/consumer, regardless of the setting. Health settings, ranging from in-home to acute care hospitals, are where consumers maintain ownership, control and responsibility of care. Also, clinicians, organizations and care providers are able to contract clinical knowledge workers, physicians, nurses and other health professionals for direct care delivery services regardless of the health setting. In the acute care setting, patient-consumers may maintain ownership for their care through hiring their primary care provider – Physician or Nurse Practitioner – and 24/7 providers (RN). This option to hire providers is flexible and extends to the consumer’s ability to contract for a complete care team in acute health areas, such as surgery through to critical care recovery.

New Clinical Knowledge Worker “Nurse” in the Future State of Healthcare

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Economic, political, and medical advances will significantly change the healthcare environment of the future. As outlined in this scenario, the role of the nurse is traditional and new; traditional in the sense of bedside care and care team coordinator; new in the sense of data/information coordinator and health team constructor. Activities outlined in the above scenario will require education and experience above and beyond what is currently available. In this near future the role of the nurse will expand beyond the current perception of the ‘nurse’ role. This ‘role’ will remain focused on patient care and the care coordination (aka – case management) aspect. However, because of advances in technology and telehealth combined with the growth of a consumer-driven healthcare delivery model, new healthcare delivery venues, as described in the scenario, will be where the new nurse, or clinical knowledge worker, will provide care for patients they may never see or touch. This new role will require advanced skills in information and knowledge management and critical think-

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ing, thus necessitating a new skill set incorporating use of evidence-based practice databases and other expert data sources.

The massive explosion in new knowledge related to genomics and disease management will also significantly increase the demands placed on nurses in all areas of professional practice [16–18]. Education and practice requirements will dramatically change [19]. These powerful changes in healthcare are driving nurse thought leaders to re-evaluate nursing practice and its educational preparation to position the profession to meet the global health care needs of the future [20–22]. Nursing is struggling with this challenge to reinvent itself in order to take on these new roles and responsibilities. A proactive and progressive plan is needed.

The nursing profession is the need to change at a more accelerated pace to meet the demands of the future. In essence, non-bachelor nursing programs have created an impending mismatch between nursing's educational background and the inherent responsibilities required for the profession to achieve quality outcomes [19]. Prior initiatives to standardize educational curricula failed to achieve desired goals. Global changes in healthcare delivery will further exacerbate this problem by placing increased demands on nursing scope of practice and responsibilities. Today's approach to preparing nurses will not be sufficient to meet the healthcare delivery needs of the future. Without fundamental changes, the majority of today's nursing workforce will fail to meet the requirements needed for the changing health care environment. Nursing could benefit from a re-examination of the profession and further exploration of alternatives in order to establish a strong foundation for survival in the future.

Recommendations for Moving Forward

In order to reach the desired future state, the profession of nursing will be dramatically redefined into the creation of a new professional role [22]. The role of non-degreed nurses as task-oriented, healthcare technicians would be leveraged. However, we anticipate that a new title would be created for nurses whose activity is more closely aligned with what may be termed "knowledge worker". And this title may actually be outside of nursing to escape the public confusion and Licensing Board restrictions, which blend all degrees into a common category of "nurse". This new clinical knowledge worker role is one requiring credentialing with a terminal degree. To achieve this redefinition of the profession, the recommendation is to leave nursing as it is today and, at the same time, move to create a new nurse role with an advanced degree, armed with the necessary education to achieve the vision for 2020. The existing nursing workforce of today will continue to provide baseline care in the environment of the future. The nurse of the future will have an advanced degree, thereby establishing congruence between the educational enterprise and societal needs. In summary, the nurse of the future is a degreed professional knowl-

edge worker who has met high academic standards and will be deserving of a new name.

Proposed Education

With the advent of healthcare consumers taking on the role of ‘employer,’ care providers will need to be highly educated in a broad liberal arts and science sense and nimble in communicating with multiple disciplines. Nurse educators will be technologically savvy in order to teach learners to understand and use current state-of-the-art technological health information tools in the client’s home, work, and healthcare setting [23]. We project that educators will demonstrate knowledge of online course design and the capability to create, deliver, and evaluate ubiquitous learning opportunities. The multi-disciplinary approach to health care provider education will include the use of mobile technologies that learners and experienced clinicians may use at their convenience, simulations that provide opportunities for critical thinking and problem solving real life scenarios. Compelling health information will be provided for care providers and clients.

Health-information educators will know the current technological systems and hardware that promote client safety and well being, as well as the health worker’s cognitive capabilities and physical well-being. These educators will be actively involved in designing and engineering new educational and clinical technologies by attending courses that pertain to architecture, engineering and computer science. Health educators will play a significant role in mentoring and educating the life-long learner in post-masters nurse residency programs. The health worker resident will work as a multidisciplinary team member and will assist in teaching and mentoring future residents by role modeling client advocacy, coordination of client care to ensure quality-care outcomes in a fast paced technologically rich healing environment that is monitored for patient care outcomes that reflect awareness of human complications and needs. Education will take place outside of traditional environments and e-learning will be the “plat du jour.” Healthcare education will incorporate Web 2.0 technologies, such as blogs, podcasting, and vodcasting. Simulations, gaming, and other active learning modalities will be introduced and used in all pedagogical arenas. Learning will be self-directed, participative, specialized, and continuous for all health professionals across the globe.

Technology in 2020

So, what is the technology alluded to in this scenario? What will impact healthcare and help propel it towards this future scenario? Foremost will be standards. The technical infrastructure will support and advocate ubiquity, regardless of provider and location (“anywhere/anytime”). This ubiquity is possible due to the development and support of standards throughout the infrastructure, which in turn provided a foundation for standards to be agreed on for all electronic

health documentation (including electronic health records). This ability, termed “health plug-n-play”, allows the exchange of data, information, and knowledge for providers and patients leading to care continuity. Due to successful standards adoption there is now the ability of multiple health data/information streams to feed the patient health record from not only organizations but also directly from the patient. While service providers are able to secure information necessary to function, ultimately the patient maintains ownership of this EHR data and information from their birth through their death.

Two other trends in technology will be influential. The development of small, inexpensive, unobtrusive, and, if necessary, wearable sensors will enable the continuous collection of health data from each individual. These might be vital signs, results from blood tests, alarms from fall indicators etc. This will result in a large collection of data that will be gathered from any individual being part in such a program. Programs could be offered, for example, to elderly people still living at home but also to younger people belonging to risk groups like diabetes patients or others with chronic diseases. Generally most prevention programs could profit from such a sensor based gathering of data.

The availability of ubiquitous Internet access and thus distributed processing power will be used to transfer the sensor data to the EHR of each individual in real time. “Intelligent”, knowledge-based programs will pre-process the data looking for any kind of pattern requiring further action like informing the wearer of the sensors and/or the healthcare provider about certain conditions (e.g. acute high blood sugar or acute high blood pressure). The automatic pre-processing of the sensor data is required since the vast amount of health data collected cannot be handled manually. Depending on the emergency of the detected patterns the patient and/or an appropriate healthcare provider will be directly notified to their Internet connected mobile PC/phone and the incident would be recorded in the person’s EHR. Similarly, detection of specific pattern like an unhealthy lifestyle could be detected and risk information could be presented to the individual with the offer of help achieve healthier lifestyle changes.

The architecture for data capture and inputting results into the EHR and PHR will largely follow the paradigm of the intelligent agent with the actual sensor gathering the data; knowledge enhanced processing of the data, and an actor initiating actions on the processed data. The sensor might be in the environment of the individual; it might be worn or even transplanted as diagnostic or treatment devices (e.g. to measure the mechanical usage of bone structures). The processing of the data could be done in the sensor itself or the available ubiquitous access to a network like the Internet could be used to transfer the data to external computers for distributed processing. So, for example, the detection of undesired mechanical stress of bone structures could be done in the sensor itself or at distributed processing units. If such an information is generated the actor will initiate an appropriate action like an acoustic alarm giving immediate feedback to the wearer of the sensor about movements resulting in

too much mechanical stress of the bone structure or the transfer of data to the electronic health record that might trigger further processing and further actions. Due to the ubiquitous access to networks and processing power the data, information and knowledge sources can be made available any place, any time using appropriate interfaces offering direct access or accepting pushed content like podcasts or screencasts for health education purposes.

Description of Proposed Model

Global and knowledgeable consumers will drive the demands of the healthcare markets and purchase healthcare services as a commodity based on providers' quality report cards. Procedures, services and providers will only be allowed based on outcomes and other important indicators for basic healthcare. Healthcare domains will broaden into new niches to include diverse disciplines such as architecture, arts, engineering, and computer sciences. This interdisciplinary team is reflected in our description of the Rhine Home Health team as it reconstructs the home to fit the client's needs for optimal, independent living. Over time, as evidence for improved outcomes is available, government healthcare will adopt the best practices developed by the specialty teams. Government continues to ensure access to basic healthcare for all regardless of ability to pay/purchase, and healthcare services above baseline can be purchased based on willingness to buy.

Consumer purchased service tier will pay for development of new innovative services. Competition between service providers will drive cost of new innovative services down. Today, governments are focusing on ubiquitous healthcare. South Korea has a plan to make a Personal Health Record available to every citizen in their country by the end of 2010. For example, u-Healthcare named "My Health Zone" will be implemented using online communication tools and smart health home technologies in South Korea by the strong initiatives from the Ministry of Health and Welfare. However, even when the EHR is implemented nationally, not every consumer will be able to utilize the PHR portal into it effectively and fully. Thus, there will need to be specialists or knowledge brokers to support the consumers, and this should be a professional armed with special knowledge & skills in health information disciplines. Nursing professional is someone who is accountable and responsible for achieving desired outcomes such as u-Healthcare in everyday life for this new century.

The professional knowledge worker (nurse)'s new roles include customized health information provision, health education, healthcare management, healthcare facilities referrals, smart health home arrangements and purchasing of u-Healthcare devices, etc. The proposed new knowledge worker "nurse" can work across all care venues and specialties. Given the confusion in the marketplace around, "a nurse is a nurse is a nurse, regardless of degree", we anticipate that this clinical knowledge worker role will assume a new name – other than "nurse". To escape from national nurse board restrictions, this role will adopt

new credentials based on a “degreed” model of education and emerging business models since healthcare will be business driven. New healthcare delivery niches will present rich opportunities for nurses and the profession, but nursing must act fast to seize these opportunities otherwise the void will be filled by other new professionals.

Summary

The purpose of this paper is to describe future structure of health care, technologies in use, and the opportunities for nurses to expand into independent practitioners who can contract directly with consumers as employers. In this projected future state, healthcare is results driven, focuses on specialization by medical condition, procedures, or surgeries, and competition exists for winning business based on quality metrics and cost. We use a case scenario to describe the structure and functioning of the system, the roles for patient-consumers and clinicians, especially new roles for nurses. The massive explosion in new knowledge will significantly increase the demands placed on nurses in all areas of professional practice. The new role opportunities for nurses will result from this fundamental change of ‘patient’ to ‘consumer’ as an active and full participant in the care decisions, disease management and wellness maintenance. Consumers’ options to contract directly for care will ultimately change the structure of health care in the distant future. The “knowledge worker” nurse of the future will have an advanced degree, thereby establishing congruence between the educational enterprise and societal needs. This shift to delivering specialty services across the home, community, acute care continuum by contracted clinicians or team is necessarily supported by technical shifts to standards throughout. The end state of universal standards is the ultimate ability to support complete ubiquity of information technology and health information exchange. Technology will contribute greatly to this paradigm shift allowing consumers to contract directly for care services from the best providers for the best care.

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