Technology in Health Care

A new research and teaching subject in collaboration between nursing science and engineering

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***Abstract*— Today, health care systems face a number of challenges related to technological developments. This work in progress is a new Swedish initiative for collaboration between nursing science and engineering focusing digitization, demographics and participation. The initiative aims at understanding how digitization affects patients and health care professionals and the role of engineers and how this collaboration proactively contributes to systems that support caring and nursing. The presentation expects input on the programs substance and boundaries and whether this initiative is fruitful to create sustainable health care systems.**

Keywords; collaboration, nursing science, caring science, engineering, patient support, digitization.

I . INTRODUCTION

Today, health care systems face a number of challenges related to technological developments. The Global Commission on Education of Health Professionals for the 21st Century describes a mismatch between the care offered and people's demands and needs; lack of cooperation; discontinuous care chains; tenacious hierarchies, and not least, a focus on technology founded on flawed understanding of the context in which the technology is used [1]. The gender system that locks structures what perceived as male and female work is deemed particularly difficult to change. Significant is also the lack of good examples of how to meet these types of challenges. Other publications confirm these results, reporting on a lack of accuracy in technological support for health care, not least the confidence in individual solutions. There are reports on an imbalance between the success factors in health care - increased life expectancy and better treatments - and the expectations of what you want done and what to expect [2] [3]. At the same time, the belief in technology as the ultimate solution still prevails. The Swedish Society for Nursing identifies a lack of knowledge about the impact of technology on caring interventions. To meet this, they emphasize individual health as an important aspect to investigate and call for possibilities to actively participate in design, implementation and assessment of new technology [4] [5]. Others stress the economic values of returning to patient centred strategies [6]. To mention one example, creating digital health care records and digital information to citizens are among the most difficult tasks to accomplish despite the wide access to Internet and digital infrastructures. Google declared a few years ago that their investment in Google Health was one of their biggest failures due to its complexity [7]. Instead they are now developing databases focusing on health and aging sciences. Another way to meet these challenges is through multidisciplinary initiatives between scientific disciplines and between academy and industry. Today there are a number of examples of international multidisciplinary collaboration, e.g., the Bio design Fellowship program at Stanford University since 2003 which is also implemented in Sweden as The Centre for Technology in Medicine and Health (CTMH). These types of commitments are key elements in promoting interdisciplinary research and development in medicine focusing problem-solving in general. However, it is rarer to find a technology focus in relation to nursing and caring.

Section 2 describes the rationale behind the organization of a new collaboration between engineers and nurses to meet the challenges pointed out above. Section 3 describes the aim more in specific with emphasis on digitization effects on inter-professional collaboration and the dependency on active patients to make technology work in their social context. In section 4 and 5 some arguments are presented to why nursing and critical technology research is a relevant combination to set the agenda for this new collaboration. Section 6 summarizes the main conclusions.

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II. NEW INITIATIVE TO MEET THE CHALLENGES

With this background we would like to present a new Swedish initiative for collaboration between nursing science and engineering, initiated jointly between KTH, the Royal Institute of Technology and SRCUC, the Swedish Red Cross University College in Stockholm. The reason for submitting this work in progress at this conference is to gather input and comments on two main issues. The first one is whether this is a fruitful strategy to create more sustainable health care systems. The second issue is how we in a multidisciplinary collaboration can work to define "Technology in health care", its substance and its boundaries.

The collaboration between KTH and SRCUC is implemented in parallel with a new interdisciplinary postgraduate program - Technology in Health Care (in Swedish: Teknisk vårdvetenskap) at KTH and as a part of the nursing science program curriculum at SRCUC. The Nursing Science program at SRCUC will therefore have a unique technological profile, added to its 150 year tradition of training nurses. At KTH, the Department for Technology and health will be given new opportunities for research into how technology works in caring settings.

The aim of the collaboration is to create sustainable and effective systems of health care through increased knowledge about how technology affects people's opportunities to regain their health and more proactive nurses and engineers participating in design and innovation processes which also enhance patient safety. The technology focus is digitization encompassing both biomedical engineering used by health care professionals in hospitals, and home health care systems, as well as digital tools used by both health care professionals, citizens at home and in mobile settings. Demographic developments will be key focusing on children and older populations, the groups that will increase the most until 2050. Many projects fall outside the boundaries of eHealth, yet include the combination of technical skills and caring skills to solve the problem at stake. Digitization is central. It is estimated that within a decade, the majority of the world's population will have accesses to virtually all the world's information in a machine that fits in its own palm. These profound changes occurring within one generation naturally has a great impact on the Red Cross, which together with the Red Crescent, is the world's largest non-profit organization (97 million members). Digital media, robots and sensors, create new opportunities to practice disaster response and care, in dangerous situations and in the monitoring of health.

The SRCUC-KTH collaboration was initiated jointly in 2012, a professor was installed 2014 and 2016 we are moving from preparations and discussions to research and education activities supported by structures for training, qualification, publication and projects.

III. PROGRAM CONTENT AND GOALS

The aim is to understand how digitization affects patients and healthcare professionals and proactively contribute to functioning systems that support caring and nursing. With digitization we refer to the on-going development from a hospital- and function-based organization focused on patients, diseases, wards and elimination of risks with single technical applications, towards a focus on health, home health care such as cancer and palliative care, monitoring and communication on distance, digitized and accessible patient care records requiring active patients and citizens and more of inter-professional collaboration and teamwork between health care professionals. These shifts in the way care and contacts with citizens are understood is underway. Our analysis goes even further, focusing on-going developments and implementations of patient safety outside hospitals and between hospitals and homes, distance surgery and design of self-care devices, the use of robotics, genetically guidance and other new roles for nurses. The critical input from this program to influence this development is a proactive approach including the ability to collaborate with engineers, initiate and formulate relevant research questions. The theoretical foundation for this critical input will be Science-Technology-Studies research providing insights on the configuration of users and contexts and from Informatics and Implementation science providing knowledge on participation in implementation of health information systems. This is expected to offset the dominant paradigm of deterministic and paternalistic views leading up to a mismatch between the care offered and people's demands and needs; lack of cooperation; discontinuous care chains; tenacious hierarchies, and not least, a focus on technology founded on flawed understanding of the context in which the technology is used. The research environment at KTH and SRCUC in which this program is developed include other programs which will be expected to make considerable input to the multi-disciplinary approaches, such as care logistics engineering, ergonomics, monitoring, nursing and public health.

To be proactive requires knowledge about technological developments and the ability to collaborate with engineers and participate in design and innovation processes both for healthcare professionals and concerned citizens. The first attempts to joint learning opportunities for engineers and nurses were successful and will continue this year The exercise is organized as a part of the curriculum in which students in nursing and students to become medical engineers collaborating around a report from the Swedish Accident Investigation Authority about a serious failure at a Swedish hospital involving medical technology and a patient. The meeting received very positive feedback and created a broader perspective on each other's responsibilities and the role of technology in a real life setting. For the moment the research group includes one professor from the engineering department with a STS-background, two PhD in medicine and nursing, one PhD in medical education related

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to informatics, three assistant professors, two PhD students and two project employed persons. The first six years of this collaboration is based on joint funding from KTH and SRCUC and from external funding. For the moment the external funding include a China-Sweden collaboration building home health care and housing for ageing populations; development of medical devices and patient safety funded by Swedish and Norwegian foundations; child intensive care developments funded by Karolinska hospital; digital ethics funded by Swedish foundations; and Age Management funded by Swedish Industry and a Swedish Research Council. The professor leading this group has for thirty years been dedicated to research and development in aging, technology and design and was responsible for ten years for the Ageing and design program at Lund University, where she still holds a visiting professorship. Her publications include a range of projects with old people participating in design and implementation. The first articles in this context were published by Mattsson & Stevens [15] [16] and Björling on coated endotracheal tubes and central venous catheters with focus on patient safety [17] [18]. During the same period Östlund published several articles on robotics and ethics [19] [20] [21].

The result of this program are expected to reinforce the participation of citizens and health care professionals in designing future health care, and as a consequence broadening the innovation capability in health care and citizens' trust and confidence in the health care system. The most tangible results in the short term is expected to be technology that does not impair care but that facilitates and enhances people's opportunities to recover and maintain their health.

IV. THE RELEVANCE OF NURSING AND CARING SCIENCES

Nursing is central in the development of future health care. In the Nordic countries, nursing as a research subject, have for thirty years, developed in parallel with “caring sciences”. Both have been expansive including caring informatics and caring theory. Nursing, which is the broad international field, has its focus on guiding nurses in practice such as routines and regulations and patient safety. Caring sciences, published in Journals, such as the Scandinavian JN for Caring Sciences among other JN, originate from phenomenology and the interest to understand principles for utilization [8] [9] [10]. Caring science is today related to person-centred care, self-sufficiency and independence. Especially since the core of caring has been revealed as central, holistic, individualized and at the same time providing expert physical care combined with fulfilling emotional needs in an adaptive environment [11]. As digitization increasingly moves in to the realms of health and self-care, the relationship between the caregiver and the individual citizen, patient or care receiver, becomes more important. Result from innovation and implementation research have not yet been applied in this field but can be important to promote”self-care management, personalized medicine” and consequences of the demographic development [12] [13].

V. TECHNOLOGY DEVELOPMENT

Technology development today is leading to greater complexity. We are now entering a new phase where it is more about interconnected systems and no longer just individual applications. Today, the use of different types of IT applications is not unknown to anyone in health care. “APPS”, digital patient records, alarms, sensors for monitoring health, social robots, “robocats”, digital incontinence, remote surgery, decision support for diagnosis, balance training for stroke sufferers are all examples of products that can add value”. Many of these examples have been shown to increase the quality of care and have already become successful business solutions. At the same time, this raises awareness about the fact that individual technical artefacts are hardly the solutions to the health care problems. This leads to a number of questions which need to be addressed: How can we permanently and sustainably integrate new applications in health care? What is the best way to implement accurate solutions in health care with a comprehensive and ongoing digitization?

Another important question concerns what is called the technological imperative in relation to caring values: are we always obliged to do what can be done in terms of technological development? Or can we find ways to criticize such deterministic views? Although technology is closely associated with the development of modern medical care, the relationship to technological development is divided [14]. Here is a criticism that high-powered specialization risks creating problems and become counterproductive. The German philosopher George Henry Gadamer asserted, for example, that it is precisely in highly developed technical civilizations that the phrases "quality of life" and "whole" are expressed, because something has been lost (15). Meanwhile, with a critical perspective on technology development, we can see that technology has a special attraction and that it has become a force for change. It also becomes apparent that a narrow technical perspective sometimes tends to give healthcare professionals the role of managing technology instead of people. It also contributes to the technological imperative i.e., what is possible to be measured must be measured even if the benefit is unclear.

VI. CONCLUSIONS

This short paper suggests that a program based on multidisciplinary collaboration between nursing and engineering is one of the key strategies to make digitization in health care sustainable. Although this can be expected to solve many of the problems addressed in the literature it is not enough. A theoretical reflection is also needed that questions the prevailing paradigm where technology is regarded as a tool independent of the influence of the context in which it is used. Such critical input will open up for more proactive strategies including the understanding of

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how digitization affects patients and how to increase participation in design and implementation of health information systems.

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