Nursing Informatics 2020: Towards Defining Our Own Future

Proceedings of NI2006 Post Congress Conference

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Editors: Peter J. Murray
Hyeoun-Ae Park
W. Scott Erdley
Jeongeun Kim

NURSING INFORMATICS 2020: TOWARDS DEFINING OUR OWN FUTURE

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Nursing Informatics 2020:
Towards Defining Our Own Future

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Edited by

Peter J. Murray

Centre for Health Informatics Research and Development (CHIRAD),
Nocton, Lincolnshire, UK

Hyeoun-Ae Park

College of Nursing, Seoul National University, Seoul, Korea

W. Scott Erdley

School of Nursing, SUNY at Buffalo, Buffalo, New York, USA

and

Jeongeun Kim

College of Nursing, Seoul National University, Seoul, Korea

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Preface

The Korean Society for Medical Informatics (KOSMI), and in particular their Nursing Informatics Specialist Group (KOSMI-NI), not only organized a superb 9th International Congress on Nursing Informatics, NI2006, but were kind and generous hosts to the NI2006 Post Congress Conference.

The NI2006 Post Congress Conference was held at Phoenix Park, Pyung-Chang, Kangwon-do, Korea on June 14–17, 2006. We were only able to invite and accommodate about 35 people, although we know that many more of our colleagues have active interests in the issues that we discussed, and would have liked to have been involved. We hope that these proceedings will compensate, in some small way, those unable to be there, and that after reading them, they will feel encouraged to participate in the necessary ongoing discussions, both within IMIA-NI and more widely in the international nursing and informatics communities.

The NI2006 Post Congress Conference and its proceedings complement the main Proceedings of NI2006. We have included the papers developed by each of the five groups, together with specially written papers setting the context and summarizing the discussions and outcomes. We have additionally included June Clark's NI2006 Congress keynote paper; this was used during the Post Congress Conference discussions, and its inclusion here fills the gap of its absence from the main Proceedings of NI2006.

We would like to warmly thank everyone who assisted in the smooth running of the NI2006 Post Congress Conference, and who have made the production of these proceedings possible. In particular, we acknowledge and thank the NI2006 Organizing Committee, for selecting such a superb and conducive venue for the discussions, and for providing their generous support. We also thank all who, under the leadership of Jeongeun Kim and Hyunkyung Ryu, assisted on a daily basis at Phoenix Park, working hard to ensure the comfort of participants and the success of the event. Finally, we thank the group leaders for their hard work before, during, and after the Post Congress Conference, and all of the participants – our nursing informatics colleagues from around the world – without whose enthusiasm and contributions these proceedings would not have been possible.

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Peter J. Murray
Hyeoun-Ae Park
W. Scott Erdley
Jeongeun Kim

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Foreword

Nurses and the Nursing Informatics Special Interest Group (IMIA-NI SIG) have long been actively involved in all aspects of IMIA, the International Medical Informatics Association. As IMIA's only Special Interest Group (SIG), IMIA-NI has a special place within the 'IMIA family'. It has its own Working Groups, who focus on the key issues within nursing informatics, bringing together experts and interested individuals from around the world. In addition, it holds its own General Assembly every year, where it leadership and members (National Representatives, Working Groups Chairs, Honorary Members and many others) meet to discuss the governance of the organization and other issues, and many of its members contribute to other areas of IMIA's activity. Over the past three years, Heather Strachan, immediate past Chair of IMIA-NI, and myself have been members of the IMIA Strategic Planning Taskforce, set up by IMIA President Nancy Lorenzi at Medinfo2004 in San Francisco, USA, and with the remit to develop a Strategic Plan for IMIA. As part of the work of the Taskforce, we had to think about what its members would like to see IMIA being and doing in the year 2015. It seemed natural, therefore, for IMIA-NI to formally think about the future of nursing, of nursing informatics, and the needs of both our own organizations and the wider nursing community. Hence, it was an opportune time to use the NI2006 Post Congress Conference to focus on these discussions; and, as nurses always like to think a little further ahead than their colleagues, we selected 2020 as our target date.

The IMIA-NI SIG has a long tradition of Post Congress Conferences, structured in interactive workshop format, immediately following their triennial NI Congress. These events provide the opportunity to not only bring together international experts, but also allow for developing new blood and new thinking by inviting less established members of our community to participate. As part of IMIA-NI's mission of encouraging the global development of nursing informatics, we particularly encourage participation from colleagues in less developed parts of the world, to assist them in fostering the development of nursing informatics in their own countries.

In 1997 in Sweden, the Post Congress Conference was focused on combining clinical practice guidelines and patient preferences; in 2000 in New Zealand, the informatics base for evidence-based practice, through clinical pathways, was explored, and in 2003 in Brazil, the focus was on the use of technology to improve patient safety. The centrality of the patient within nursing and within health and healthcare have, thus, been a strong theme in recent years, reflecting the unique role within the healthcare team that is played by the interaction of nurse, patient and family. The role technologies increasingly play within these interactions has also been a pivotal part of the equation. While the

theme for the 2006 Post Congress Conference may seem, at first glance, to less overtly follow this tradition, those who were involved in the discussions and in the editing of these proceedings can clearly see that the patient, and the nurse-patient interaction, have remained central to our thinking.

The theme of the main NI2006 Congress, 'Consumer-centered computer-supported care for healthy people', clearly demonstrates the focus on people that carried over into our explorations of possible futures and the implications for nursing informatics, for the wider nursing community, for our health professional colleagues, and most importantly, for our patients and those who have needs for support in maintaining their health status and perhaps avoiding becoming patients. The discussions within the Post Congress Conference recognized the role to be played by changing technologies in the ways in which we support and deliver care in the future, but they also clearly demonstrated that technology is only one part of the equation, and that many other factors must be borne in mind. We also acknowledged the need to explore not only the visible and predicable future, but also the less likely scenarios that may suddenly be thrust to the forefront of our attentions.

William Gibson's observation that 'the future is already here, it's just unevenly distributed', echoes many of our discussions and deliberations. Different combinations of the technologies can offer possibilities for differing solutions in different countries to the similar problems that we know many are likely to face. The exchange of ideas that is reflected in these proceedings offers opportunities to celebrate nursing's commonalities, while at the same time considering its necessary evolution and adaptation to new challenges. We know, from past experience, that locally, nationally and internationally, nurses can and will rise to those challenges.

The IMIA-NI SIG will be using the outputs of this Post Congress Conference to contribute to discussions on its own future directions and focus. I believe that the example of this formal exploration will also contribute to the success of the IMIA Strategic Plan, and provides an example for other health informatics groups, both among IMIA's Working Groups, and within the regional and national health informatics organizations, to explore the implications of the future for their own strategic planning. We all, individually and collectively, need to contemplate our futures, so that we can contribute to creating them, rather than having them imposed on us. We must, at the same time, not ignore the lessons of history. I hope that, in these Proceedings, you will find sufficient stimulus to join with your colleagues, in IMIA-NI, IMIA and elsewhere, in creating the kind of future for our world that you hope to see, rather than that you fear may happen.

Peter J. Murray RN, PhD, FBCS CITP
International Medical Informatics Association, Vice President for Working Groups and Special Interest Groups

Contents

Why Nursing Needs to Explore and Shape Its Own Future – The Background to the NI2006 Post Congress Conference

Peter J. MURRAY (UK) and W. Scott ERDLEY (USA)

Abstract. Within this paper we describe the background context and discussions that lead to the selection of the theme for the NI2006 Post Congress Conference. The rationale for the choice of the overall theme is introduced, together with the selection of the five main sub-themes, on which the group discussions were based, and that lead to the production of the group papers that form the core of these Proceedings.

Keywords. Nursing informatics, future, nurse role

From Rio de Janeiro to a History of the Future to Seoul

We do not claim to be the first or only people to have considered the need for nurses to consider the future, nor for them to explore the likely impacts of developments in healthcare and more widely on the development of the profession and the nature of nursing, and more recently, nursing informatics. Many of our colleagues, some of whom participated in the Post Congress Conference, have engaged in such deliberations and have produced interesting and stimulating ideas.

However, the start of the particular path that lead to Phoenix Park, Korea and to the NI2006 Post Congress Conference can be traced back to Copacabana Beach, Rio de Janeiro, Brazil in 2003. At NI2003, the 8th International Congress on Nursing Informatics, held in Rio de Janeiro, Dr Scott Erdley started discussions with various people about a possible project for nurses, and in particular nurse informaticians, to explore what might be some of the technologies and other developments that would affect nursing over the coming 20–50 years. We took the view, rightly or wrongly, that much of what nurses do had in the past been determined by other people and other developments, and that nurses were not very good at setting out their own vision of what the profession should be. We recognized that, as the pace of technological change continues to increase, nurses need to explore the ways in which technologies might be harnessed to benefit their work. We also recognized that there are many changes in

society, global and local, that we know are under way, and some emerging possible threats (global pandemics, for example) that will or are likely to impact healthcare, and for which we need some degree of contingency planning. Additionally, two other not so obviously related issues influenced the way in which our thinking developed. The first was the consideration that imagining potential futures, in part, but not exclusively, through scenario planning and similar techniques, and then looking back and exploring what would be the stages to reaching that future, was one possible way in which we might frame such a project. The second was that many writers and film-makers have over the years imagined possible futures, and that some of their work might provide the 'what if' scenarios from which we might work.

A website was established for a 'History of the Future' project (http://differance-engine.net/ni-futures/), with a view to bringing together a cohort of interested individuals to develop the project through scenario planning, online discussions, and possibly face-to-face discussions at suitable nursing informatics events. Naturally, time to devote to the project was always in short supply, and so the work did not progress as quickly as our enthusiasm had planned or hoped for.

The opportunity to explore some of these issues at NI2006 was one that we felt we could not ignore. The triennial Nursing Informatics Congresses, held under the auspices of the Special Interest Group in Nursing Informatics of the International Medical Informatics Association (IMIA-NI), are the largest international events bringing together nursing informatics experts from around the world. We were therefore delighted that, following discussions at MIE2005 in Geneva, the NI2006 Scientific Programme Committee accepted our proposal to theme the NI2006 Post Congress Conference around exploring the future of healthcare, nursing and nursing informatics. In both face-to-face discussions (AMIA 2005 in Washington DC) and in online discussions, the members of the Scientific Programme Committee, and in particular its Chair, Prof. Hyeoun-Ae Park, worked with us to refine the focus of the Conference themes.

It is worth noting that other contextual developments have made the NI2006 Post Congress Conference discussions opportune. At Medinfo2004, in September 2004 in San Francisco, USA, the International Medical Informatics Association (IMIA), formally launched work to develop an IMIA Strategic Plan. An important element of this work, which built on an earlier survey of IMIA members to consider how they saw IMIA developing in the future, was to consider what IMIA sees itself as being in the year 2015, and therefore, how it is going to develop, strategically and in terms of specific objectives and tactics, to achieve the vision of IMIA in 2015. That IMIA-NI, as one of the largest and most active parts of IMIA, should in parallel begin work to explore its own future development is therefore appropriate.

The rest of this paper outlines the purpose of the Post Congress Conference, and briefly describes the preparatory work that lead to a group of 35 nursing informaticians from all parts of the world gathering in an off-season ski resort,

Phoenix Park, near Seoul, Korea, for three days of intensive discussions when they had already spent up to a week involved in a major international conference and associated meetings.

Purpose of the Post Congress Conference

The NI2006 Post Congress Conference aimed to discuss the possible future nature and scope of nursing informatics, nursing and healthcare, as viewed from likely developments between the present (2006) and the year 2020. The year 2020 was chosen as a somewhat arbitrary date, not too far in the future as to unimaginable to most people, but also sufficiently far away that people could, if they wished, let their imaginations run a little wild, and not be too constrained by changes that we already know are highly likely and the need to focus of their everyday reality.

As already alluded to, this work was felt to be opportune given the ongoing work on development of the IMIA Strategic Plan, titled "Towards IMIA 2015" [1]. It was felt that not only might it provide input to the IMIA Strategic Plan, but also would help inform future revision of IMIA-NI's own Strategic Plan, which was last extensively revised in 2003.

As originators of the proposal for the Post Congress Conference themes, we started from the premise that much of the current scope of nursing informatics has resulted from a *post hoc* reaction to wider developments. This is not a view we necessarily expected would be fully, or even partly, subscribed to by all the other participants. We felt that, if nurse informaticians are to define their own roles and scope, they need to take a proactive stance, identifying likely future trends in technology, information technology, healthcare, nursing and society, and the impact these will have. From this, they might then set out a vision, or visions, for how they would wish to nursing, informatics and healthcare develop, and the impact on their roles.

Discussions in the Post Congress Conference (of which more detail is provided in the following paper) were based in position/discussion papers for each of the sub-themes. These had been developed and circulated in advance by the theme leaders, and sought to provide some background reading that identified some of the major issues or trends that are already emerging, or could emerge, over the next 15 years.

We identified five sub-themes and encouraged the leaders of each, who were responsible for preparing materials that could set the scene and provide a starting point for the discussions, to be imaginative and creative, and not necessarily constrained by what they think are the likelier scenarios for the future. As is well known, unexpected things can happen relatively quickly that have considerable impacts on an aspect of society, healthcare, or use of technology. Although we set the year 2020 as a guideline date to think about, we also encouraged them to feel free to think further into the future and, if they felt it appro-

priate, to use scenario-planning as the basis for the discussions in their groups, and therefore to develop a range of scenarios for discussion (from optimistic to pessimistic, likely to unlikely, or with any other range of parameters they feel appropriate).

We were keen, however, not to constrain the participants in their thinking, and so preparatory reading was not extensive or prescriptive; we wished people to bring their own ideas and imaginations to the discussions. The intention was that the post-conference should start to identify how nursing informatics might pro-actively define its future scope as a result of these emerging trends. It was recognized that it would be necessary to examine technology developments, demographic changes, changes in policy and practice within healthcare delivery, and possibly new theoretical and philosophical approaches.

As the Post Congress Conference was being held as an official part of IMIA-NI activities, it was felt that the outputs emerging from the discussions would also help to define the future scope of IMIA-NI, the areas it needs to address, and help in defining its Working Groups and other areas of legitimate activity. Several members of the current leadership of IMIA-NI, including the Chair, Robyn Carr, were able to participate in the event.

Sub-Themes Used in the Post Congress Conference

Five sub-themes were identified in advance. Post Congress Conference participants were asked to select their preferences for which sub-themes they wished to contribute to, although some people had to be moved to balance numbers in each group. We were aware that there is obviously some potential overlap between sub-themes 1 and 5, and the potential for the two groups to discuss very similar issues, but felt that there was a distinction to be made. The descriptions of the sub-themes provided were deliberately described in loose terms, as we did not wish participants to feel constrained by them, but to use them as a starting point for exploration.

The sub-themes, as originally described to the participants, were:

1. Technology developments applied to healthcare/nursing

This sub-theme will examine technological developments that will be influencing direct and indirect patient care, heath promotion, and nursing both within formal care settings and in informal, out of hospital settings. These may include remote (e.g. wireless) monitoring, ubiquitous access to computer networks, lifelong electronic health records, wearable monitoring and treatment devices, and treatment based in genetic medicine. What effects will some of these have on the practice of nursing and of nursing informatics? What implications will they have for education and training?

2. Changes in society at national and international levels

This sub-theme will address societal changes as impacting health/nursing/ nursing informatics. As economies have become global/made country boundaries invisible, so too will health care/nursing/NI become practices without borders? Among issues that might be addressed are:

- how will these disappearing boundaries and increased societal mobility, along with increased IT (information technology) presence, impact health/ nursing/nursing informatics care?
- how will the changing demographics of societies in all countries (aging populations) affect healthcare, nursing, etc?

3. Healthcare in the year 2020 – practice and policy

This sub-theme will specifically examine/explore/address healthcare and nursing practice. Using current and past information related to trends, projections related to future nursing practice, both nationally and internationally, will be discussed. Among the issues that might be addressed are:

- how will these changes/direction impact nursing informatics?
- will nursing exist as we know it?
- will countries be compelled to move, for economic, political, or other reasons, to more community and preventive care and less hospital-based care?

4. What philosophical and theoretical issues will help us?

This sub-theme will delve into issues related to health and nursing care in both the near (5–10 years) and far (10–25 years) future. Participants will discuss critical philosophies and or theoretical issues potentially driving both health and nursing, as well as nursing informatics. How best will these needed elements be determined?

5. IT evolution to 2020: the potential in healthcare and informatics

This sub-theme will primarily address IT, and then IT an influence on health/ nursing/nursing informatics. How will IT change over time? What will be the important technologies in 2020 and beyond? How will nursing informatics take advantage of these tools in the future?

Summary

This paper has provided a brief overview of the background and context to the NI2006 Post Congress Conference. We have sought to explain some of the ra-

tionale, and have presented a summary of the themes and issues from which the participants started their discussions. In the next paper, we present a summary of the discussions within the Post Congress Conference and some of the issues as they emerged.

References

[1] IMIA Strategic Planning Task Force. Strategy in a Fishbowl: An invitation to determine the shape of IMIA in 2015. Methods Inf. Med. 2006, 45:235–9.

Reflections on an Evolving Discussion of the Future – An Overview of the NI2006 Post Congress Conference

Peter MURRAY (UK)

Abstract. Each of the five working groups in the NI2006 Post Congress Conference produced a paper summarizing the discussions within their group. This paper provides a summary of the evolution of the discussions, from inti ital presentations through the final papers. Some of the common themes emerging are presented, including the changing role of the nurse, the impacts of technological and demographic changes, the importance of genomics, and introduces the concept of u-nursing, meaning nursing as practiced within a context of ubiquitous technologies.

Keywords. Nursing informatics, future, scenario, change, technology, u-nursing

Introduction

This paper provides both an overview of the discussions in the NI2006 Post Congress Conference, and a summary of how the discussions evolved, finally resulting in the papers developed by each of the working groups. It is not meant to substitute for any of the working group papers, but there will, of necessity, be some repetition of and overlap with their content.

This paper is not meant to give a mechanistic, blow-by-blow account of who said what and when, but attempts to show the journey from the initial, disparate materials presented by each of the groups, which nevertheless covered many similar issues, through to the commonalities that emerged from many of the group discussions, and that are reflected in the reports from the five working groups. The preparatory work before the NI2006 Post Congress Conference has already been presented in the previous paper, and so will not be repeated here. Two possible future scenarios, used in the introductory presentations, are given, and each of the emerging themes are discussed in some detail.

Introducing Scenario Planning

It is difficult to come to an intensive, interactive workshop, held over a short time period, from cold. While all of the participants had been involved in the

preparation of materials prior to the NI2006 Post Congress Conference, as originators and co-leaders of the activity, we also felt it necessary to prepare some materials to stimulate discussions.

The motto of the Institute for Alternative Futures (http://www.altfutures. com) is "The challenge is not only to anticipate the future, but to create it". As with many other organizations involved in exploring possible futures and developing strategies, they use scenario planning, which can be a powerful tool for thinking about the future, and for thinking through the implications of strategic choices in organizations. By imagining some possible future scenarios, we can think about steps to get to futures that we might envision – or how we might avoid getting there if they are not what we would like to see. Scenarios can be realistic, based in little change from what we know if fairly certain to happen. However, it can be much more interesting to take some leaps of imagination in developing scenarios. [1]

Two possible scenarios, based in some common possible future events, were developed and presented as part of the opening discussions for the NI2006 Post Congress Conference. They were useful to formulate, and provided for some discussion, but as participants had already prepared materials, we did not use them extensively. However, as will be seen in the subsequent exploration of the issues that emerged from the NI2006 Post Congress Conference, some of the ideas developed in the scenarios echo issues and themes that were identified in many of the groups' own deliberations; they are therefore useful to reproduce here as part of the historical record of the NI2006 Post Congress Conference. Both start from a similar set of possibilities, based in issues that were being discussed in the news nationally and internationally in the months leading up to the NI2006 Post Congress Conference, but show marked divergence in the possible outcomes.

Scenario 1

From this year of 2026, we can look back on an overview of the major factors that resulted in the crises in global healthcare of the past 15 years. The global avian flu pandemic of 2009–10 had far more serious effects than the worst predictions. For many older people, who had been exposed to previous influenza outbreaks, the mutation of the H5N1 virus that allowed human-to-human transmission resulted in minor symptoms from which they quickly recovered. It proved more deadly for those under 35 who had built up little resistance through previous exposures. In developed countries, due to the spread by air transport before the UN-WHO air traffic ban of 2009, death rates in the under-35s were over 50%. Developing countries were less badly affected due to lower levels of air traffic, but still lost 10% of their under-35s, which worsened the generational loss due to AIDS/HIV that was already affecting many.

This resulted in an acute worsening of the demographic time bomb; less younger earners to support the care needed by an increasingly elderly popula-

tion with increasing healthcare needs; less tax revenue to support healthcare systems. In many countries, emergency laws, such as that enacted across the European Union by EU President Mandelson in 2011 compelled many retired healthcare workers, including nurses, back into the health services to fill the gaps. One beneficial effect was that the drain of healthcare workers from developed to developing countries was halted, so local workers were able to help with problems in their own countries.

The adage that 'it never rains, but it pours' came very true with the additional problems of IT systems to support healthcare. After Prime Minister Brown scrapped the UK's National Programme for IT (NPfIT) in 2008, soon after coming to office, confidence in monolithic, centralized and proprietary IT systems for healthcare plummeted worldwide. Just as the global avian flu pandemic showed the need for IT systems to combat such health problems, the after-effects of US President Rice's 2009 bombing of Iran's nuclear facilities hit home. A global alliance of terrorists and hacker/spammers launched the Gates-Borg worm in 2010. This overnight resulted in the destruction of all hospital records that were reliant on Microsoft/Windows platforms. Only those healthcare IT systems running other operating systems survived; Microsoft filed for bankruptcy in 2012.

WHO mandated the adoption of the OpenVista system as the only solution that was readily available to provide a basic healthcare IT infrastructure to tackle the pandemic. In many countries, due to past reliance on a small number of IT suppliers, even this was not possible and a return to paper records was the only solution.

Scenario 2

From this year of 2026, we can look back on an overview of the major factors that resulted in the current golden age of global healthcare. The global avian flu pandemic of 2009–10 had less serious effects than many had predicted, but the worldwide quarantine measures to stop its spread, including the UN-WHO air traffic ban of 2009, had some beneficial effects too. The drain of healthcare workers from developed to developing countries was halted and local nurses and doctors were able to deal with the worst effects within their own countries.

After Prime Minister Brown scrapped the UK's National Programme for IT (NPfIT) in 2008, soon after coming to office, confidence in monolithic, centralized and proprietary IT systems for healthcare plummeted worldwide. The global avian flu pandemic nevertheless demonstrated the need for IT systems to fight the problems. As commercial suppliers were unable to collaborate on developing truly interoperable solutions, WHO offered its own version of Open-Vista to any healthcare facility needing it; this facility of a global, interoperable system, lead to the demise of many commercial IT suppliers. Microsoft filed for bankruptcy in 2015.

The use of a global interoperable healthcare IT system lead to some other rapid developments and collaborative ventures, based in open access and open source models, in knowledge sharing and the development of solutions to healthcare problems and new treatments. WHOGrid, a global computer network that resulted as a by-product of the OpenVista use, resulted in collaborative projects in gene-sequencing and the development of tailored drugs and treatments for sections of populations. Cuban developments in biotechnology were built on and have lead, in the past 10 years, to the eradication of many common diseases in developing countries.

Initial Thoughts from the Working Groups

At the start of the NI2006 Post Congress Conference, each working group provided some initial thoughts on the issues that they had been exploring. The following sections present these initial issues, in no particular order of importance. Rather than provide the fine detail of the ideas from each group, as there were several common issues that were raised among several or all of the groups, we have attempted to summarize the broad issues; of necessity, some detail will be missed, but we believe that much of this has been covered in the papers arising from the final deliberations of each group.

The NI2006 Post Congress Conference discussions were held under the Chatham House rule ("When a meeting, or part thereof, is held under the Chatham House Rule, participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed".) [2] Thus, to avoid inadvertently ascribing views to people that they may not hold, but which they may have been simply reporting or raising for discussion, comments will not be attributed to any individuals. It should also be emphasized that, for issues raised here, the reader should not infer that the NI2006 Post Congress Conference members as a whole, or any particular individual, necessarily subscribes to any particular viewpoint. The purpose of the NI2006 Post Congress Conference was to explore a range of possibilities, some of which may be less palatable or preferable than others, but all of which need to be considered in order to move towards a future we do seek to envisage or influence.

Issue: Demographic Changes

We know that there are important demographic changes already occurring, and there are others that we can anticipate, that will have an important effect on the nature of healthcare globally and within different geographical and societal sectors. There are life expectancy increases and falling child mortality in many countries, but we must be aware of the impact of some important diseases on mortality, life expectancy, total population levels and age structure of some nations, for example the impact of AIDS/HIV in many sub-Saharan countries.

Older people are increasingly dominating healthcare facilities, including high dependency and intensive care, while new and re-emerging diseases will have an impact on healthcare, e.g. SARS, Ebola virus, and the possibility of pandemic influenza resulting from avian flu mutations.

Issue: Healthcare Delivery and Organization

We need to be aware, in discussing approaches to healthcare, of the gaps that exist in many aspects of care, for example between the healthcare available in many wealthier, often developed nations, and the reality of everyday life and healthcare availability in the parts of the world where the majority of the global population live, for example in India, China, and large parts of Africa. Most care (perhaps as much as 95% in many countries) is provided in the home and not in hospital, even in wealthier Western nations with well-developed health infrastructures. Yet, there are also many inequities in health, especially in large population areas, and urban-rural disparities that in some cases have changed little, or even worsened, in the quarter century since the UK publication of the Black Report on inequalities in health. [3]

As resources and expectations change, we will need to increasingly address the question of what are the actual health needs of different populations. We may need to redirect efforts, in particular to addressing under-served sectors, for example, where there is a lack of mental health issues being addressed. The large element of self-care that exists in much healthcare provision in many countries will be vital to maintain, as ordinary people will be the key resource for healthcare in the event of a societal collapse for whatever reason, such as following a pandemic disease.

There are many other changing models of healthcare, with increasingly early discharge from hospital care, hospital avoidance strategies, increasing home-care, extended community roles, and extended roles in rural and remote areas. In a large number of countries, many of these changes are being driven by cost factors. It is also increasingly recognized in many countries that we cannot afford health systems as we have them now; we are seeing moves towards co-payment/patient investment models of healthcare financing, also known as a cooperative world. Variants exist as to how such models might develop, but they include clinicians as essentially employees of patients. This leads inevitably to the question, what does nursing have to sell to the patient? The only answer may be 'knowledge'.

Issue: Health Policy

Health policy has had many drivers at the global and local levels. One of the most famous was the World Health Organization's (WHO) Alma Ata Declaration [4], and although this was published in 1978, and aimed towards 'health for all by the year 2000', we must question how much progress has been made towards reaching these laudable goals. In many countries, politicians and pol-

icy makers are talking a great deal about the potential to leverage care, but what is often happening is that there are centralized, controlling perceptions of electronic health records (EHRs) produced by government, but the policy changes and desires that emerge from strategies seem often to neglect the patient.

Patients and information are seen by many as the most underutilized resources in today's healthcare system. We know, however, that there are also changes occurring as patients become more knowledgeable about their health and illnesses, and that many patients wants to distinguish the best from the worst. This, as with many other emerging areas of healthcare, raises the need for standards, measures, and common languages. These changes have many implications, including for redefinition of the EHR, to become broader than the individual patient, and than centrally-located repositories of data. Consumer empowerment means changes in how to structure information technology and a re-structuring of care around the needs of consumers and not those of providers.

Issue: Technologies in Healthcare

In many respects, the fundamental technology has not really changed over the last 40 years in many healthcare facilities (e.g. intensive care units – ICU), with only new versions of long-existing technologies such as ventilators being developed. However, in many areas, even without the emergence of electronic health records, data capture has changed markedly. We now can and do capture many more items/elements of information, and there is increasing need for the crucial issues of interoperability and communication to be addressed. We cannot deny that new technologies are emerging, but as some recent studies have shown [5], technology use tends to be in isolated pockets of often good examples of technology, rather than widespread use.

Among the new technologies emerging that will have an impact on the delivery of healthcare are increasing availability of wearable devices, wireless data capture and transmission, and point-of-care data capture, with many new sensors being developed (e.g. optical, pressure, fiber optic). Body sensor technologies, including body area networks and personal area sensor networks need to be considered, while increasing use of wireless sensor networks, e.g. using nano-sensors (motes) and networks (smartdust) will affect the capture and use of data. [6] Ubiquitous computing is the new buzz-word, and will affect all aspects of data capture and use. However, in true ubiquity, the technology must become transparent. We are moving into a post-data, post-technology environment, which will need a truly knowledge-based world and the information and knowledge systems to support care based in this paradigm. We already see many efforts towards the development of different forms of lifelong electronic health records, with the use of smart card technology, for example, to access health portals. While telemedicine and telehealth as concepts have been around for some years, as they develop further, their success might be best seen at the point-of-care level, rather than through any system wide or broader use.

Issue: The Future of Nursing

As already discussed, technology is important in healthcare; as we try to envision the future and its implications, then we will again need to ask what will be the new, changed role of the nurse. In the reality of many of the changes occurring within healthcare, much of the body of nursing knowledge and practice has been moving to be undertaken by non-nurses (e.g. medical support workers, health administrators, etc.), and this inevitably leads to a different future of nurses. We may even have to ask 'will there always be nurses?' The nurse's role may not, in the future, be bound by geographic 'walls', in particular if the nature of direct patient care changes from data driven to knowledge based. This will necessitate a re-examination of the nursing/education/practice perspective, and possibly a move into the true application of informatics principles (above and beyond a focus on how to use data/information for care).

However their role changes and we know from history that it will change, nurses are important as caregivers in most if not all cases, and nurses are the 'glue' holding together care and technology. However, there is concern about the education of nurses, and the lack of use of their potential and flexibility; we are not educating nursing students to take account of changing care and technology, and without the inclusion of these issues in curricula, there is no potential for the use of emerging technologies. Technology will need to be integrated into education, but without maintaining old silo-based approaches. While informatics is not necessarily new – Florence Nightingale is now recognized by many as the first nurse informatician [7] – informatics and information technology have the capability for being the stethoscope of the 21st century approach to care, in terms of its radical effect on care processes and its vital importance to delivering care.

One currently under-recognized and under-appreciated aspect of emerging healthcare is the role of genomics; the personal genome will increasingly become an integral part of care and the care record. As a result of this, we can envisage nursing actually being faced with the totally customized patient care that the rhetoric says they have so long craved We will have not just the psycho-social aspects of care to add to the physical, but also genetically-driven customized care, with all the information and education implications that arise.

Among the ways in which the role of the nurse may change are moves towards patient-centricity of care, with more emphasis on communication and collaboration (among nurses and other healthcare workers, and between healthcare professionals and patients), which will act as enablers for nurses and caregivers, possibly leading to new roles. However, there will need to be educational changes to facilitate this happening; one current approach is the TIGER initiative – Technology Informatics Guiding Educational Reform – in the USA. [8] One aspect of genuine patient-centric care means a possible role for the nurse as 'infomediary' (someone who gathers and organizes large amounts of data and acts as an intermediary between those who supply the information and those who want that information).

Beginning to Crystallize Ideas

After the initial ideas from each group had been presented in plenary session to all the participants, the individual groups spent time in discussing and refining the implications of their own ideas, and what they had heard from other groups. Over two days, a series of group discussions, followed by plenary feedback and discussion of emerging ideas, took place, with each group beginning to focus on particular topic areas that seemed to crystallize from their deliberations.

Many of the issues raised in initial discussion remained under consideration throughout the remainder of the NI2006 Post Congress Conference and, as will be seen in the group papers, were highlighted as important in the final reports of each group. In the closing plenary discussions, each group presented the ideas they had come to, and that were expected to form the basis of their final group reports. Rather than present each of these in turn, as many of the issues remained throughout the discussions, and were not discarded as less important, then there is a risk of too much repetition if the interim outputs and then the final outputs are described separately. The next sections will therefore weave together elements from the latter part of the NI2006 Post Congress Conference, and again will bring together ideas that were generated across several of the groups where there was a common consideration of an issue. For example, the changing nature of healthcare and possible new models of care delivery, with the impact on the role of the nurse provided a set of issues that were discussed in several groups. The impact of the Internet-aware healthcare 'consumer' was another issue that arose in more than one group, as did the need for nursing to address the emerging educational needs implicit in many of the changes that we might see. Naturally, the future role of the nurse featured strongly in many discussions.

Issue: Towards u-Nursing

The concept of u-nursing emerged strongly within several groups (i.e. ubiquitous, or ever-present), deriving from the concepts of ubiquitous computing and 'u-Korea' discussed by Prof. Unna Huh in her opening keynote at the NI2006 Congress. U-nursing is defined as the provision of nursing for anyone or any organization, any time, anywhere, through any networks. It has implications for defining groups or paradigms (new consumers, services, technologies, roles for nurses), and has implications on the uses of technologies across the health-illness spectrum, possibly with the intensity of technology use and interventions increasing from call center types of health information provision to more specialized sites, including hospitals. A brief SWOT analysis of u-nursing identified strengths as including interoperability, mobility, portability, while weaknesses include lack of control of technology development and computer/technology literacy, with opportunities focused around the emergence and development of new nursing/professional roles. There will also need to be

a bold transformation of education for nursing, otherwise it is feared that nursing and nurses will not be able to use informatics.

In a u-health care system, with an interaction of consumers, traditional health care facilities, and perhaps a new u-health center, healthcare can be customized for individual needs (the infrastructure and technologies are already in place for this). In, for example, a smart home model, with messages/alerts going to a u-nurse as necessary, body sensor networks may possibly interact with systems for decision-support. We have to learn from the past; the drivers of healthcare change are likely to be industry/business, and nurses will have choices of what to go into; technology is not going to wipe out nurses.

Issue: The Changing Nature of Healthcare and Role of the Nurse

Nursing myths and the exact nature of nursing are perennial issues that it is nevertheless important to address in the context of change. There are often blurred boundaries to the profession and the subservient nature of nursing to other health professions has not changed in many parts of the world. Nursing can still be invisible in healthcare in some places. The degree of influence that nurses have in reality in healthcare systems remains debatable and variable in different countries, and a need for change at higher political levels is recognized, although there are often legal and political barriers and challenges, and policy initiatives that impact healthcare; politics is often about money, and in many countries nurses are an expensive resource.

In most countries, the boundaries of clinical and nursing practice are defined by legislation, but nurses often don't know what they can and cannot do, and many nursing communities do not have strong leadership. The scope of the nurse today still largely falls under activities of living and physicians' orders, and it may be that we need to draw a line in the sand here for this group of health workers, stop fighting the fight over 'a nurse is a nurse is a nurse', and reinvent the name and the nurse.

It was suggested that desirable outcomes and benefits realization need to be addressed: health policy may need to be focused to achieve healthy populations and sustainable health systems, with a consequent need to monitor the impact of decisions on health status. Part of this change will be in focus, from ill health to reducing demand for services, with consequent emphasis on issues of health promotion, the availability of consumer empowerment and optimal use of nursing practice. In order to support the delivery of such changes, there will need to be integration of ICT (information and communications technologies) to underpin nursing, including education and practice.

Issue: The Nurse as Knowledge Professional, and the Changing Educational Need

What is likely to be needed, some suggest, is a new group as knowledge-intensive professionals, educated to degree level and above, skilled in the as-

similation of information into knowledge, and with high level critical thinking skills. The importance of knowledge acquisition and use, knowledge modeling, and putting knowledge into the hands of nurses will continue to grow. In order to support these changes, there will be need to be increasing transparency (invisibility) of technology, with the emergence of intelligent agents to deal with the issues of data overload as data mountains are produced every second in healthcare environments. We will need to address questions of data display and selection and pre-processing of data if we are not to be overwhelmed. Technologies and techniques will need to be developed to grow information out of data in real time, so as to improve care quality, and reduce medical errors. Many current healthcare information systems are generally not designed for human use, and if we continue to not understand the human uses, the systems developed will be worthless; goals are therefore needed around information infrastructure and human-centered design.

A second set of issues coheres around knowledge acquisition and use/ modeling. The aim should be to put knowledge into the hands of nurses, who are often eager and enthusiastic to practice, but lack supporting knowledge frameworks, so access to knowledge at point of care is essential. There is a need for democratization of information, including making nursing information public. We also need to know not only what is significant and what the evidence base shows works and is good care, but what does not work, or has not been demonstrated strongly – perhaps a 'Journal of Nursing Insignificance'. Issues of professionalism within healthcare continue to be important, and of the need for nursing, if it is the largest part of the health workforce, to move into new roles. There still remains, however, uncertainty as to what 'professional' really is in healthcare, and whether the older model of nurse 'technician' might or might not fit into this.

The nature of the relationship between nurse and patient if care is delivered via remote connectivity needs to be addressed, in particular how to keep this sort of relationship alive. Initiatives such as the US "TIGER" initiative, which envisages bold transformation of nursing education, may help to address the issues. Education will be necessary to help enable many nurses to move into these new niches; globally-delivered e-learning might offer formal education opportunities to assist in moving into these new niches.

Issue: Towards 'Patient Informatics'

'Patient informatics' may need to be the new superclass into which the other informatics domains (nursing, health, medical) should fall, if we truly accept the patient as being the center of care and the rhetoric of patient-centricity. This, however, leads to a need for definition of the term 'patient', which may be seen differently in different countries (e.g. some may see a more family or social unit based approach). True patient-centered health services have many other implications, including care being focused around patient values, not clinician values, and a shift from provider to patient driven care.

New, possibly commercial, models of care contracts may emerge, with the consumer as the driving force in hiring/firing their healthcare professionals, and with the power. They may be the ones making the decisions on when to engage, with individual professionals or organizations, and we may see emergence of quality report cards of healthcare providers/teams/organizations. Healthcare/medicine delivery patterns will change, and other possibilities we may see emerge are 'nurse/nursing in a box', or ATM models of service delivery.

Issue: Healthcare Models – US Hegemony or Simply Common Problems?

As group and plenary discussions continued, some discussion centered around whether the ideas that were emerging from the groups were essentially US-based, and addressing the needs of the American healthcare system, and whether a truly global picture was being considered. In a discussion forum where 30% of the participants were American, this may not be surprising, although this lead to consideration of whether the issues emerging from the US system and the possible solutions there were applicable to other countries' healthcare systems.

While many changes in society are likely, or can be discussed in scenarios, we know that there are several clear certainties that will necessitate exploration of the health challenges, nursing challenges, and informatics challenges they will present. Perhaps primary among these is the global aging population, and in particular the implications of care needed in increasing levels of dementia and frailty. In addition, the changes in dependency ratio (number of younger, working age people to support older populations), changes in family structures and processes, and decreased infant and child mortality will have implications for policy and healthcare delivery. Increasing globalization, mobility and educational changes, coupled with increasing global industrialization, need to be addressed alongside advances in science and technology, particularly ICT.

Discussion of the issues recognized the need to explore the economics of these new types of system (for example, with respect to technologies and availability), and work on this is only beginning. In some countries, e.g. Korea, the emergence of similar types of technology-supported home and community-based care can be seen. Such changes to healthcare delivery will have implications for the education of this future home care nurse, and will raise ethical issues, such as where the line lies between monitoring and surveillance when such technologies are embedded in the home.

Issue: The Netizen's Demands on Healthcare

We have, for several years, been seeing the gradual emergence of the 'educated consumer', demanding choice, and becoming an increasingly 'global' consumer, through accessing information from anywhere on the Internet. This is

already being seen in many other countries, for examples with the emergence of 'netizens' in South Korea. It was suggested by some that this model might not work in countries such as China, India, Malaysia, or Africa, for a variety of reasons. Whatever the healthcare model in a given country, because of higher expectations by consumers, many will 'purchase' health care as a commodity, perhaps increasingly based on providers' quality report cards. It was recognized that, in all countries, irrespective of their healthcare or political systems, money and outcomes are crucial issues and drivers in considering the future of health care; individuals, institutions and organizations are increasingly likely to be evaluated on outcomes, but the question has to be asked 'what is the outcome, and who determines it?'

Issue: Genomics Will Not Go Away

Genomics is a major issue that has little presence in the nursing literature currently, but the importance/power cannot be underestimated. The genome 'is what it is', i.e cannot be refuted in the same way as other elements of knowledge can, and so the consequences of this will need consideration. This will include the role of insurer awareness, who will pay for treatments and care, and what will be role of the nurse and of nursing. Much technology currently gets in the way of care, and there is a need for increasingly transparent technology, which will need to function in the background; if you talk about the technology, it is not transparent.

Issue: Maintaining an Ethical Stance with Changing Values

Issues of ethics and values featured strongly. While patient-centered choice was seen to be paramount over professional choice, many issues arise, which may vary between cultures and societies, of who really has or makes the choice. The ethics of care for self-induced health problems, and the societal approach raised many issues that could not be answered, but along with this were ethical issues of the appropriate/inappropriate use of information. In many countries, privacy issues are mainly rooted in paper-based record systems, and different issues may arise via electronic/digital systems, which again may necessitate different solutions in different societies which have differing approaches to social versus personal value sets.

Concluding Remarks

In describing the format of the NI2006 Post Congress Conference discussion and some of the content as it emerged and evolved, we have sought to avoid an overly mechanistic description and excessive repetition. It is evident, looking back from the closing stages of the NI2006 Post Congress Conference to the

initial ideas that were introduced, that there were many issues in common among the groups. Many participants shared concerns and similar issues were identified from a diverse range of countries and health systems. In the next section of these Proceedings, the papers developed by each of the five working groups are presented.

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Technology Developments Applied to Healthcare/Nursing

Karl ØYRI (Norway), Susan NEWBOLD (USA),
Hyeoun-Ae PARK (Korea), Michelle HONEY (New Zealand),
Amy COENEN (USA), Anneli ENSIO (Finland) and Elvio JESUS (Portugal)

Abstract. Future technology developments as applied to healthcare and particularly nursing were discussed. Emerging technologies such as genetics, small unobtrusive monitoring devices, use of information and communication technologies are as tools to not only facilitate but also promote communication among all parties of the healthcare process. These emerging technologies can be used for ubiquitous healthcare (u-health). The role of nursing in the u-health is fundamental and required for success and growth. Nursing's role will evolve as nurses become 'information-mediators' in a broader-sense than current role. All technologies will ultimately focus on the consumer through 'behind-the-scenes' data collection, which in turn will also allow nurses to analyze these data to improve care. We need to acknowledge an increased presence and or pervasiveness of information technologies as key components of quality healthcare. This sort of acknowledgment will help propel nursing, and healthcare, to increase use of these tools. To develop nurses with these types of skills the nursing education process will require a fundamental change to integrate these technology-sorts of tools as necessary elements for success.

Keywords. Nursing informatics, future, nurse role, emerging technology, u-health

Introduction

Our international group – consisting of nurse leaders in informatics from Norway, USA, New Zealand, Finland, Portugal, and Korea – of International Medical Informatics Association – Nursing Informatics Special Interest Group (IMIA-NI SIG), was charged with examining the potential trends in health informatics focusing on technology and healthcare for the future at the Post Congress of NI 2006 (Ninth International Congress on Nursing Informatics). The continuing rapid developments in technology and the myriad of resulting possibilities prompted the IMIA-NI SIG to look forward to 2020. This report presents a summary of the group 1 discussions and conclusions. The focus was on emerging and future technologies and how these technologies could be utilized to provide healthcare in the future. Technology use will become ubiquitous,

being everywhere and part of everyday life. The changes in technology by 2020 will impact significantly on nursing practice, education, and research. A definition of ubiquitous nursing (U-nursing) is provided, along with discussion of several of the issues and challenges for nurses, the consumers of healthcare services, and the health services themselves, and the place of technology within healthcare.

Background

The Post Congress of NI 2006 was held in Pyung-Chang, Kangwon-do, Korea, in June 2006. The objectives of this meeting were to bring nursing informatics experts from different parts of the world together in a collaborative attempt to define the future nature and scope of nursing informatics.

This paper represents the report from a group charged to consider technology developments applied to healthcare and nursing. Using an analysis of major trends that are already emerging and possible developments over the next 15 years, the group explored technology developments in a broad sense. Here the technology developments are identified and discussed, along with their implications for healthcare and nursing, and the associated opportunities for strategic planning and research.

Technology Developments Applied to Healthcare and Nursing

The group discussed technology developments that will influence nursing services for direct and indirect patient care, disease prevention, and health promotion in both formal care settings and outside the hospital system. These developments included remote (e.g., wireless) monitoring, ubiquitous access to computer networks, lifelong electronic health records, wearable monitoring and treatment devices, and treatment-based genetics medicine. The group addressed questions such as: What effects will these technologies have on the practice of nursing and on nursing informatics? And what implications will they have for nursing education and training, and for organizations, providers, and patients?

Emerging Technologies

Emerging technologies do not automatically directly influence nursing and nursing informatics, but instead have a potential impact on future healthcare and nursing informatics. All healthcare professions now rely on advances in biomedicine and technology that influence the use of informatics in healthcare and nursing. Advances in some professional domains in turn influence other overlapping professions and domains, resulting in opportunities to leverage the

potential progress and development in healthcare informatics, and consequently nursing informatics.

Continuing advances in technologies will influence healthcare and nursing informatics, including advances in genomics, micro electromechanical systems (MEMS) and nanotechnology, wireless radio standards, information and communication technology (ICT), minimally invasive technology, and sensor technology.

1. Genomics

Recent knowledge advancements in genomics have led to a new understanding of genotypes and phenotypes. The methodology used to advance symptom treatment and the goal-oriented therapies to minimize consequences of disease are undergoing change. A new treatment paradigm with the objective of preventing disease before it occurs is based on screening the genetic makeup of population groups by identifying the genotypes and phenotypes of individuals. This will result in a shift to the prescription of therapy and medication based on the genetic makeup of an individual instead of assumptions based on results from similar groups of diseased individuals. This should reduce the occurrence of adverse events from medications and therapies since they will be better tailored to the individual's specific needs [1].

2. MEMS and Nanotechnology

MEMS and nanotechnology allows the dramatic downsizing of biomedical devices and machines. This can facilitate organ-specific parenchyma monitoring, replacing the current indirect monitoring of global parameters (e.g., blood pressure). Technological progress in this area presents the opportunity for introducing new types of biomedical sensors and biosensors. The functional elements of biomedical sensors are divided into four areas: sensors, computational processing units, communication devices, and batteries. All of these elements are undergoing rapid improvements, including reductions in size, which increases the opportunities for their use in clinical applications.

Nanotechnology opens the possibility of developing biomedical devices the size of molecules. This type of technology is still in the development stage, although research on nanotechnology in healthcare-related applications is expanding worldwide. Many risks related to the use of this technology have been identified, but overcoming them will increase the potential for the application of nanotechnology in healthcare [2].

3. Wireless Radio Standards

Wireless networks are based on radio communications at various frequencies. This technology has expanded the use of laptops, tablet computers, and tele-

phones in real-time worldwide communications. Improvements in processor computational power and storage size in personal digital assistants (PDA) and mobile telephones advance their potential applications as medical digital assistants (MDSs) in various clinical settings. Wireless network technologies include wireless local area networks (WLANs), Bluetooth, ZigBee, and radio-frequency identification (RFID) [3].

3.1. WLANs

WLANs operate at open radio frequencies around 2.4 GHz, and have industrial, science, and medical (ISM) uses. WLANs replace the need for physical connections between computers in zones defined by the capacity of the wireless signal routers. However, complex wireless infrastructures covering large areas such as hospitals are commercially available for clinical applications in a variety of fields, including nursing.

3.2. Bluetooth

Bluetooth is a wireless radio standard that also operates in the 2.4 GHz ISM band. Bluetooth was developed to replace wires between close-range electronic devices. Research performed on the implementation of Bluetooth in biomedical devices in clinical settings has produced positive results [4]. Bluetooth allows up to eight wireless devices to operate safely in an uninterruptible ad-hoc network. The cost of Bluetooth is relatively low due to its widespread use, although it has limitations related to power consumption and battery capacity.

3.3. ZigBee

Another wireless radio standard in the 2.4 GHz ISM band is ZigBee, which costs approximately one-tenth of Bluetooth and has a much lower power consumption. In theory ZigBee can handle up to 256 wireless sensors in one network. Moreover, sensors can operate in a "sleeping mode", waking up to full operation when variables vary from predefined values [5].

3.4. RFID

RFID is another emerging technology with potential uses within healthcare. RFID tags can be placed on biomedical devices, equipment, and medications to keep track of their locations, expiry dates, and replenishment needs [6]. Wireless sensor networks allow large numbers of tiny wireless sensors to communicate in a network. Some claim that the impact of such networks over the next 10 years will be comparable to the impact of the Internet in the 1990s.

4. Information and Communication Technology

Both ICT hardware and software are improving. Computational power continues to increase, and the user-friendliness of human interfaces has improved in a wide variety of software applications due to improvements in their graphical and intuitive features. Combined with progress in wireless technologies, this will lead to new application areas for these technologies as they become increasingly potent, portable, and cheaper.

The Internet has had a major impact over the last 10 years on knowledge distribution within healthcare. This development has been largely driven by governmental institutions, universities, hospitals, and healthcare education providers. The second-generation Internet applications (Web 2.0) [7,8] are changing the traditional ways of communication between humans by reducing physical borders and by facilitating new ways of interaction and the availability of resources, such as newer collaborative Web-based server software applications accessed by browser clients, and blogs, wikis, and forums with content linked to relational databases for dynamic content retrieval [9]. Vendors have been working for decades to develop fully functional electronic patient records (EPRs) for replacing paper-based systems, but many of the current EPR systems are not still fulfilling the needs of clinicians. An important step towards replacing paper-based systems is improving the interoperability between hospital-wide applications, which has been hindered the use of proprietary software applications and the lack of international standards. The availability of structured health data improves interoperability between ICT systems, but the widespread integration of all applications is still a long way off in most hospitals. Hospitals and healthcare institutions are complex organizations, and there are no easy methods for digitizing all their clinical data. The process of information generation is based on data entry, interpretations of these data, and generating knowledge from the data so as to provide the information needed to support clinical decisions.

5. Minimally Invasive Treatment

Over the last 15 years percutaneous coronary interventions (PCI) have been performed on up to 70% of angina pectoris patients as an alternative to open heart surgery. Several procedures can be treated with catheter-based, image-guided radiological, and MRI-guided interventions, thereby reducing the treatment trauma imposed on patients relative to traditional open surgery. Videoscopic, minimally invasive procedures have been introduced in thoracic, orthopedic, gynecologic, and abdominal surgery to replace the traditional open surgery performed with much larger and more traumatizing incisions.

The use of videoscopic procedures not only reduces the length of the actual procedure, but also reduces the level of postoperative levels of pain and dis-

comfort, leading to more rapid mobilization and a shorter hospital stay for large groups of patients undergoing keyhole surgical procedures [10].

6. Sensor Technology

Sensors used in medical applications can be categorized into several groups. The first are biosensors containing biological materials such as enzymes or antibodies used in devices for detecting analyzed substances, which combines a biological component with a physicochemical detector component (see http:// en.wikipedia.org/wiki/Biosensor). The development of biosensors for monitoring blood glucose is a growing field fueled by market demand and new areas of application thanks to the implementation of MEMS and nanotechnology.

The second group comprises biomedical sensors designed to measure physiological variables in the body, such as mercury/water-pressure sensors, piezoelectric and piezoresistive sensors, capacitance sensors, and optical sensors for use in near-infrared spectroscopy (NIRS) [11]. NIRS is a relatively new noninvasive optical technique for measuring hemodynamic responses. Biosensors and biomedical sensors have been used for decades for invasive or noninvasive measurements when attached to patients at the point of care, defined as the immediate surroundings of the patient's bed. Point-of-care data are used for patient assessment and decision support. The arterial and venous blood pressures, intracranial pressure, urine bladder pressure, body temperatures, and noninvasive variables such as the ECG and respiratory rate are continuously monitored in critically ill patients to facilitate optimal titration of therapy. Indirect measurements for determining organ-specific functions such as cardiac output or peripheral systemic vascular resistance are obtained using algorithms.

New sensors are smaller, less invasive, and provide data of a higher quality with a higher resolution. Another trend in sensor development is making direct, organ-specific measurements of early markers of severe ischemia and severe disease in vital organs, to replace indirect global parameters. Moreover, multiple sensors can be used to provide the most accurate description of the status of a severely ill patient. A spin-off from this development is the availability of new, high-resolution, and noninvasive sensors for use in home-care settings.

A distinction must be made between the following two major trends or areas in the development of sensors to secure the wellness of an individual: (i) personal biomedical sensors or biosensors attached to the patient or user, and (ii) sensors implemented in the surroundings of the patient or user (e.g., smart house). These two approaches represent very different conceptual and philosophical ways of developing sensors. The new and rapidly growing arena of sensor implementations is in patient homes. Sensors are less intrusive in the home environment when they are mounted in furniture, rooms, and architectural structures, or on other devices in everyday use by the patient. This use of sensors is growing due to market dynamics and potential commercial advantages. Such generic sensors are becoming miniaturized and increasingly inter-

operable with ICTs and wireless sensor networks. The cost of generic sensors for detecting temperature, movement, and pressure is decreasing due to increasing production volumes. When implemented in homes, such sensors can be used for the surveillance of people at risk and for the detection of activities with potential health risks.

The third area of sensor implementation is combining biomedical sensors and biosensors attached to the patient with sensors placed in the surroundings of the patient so as to facilitate optimal monitoring of the patient's health. Combining personal and individual environment sensors might yield the optimal benefits from technologies currently emerging in this field.

Use of Emerging Technologies in Healthcare

1. Health and Wellness Management

Genomics can be applied to prevent a disease in a predisposed individual based on their genetic makeup. Knowledge based on the individual's genotype (genetic makeup) and phenotype (the genetic interaction with the environment) can be used to determine the most appropriate interventions. This implies a shift away from treating symptoms related to disease, which is where the major resources of healthcare are allocated today, towards efforts aimed at preventing disease even before it occurs. Scanning of families identified as predisposed to various forms of chronic syndromes or diseases, or even scanning all individuals to identify their health profiles and risk for chronic disease, opens the possibility of completely new types of healthcare services. This shift of focus from ill patients to healthy people will result in changes in the organization of healthcare as well as to the professional roles in healthcare.

Another example of emerging technology use is the use of step counters with advanced software to provide feedback on energy consumption (e.g., calories), physical parameters progress, and the location or planning of future training activities to improve health. Future versions of such gadgets might include extension to monitoring variables aimed at preserving or even improving the health of consumers. This type of gadget can be utilized not only during physical exercise, but also in daily activities at home, school, and work. An infrastructure in various daily-life settings that facilitates the interoperability with wireless networks will allow the provision of new types of sophisticated healthcare services.

2. U-healthcare System

Unna Huh, president of the Information and Communications University, Korea, reported on the arrival of ubiquitous life (U-life), referring to Mark Weiser from Xerox during her keynote presentation at NI 2006. Weiser defined U-life
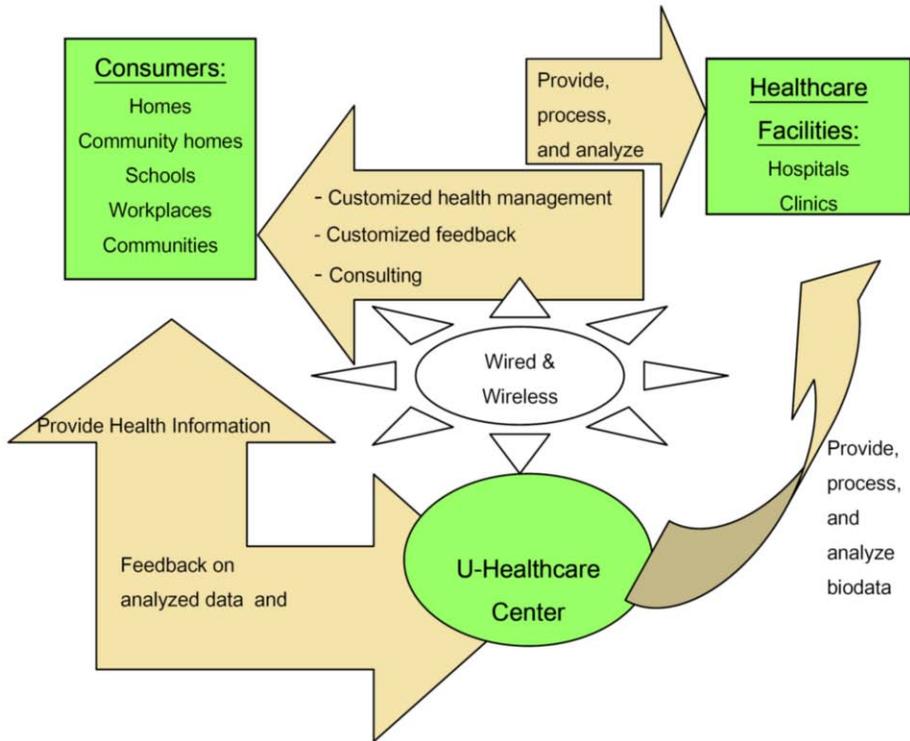
Figure 1. U-healthcare System (modified from Park et al., 2006).

in 1988 as where "anyone or any organizations can utilize an on-line networked computing environment any time, anywhere, through any networks and any devices". Extended use of ubiquitous computing for the wellness of consumers is dependent on planning and creating new business models by several global commercial organizations and industries within telecommunication, ICT, and insurance and governmental organizations at the local, regional, national, and international levels.

The IMIA-NI SIG came up with the model for describing a U-healthcare system illustrated in Fig. 1 based on the work of Park et al. [12]. The system consists of three components: the consumers, the U-healthcare center, and the healthcare facilities. A healthy person can live in a U-healthcare environment at home, at school, in the community, or at work according to where sensors monitor health-related data. Personal health information variables and data are transmitted to the U-healthcare center via the wired or wireless network infrastructure. The data are analyzed, processed, compared with the optimal profile of the individual, and stored at the U-healthcare center, which provides feedback to the individual based on the monitored data. If adverse events occur or symptoms of illness are detected, the consumer is contacted by employees of the U-healthcare center and assisted with correcting any problems. These em-

ployees are healthcare professionals (e.g., nurses) who are trained to assess and develop clinical pathways and individual care plans for consumers. If a consumer turns out to be unable to correct or comply with correctional activities related to illness symptoms, the U-healthcare center refers him or her to a healthcare facility, which can be a hospital, clinic, or other healthcare environment. When the healthcare facility discharges the consumer to their home setting, the individual's data can be monitored by the U-healthcare center until the condition has stabilized. The U-healthcare system thereby provides a closed loop of surveillance, supervision, and treatment, covering consumer needs related to the maintenance of wellness and health.

Scenarios for the Use of Emerging Technology

1. Scenario for Wellness Management at Home

Advances in ubiquitous computing and communication technology have enabled ubiquitous health monitoring at home. Here we consider a scenario involving health monitoring in a smart house that contains a smart toilet, kitchen, living room, and three bedrooms with different sensors measuring biomedical signals, activities, and environmental parameters in Seoul, Korea [13]. In the bedroom, ECG signals, body weight, body movement, and snoring can be measured using sensors in the bed. Activity is monitored using a magnetic switch attached to a door. Communication (via TV and entertainment centers) involving access to the personal EPR is used to establish and evaluate personal health goals. An exercise machine monitors vital signs and communicates with the EPR. RFID tags in the refrigerator are used to monitor the diet, provide nutrition recommendations, and indicate when food supplies need to be replenished. Several environmental parameters such as temperature, humidity, noise, and illumination are monitored continuously.

Unobtrusive health monitoring was possible in this smart house due to the use of a wireless communication infrastructure. A Bluetooth network is used to transfer data from the sensor to the Bluetooth access point, and a WLAN is used from the Bluetooth server to the home server. The WLAN comprises a PDA in each bedroom. In order to monitor several signals automatically and unobtrusively, the sampling rate and duration of measurement is set for each sensor using monitoring software. The ubiquitous-house project team intends in the future to add other sensors to measure body fat measurement, infrared sensors for movement detection, and humidity sensors.

2. Scenario for Illness Care at Home

One of the most promising visions of ubiquitous computing in healthcare is the unobtrusive at-home surveillance of patients with severe chronic disease, reducing the need for face-to-face medical visits or hospitalization. Here we con-

sider a scenario involving a patient with a severe chronic health problem – chronic obstructive pulmonary disease [14]. After the patient is discharged from an acute-care facility, he/she remains under continuous monitoring at home. Telemonitoring pulse oximeters are installed near the bed of the patient, who is instructed to place the oximeter sensor clip on one finger before going to sleep. Arterial oxygen saturation and heart rate are measured twice weekly, and the data are automatically transmitted early in the morning to the hospital's processing center via a normal telephone line, and stored in the patient database. On the same morning, a respiratory physician analyzes the transmitted data using software supplied by the manufacturer, and then telephones the patient to discuss symptoms and changes in prescriptions.

3. Scenario for Ambulatory Care at Hospital

Here we consider a scenario involving a patient visiting the ambulatory-care unit of a ubiquitous hospital (U-hospital). When the patient visits his doctor for hypertension management, he checks in by inserting his RFID card into an information kiosk in the hospital lobby, which provides directions to his doctor's office. When he enters doctor's office for his appointment, the doctor is ready with the patient's electronic medical record on his screen. The doctor examines the patient, orders some laboratory tests, and prescribes medications. Comments concerning possible interactions of a new prescription with an existing one together with some recommendations for an alternative are presented immediately on the screen. The patient exits the doctor's office and inserts his card again into one of kiosks, where he pays for his laboratory tests and medication orders, and makes an appointment for his next visit. He can transmit his medication order to a nearby pharmacist. The kiosk then directs him on where to go for his laboratory tests, and prints a prescription slip and appointment slip. After his test, he can go to a pharmacist, pick up his medication, and go home.

4. Scenario for Inpatient Care at Hospital

Here we consider a scenario involving a patient in a U-hospital. A patient suffering from angina pectoris admitted for a PCI. The patient is waiting for procedure to be performed. A personal-area-network gadget containing sensors is attached to the upper left arm, including an RFID tag for localization. Data from NIRS for monitoring blood glucose, peripheral arterial oxygen saturation and carbon dioxide, pH, electrolytes, ECG, BP, and peripheral temperature obtained ccontinuously from sensors are entered into the EPR. Appropriate data are extracted for decision support and reporting adverse events. A duty cardiologist (who is occupied with another patient) monitors the patient using a wireless MDS, obtaining his or her preferred information (requiring login with an authorization system based on biometrics).
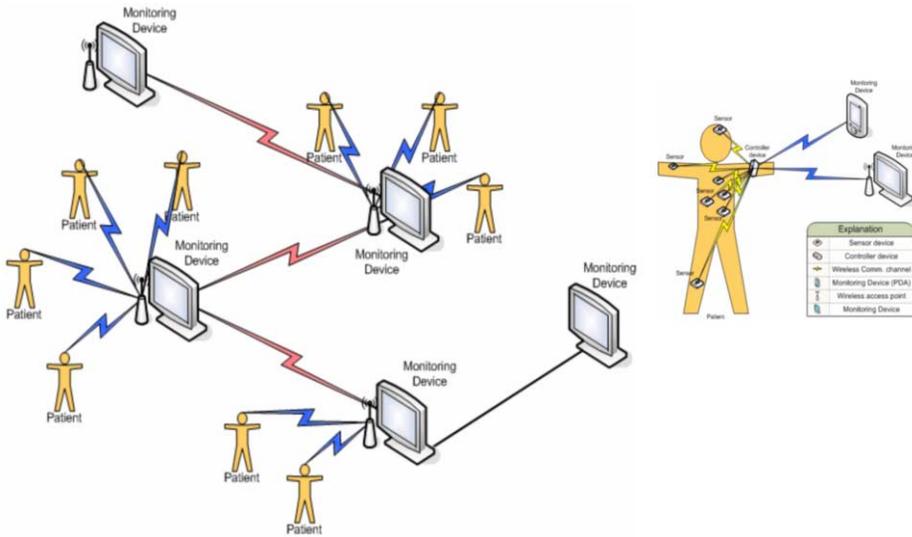
Figure 2. Wireless network infrastructure with sensor devices, controller devices, wireless communication channels, wireless access points, and monitoring devices [15].

Automatic medication, fluid, electrolyte administration (and other …) based on phenotype, genotype, laboratory and other data. All patients in the clinical care facility are monitored using infrastructure based on a wireless sensor network (see Fig. 2).

5. Scenario for Care at a U-healthcare Center

Finally, we consider a scenario involving a patient receiving care from a U-healthcare center. A patient with diabetes is discharged from a clinical care facility after bypass surgery. He lives in a smart house and wears a wristwatch gadget that has NIRS sensors for monitoring blood glucose, peripheral arterial oxygen saturation and carbon dioxide, pH, electrolytes, ECG, BP, and peripheral temperature. Sensors in chest and leg dressings can send message to the U-healthcare center when they need to be changed. An RFID-based medication cabinet monitors the use of prescribed medication and replenishment needs. The daily exercise program and diet is scheduled by a nurse at the U-healthcare center, and teleconferencing can be provided when necessary. Motion detectors that detect falls or the absence of movement will signal the U-healthcare center. The patient can participate in a chronic disease support/education group.

Sensor data transmitted to the U-healthcare center are processed, and any values outside the range are returned to the consumer with correctional suggestions. A communication system (voice-activated videophone) is also provided between the home and U-healthcare center.

Impact of Emerging Technologies on Nursing

1. U-nursing

As stated in Section 1, it is difficult to directly relate the general development of new technologies to progress in nursing and nursing informatics. Instead of new and emerging technologies directly bringing about change, they may influence other domains with their implementations resulting in novel areas of potential development.

Traditionally nurses are crucial to communications with the patient, by arranging the process of care and scheduling treatment from other professionals. Many nurses already use advanced ICT applications, but expanding their use could result in a variety of new outcomes in nursing. A major change has taken place within informatics related to communication, such as involving the Internet and e-mail. The wider use of EPRs and other hospital-wide applications has made nursing documentation even more important for describing the nurse's contribution to patient care, not only to other nurses but also to other healthcare professionals involved in patient treatment.

The group has proposed the following definition of U-nursing: "The provision of nursing for anyone or any organization, anytime, anywhere, through any networks and any devices". The results of an analysis of the possible strengths, weaknesses, opportunities, and threats (SWOT analysis) of U-nursing by the group are presented in Table 1.

The SWOT analysis identified many issues and challenges, and indicates the possible far-reaching consequences of U-nursing. Most significantly, we predict major changes to the traditional roles of nurses, patients, health services, and the place of technology within the healthcare system.

The nurse of the future will play a key role as an information mediator to facilitate the use of technology by consumers. The group has focused on the nurses' role and the education needed to develop the required knowledge and skills. It is recognized that current nursing education will not adequately prepare nurses for the envisioned future. Patients will be redefined as consumers, users, and partners in healthcare. The group agreed that the focus should be on consumers rather than on the technology, with consumers and health priorities driving technology developments. International trends of increasingly aged populations and increasing prevalence of chronic diseases mean that the consumers of the future will be older and more likely to have chronic diseases such as diabetes. Health services will be needed to support these consumers. However, an additional important focus will be on health promotion and maintenance to reduce the burden on the health services. Education and technology support provided to healthy consumers will focus on wellness, examples of which are described in Section, Scenario for Wellness Management at Home. In summary, we suggest that U-nursing will occur within an environment of new consumers, new services, new technologies, and a new understanding of nursing.

Table 1. SWOT analysis of U-nursing

STRENGTHS	WEAKNESSES
- Interoperability - Mobility - Portability - Availability of U-technologies - Secure infrastructure - Inclusive - Accessibility of information to consumers and providers of services - Globalization - Facilitate self-care - Customized/personalized care - Increased autonomy of consumers and nurses - Supports advancement of telehealth/telenursing - Provision of e-learning resources - User-friendly - Open source - International standards	- Lack of control of technology developments - Lack of technological literacy - Lag of educational preparation - Conservative attitudes and work processes in nursing and healthcare environments - Technology-driven - High setup costs - Limited human resources - Lack of standards - Time-consuming - Lack of reimbursement and backup infrastructure
OPPORTUNITIES	THREATS
- New nursing/professional roles - New roles for consumers - Consumer-driven services and technological advances - Improved decision support - Improved collaborations/partnerships - multidisciplinary - between providers and consumers - between nurses - across the continuum of care - New educational paradigms - Shift from disease management to health promotion and disease prevention - Facilitates middleware development - Humanization - Holistic - Facilitates research - Generation of nursing knowledge - Consumer-oriented care across the continuum - Public health surveillance facilitates collection and accuracy of data - Easy dissemination of information - Nurses promoting technology developments	- Poor affordability increasing the digital divide - Viruses and system breakdowns - Loss of privacy - Potential for misuse of information - Socioeconomic status of nurses - Leadership void in nursing - Lack of succession planning - Globalization - Dehumanization - Isolation - Dependency on technology - Intellectual property - Proprietary solutions - Cultural adaptation

2. New Nursing Services

The need for new nursing services is illustrated in Section 3, as exemplified by the U-healthcare system illustrated in Fig. 1. Nurses will be involved in all aspects of the U-healthcare system. The U-nurses will be health professionals running the U-healthcare center, whose role is to care for both healthy and ill consumers living at home. The U-healthcare center represents the linkage between clinical care facilities and consumers. Consumers discharged from a clinical care facility will be followed up by a U-healthcare center. U-nurses will also be employed at clinical care facilities, as they are in current healthcare institutions.

There will be several major changes from the current situation, with a much stronger focus on the consumer. The autonomy and integrity of the consumer will change as the emerging technologies provide new ways of dealing with health and illness. The shift of focus from illness to wellness will be very significant. The application of genomics will emphasize health promotion and disease prevention. This development is still at an early stage, but might lead to a different panorama of chronic disease. Wellness and health management systems involving emerging technologies facilitate new methods of self-care. The management systems will provide direct decision support to consumers in different ways. With a U-healthcare system established at the individual consumer level, wellness and minor symptoms of disease and even chronic disease could be managed by self-care without direct involvement from healthcare professionals. In this setting U-nursing might occur at a supportive, advisory level, more like wellness or illness coaching. Traditionally nurses are information mediators in healthcare, and such as role will not be unfamiliar to U-nurses. The differences relate to the use of technology-based systems for surveillance, observation, and data collection. ICT systems have the capability to act intelligently, in the sense that they can suggest interventions and provide decision support – especially when used with multiple data sets obtained from multiple biomedical sensors and other data sources, computers can provide high-quality clinical knowledge based on evidence-based analyses.

The market penetration, cost, ease of use, and general availability of communication tools have changed dramatically. Young and middle-aged people already have the required computer literacy and are familiar with these technologies, and distance and geographical borders no longer represent major limitations. Moreover, nurses already have professional platforms for handling patient information related to disease prevention and on how to cope with disease and its consequences. A major future challenge for the nursing profession is their involvement in the development of the new types of complex ICT-based services and infrastructures, whether funded by commercial entities or governments.

A fundamental role of nursing is caring for infants and the sick, weak, and old who are not able to secure their basic needs due to impaired or temporary

altered ability for self-care, and this will not change in the U-healthcare system. The manual, physical work associated with preparing, assisting, and compensating for impaired functioning in patients will remain an important component of the care provided.

3. New Nurses

Improvements in ICT and working at U-healthcare centers will require nurses to acquire new skills and knowledge. Indeed, emerging technologies represent a challenge for all healthcare professionals in terms of clinical practice, management, education, and research and development.

In many countries a major challenge in nursing education is recruiting sufficient students, due to the profession being perceived as an unattractive career choice. The theme of caring is not popular in young students when are choosing their studies. Nursing education has to promote why nursing is worth considering and pursuing, which can be aided by addressing the respect for the profession and the salary. Nurse educators are currently not eager to include ICT in their curricula, and there is even fear in the profession about the increasing influence of ICT. In contrast, many nurses are eagerly waiting for new technology solutions to enhance their capabilities. In the future, technology will be used in all healthcare settings (not only in critical care and operating rooms), and therefore all nurses will require technological skills. Nurse educators and expert nurses have a responsibility to help novice nurses to understand the role of ICT in nursing practice. Moreover, the use of ICT and medical technology in nursing practice might make nursing more attractive to students, given that currently nurses are currently restricted to learning how to manage information including evidence-based guidelines and how to apply this information in patient care in their workplaces.

Nurses in different care settings currently need different levels of technological skills, but in the future every nurse will need to be able to use ICT. Nurse managers will also need ICT skills to facilitate the optimal use of information produced by staff nurses. The systematic documentation of nursing activities using international standards is one way to increase the visibility of nursing. ICT will thereby support the work processes of nurses and adding value to nursing practice.

4. Need for Educational Change

The central requirements of nurses in the future are caring skills, nursing knowledge management, and skills to manage change and development[16]. Caring skills represent the core content of nursing, and there will be new emphasis on providing support for consumer self-care and promoting health; however, this aspect of nursing is unlikely to change radically. Nursing information and knowledge management – which covers technological skills and the use

and application of information – will be challenging in the future. The use of technical gadgets requires skills that can be learnt during practical work. The use of ICT must be closely and extensively integrated into the everyday practices of healthcare staff, since this supports the holistic care of patients. ICT will also be used to educate patients and in nursing documentation. Managing changes and developments also requires social and cooperation skills, with the relationship between consumers and nurses becoming more equal as consumers receive more comprehensive information.

Nurses searching for new evidence for use in professional decision-making or when answering consumer questions about information they obtain from the Internet will need to be computer literate. This involves a new role for nurses as facilitators of the use of ICT by consumers. The role of the patient will in future turn to the role of consumer who will be more active and have much more information and knowledge of diseases and related factors than today. Nurses will need more information and new skills when interacting with this type of consumer.

Conclusion

The group has speculated on how emerging and future technologies can be used to provide healthcare in the future. ICT will become ubiquitous in nursing, and the group has considered how developments in technology will affect the practice of nursing and nursing informatics. These developments may influence many aspects of healthcare, including in terms of genomics, MEMS, nanotechnology, wireless radio standards, ICT, minimally invasive technology, and sensor technology.

Emerging technologies will be used for both healthcare and wellness management. A model of a U-healthcare system has been developed that consists of the consumer, the U-healthcare center, and the healthcare facilities. Wellness will be the primary focus at both home and work, with healthcare services for those who are ill being provided at both home and in clinical care facilities.

U-nursing will focus on the provision of nursing for anyone or any organization, anytime, anywhere, through any networks and any devices. A SWOT analysis delineated many issues and challenges of using technologies to support nursing practice. The future role nurses will center on facilitating the use of technology by consumers and supporting information exchange. The need for new nursing services has been discussed with the accompanying need for changes to nursing education. Technology will drive healthcare and nursing, and in turn nursing has the opportunity to channel the technology to provide higher quality, evidence-based healthcare.

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Changes in Society at National and International Levels

June Clark (UK), Marion BALL (USA), Robyn CARR (New Zealand),
Connie DELANEY (USA), Sun-Mi LEE (Korea), Heimar MARIN (Brazil),
Virginia SABA (USA) and Satoku TSURU (Japan)

Abstract. Many societal changes will influence the future nature of nursing, nursing informatics and health. Among these are environmental changes, increasing globalization, industrialization of developing countries, and educational developments. The paper considers these issues, and in particular the 'bold transformation' of nurse education that will be necessary if the profession is to be able to deal with the future. The paper concludes with a series of recommended strategic changes.

Keywords. Nursing informatics, future, society, education

Introduction

Within this sub-theme, the group addressed societal changes that might impact on health, nursing and nursing informatics. As economies become global, making national boundaries invisible, the interface between these three subjects creates borderless practices. The key societal changes identified were demographic changes, globalization, changes in the environment, industrialization, developments in education, and advances in science and technology. Each of these headings contained subsets which were examined to identify the resulting health challenges, nursing challenges, and developments in informatics which might be directed at supporting and servicing these challenges. Throughout the investigation it was recognized that globalized change is in itself a given: the momentum varies across countries and in many cases it is driven by demands that are, in effect, non-controllable.

Demographic Changes

The demographic changes include an aging population, which produces change in the dependency ratio (the ratio of people who need care to the number of people available to provide care), population mobility, and changes in family structures and processes. The results of these changes are both positive and negative. On the one hand improvements in living standards (in most countries)

mean that people are enjoying longer lives and better health. On the other hand, increase in the number of the "very old" increases the demand for care. An aging population produces an increase in the prevalence of chronic disease, frailty, and dementia. At the same time the change in the dependency ratio reduces the availability of people to provide care: In many cases the "old" are the prime carers of the "very old."

Workforce shortages are paralleled by a reduction in the availability of informal carers, and a reduction in the financial resources necessary to pay for the increased demand. Attitudes towards caring for frail old people within the family vary across countries and cultures, but even in "traditional" cultures which have always cared for their elderly relatives within the family, for example in the South Pacific island nations and parts of South East Asia, attitudes are changing and the demand for external support services and residential provision is increasing. In many Western style countries the proportion of single person households is increasing as result of later marriage, increase in marriage breakdown and divorce, women's educational and career aspirations, and different life expectancies of men and women.

At the other extreme of the age spectrum the decrease in infant and child mortality, also brings new health challenges in pre-natal care and a greater need to be aware of nutrition, hygiene and care-giver education. Nations with a hitherto poor birthrate survival statistics now find themselves required to accept new ways of developing requisite skills and new working methods.

These changes pose new challenges for nursing which require fresh and forward thinking by health and social care professionals and policy makers, and a new direction for nurse education. Hospitals are no longer seen as the main providers of health care in all circumstances: they are now recognized as being too expensive, and as unsuited to the management of chronic illness. While hospital care will still be necessary for the treatment of trauma and acute conditions, more care will be given in community settings and people's own homes. The traditional hospital trained nurse of forty years ago must, according to WHO, be replaced by a better educated (as opposed to trained), much more flexible, multi-skilled, primary healthcare "family health nurse."

Many developments in informatics are already available to support these changes. Pervasive mobile technology enables "anywhere any time" care. Enabling technologies include satellite driven mobile phone technology which can be used for biometric monitoring and transmission of images as well as word messages. In more remote areas of countries with unfriendly terrains and widespread hinterlands the use of electronic technology both for the dissemination basic care information and the electronic transmission of images for diagnostic purposes comes into its own. Satellite driven mobile phone technology is now superseding the highly successful radio wave transmissions that Australia used for many years in their thinly populated outback areas. The use of assistive technology ("telecare") will facilitate self-care and enable people to be supported in their own homes.

Nurses will need to recognize that informatics is not a field reserved for technicians – rather it will require being a mainstream part of the basic nursing education curriculum. In addition to basic computer skills, nurses will need to understand the underlying concepts of information management, and to learn new skills in managing and maintaining the nurse patient relationship when the nurse and the patients are not physically present in the same place.

Globalization

Globalization was considered in terms of its economic, communications, and population mobility aspects. Like the demographic changes, globalization has both positive and negative effects. Cheap food and other goods in one part of the world may be bought at the price of exploitation and deprivation in other parts. While immediate access to knowledge sources (e.g. through the Internet) enables early warning of impending health threats and the sharing of good practice, it may also lead to information overload. Cheap and frequent air travel increases the risk of infectious diseases as well as the information necessary for their control.

The nursing challenges associated with globalization include a need for increased knowledge of public health, recognition of the need to share and use information about best practice, and the development of new skills in community development and working with vulnerable groups to overcome health inequalities.

The informatics input to this dilemma is most important. While search engines and persuasive technology are useful as front-end directions the real goal will be to utilize EHR interoperability to assess optimum international standard solutions. The use of trained nurses in this area will be vital – this again is not a technician role but a means for a skilled medico-nursing operative to bring opportunity for timely and maximum health solutions to the patient.

Environment

The challenge of global warning is now widely recognized and with it has come an increased incidence of natural disasters such as tsunamis, hurricanes, floods and droughts. War is an even greater determinant of population mobility, poverty and starvation. Social and political changes have increased the threat of bioterrorism.

Experience has revealed the inadequacy of the nursing skill base for responding to such disasters. The work of skilled support organizations (e.g. Red Cross, Medicin sans Frontières) is often delayed by the problems related to distance, difficulty of physical access or the frustrating bureaucracy of the nations directly hit. Clearly the ability to have on-the-ground local nursing staff suita-

bly trained must be a high value aim. Informatics has a great deal to offer in these circumstances. Communication is clearly critically important.

Education

The group discussed education both within the context of identifying societal changes and in subsequent discussion (led by Dr Connie Delaney and Dr Marion Ball) about changes in nursing education needed to incorporate IM&T (information management and technology) into mainstream nursing practice.

Developments in general education are changing perceptions of human rights and citizenship, and leading to rising expectations and demands in healthcare. This, coupled with increasing access to information via television and the Internet, is creating a public that is much better informed about health, healthcare and treatment options. It is now not unusual for a patient to present at the GP's surgery or doctor's office holding a computer printout describing full details of a disease that he believes he has, together with a list of treatment options; the patient expects to discuss this with the health provider instead of merely asking the question "What's wrong, doctor?". While this situation may be disturbing to some health professionals because it transforms the power balance of the professional-client relationship, many welcome the opportunity it creates to make care much more patient centered, even patient controlled. Research shows that, particularly among those who have a chronic disease, patients who are well informed about their disease and well educated in self-care achieve much better health outcomes. In the UK specific health education programmes, known as "Expert patient" programmes, have been developed to encourage this approach. Involving patients in their care also improves safety and quality.

Nurses should welcome this change because nursing, as distinct from medicine, has always focused on doing things "with" rather than "to" patients, and on enabling patients rather than merely treating the disease. It strengthens the role of the nurse as the patient's advocate Moreover, since one problem associated with using the media or the internet as a source of information is that the information may not be accurate, or may need interpretation, it creates a major new role for the nurse as interpreter and information broker.

The informatics developments which are driving, as well as enabling, this change include electronic systems for drug prescribing and administration, for the transmission of pictures including X-ray images, for surveying care providers to enable greater patient choice, and the development of electronic patient records. In addition to the technical challenges, there are major issues of security and patient confidentiality, ownership and access to the record (including access by the patient), and the potential for secondary usage of aggregated patient records.

Table 1. Changes

CHANGE FROM	CHANGE TO
Traditional teaching methods	E methods
Soaking up the facts	Critical thinking
Lectures	Student participation
9–5 Monday to Friday	24/7 availability
Same for everyone	Customised product
Single discipline	Multi discipline
Information	Knowledge
Disease based	(Nursing) problem based
'Nursing is Doing'	'Nursing is decision making'
Hospital	Primary health care
Preparation for current practice	Adaptability

These changes require changes in nursing education at all levels – basic nursing education, continuing and specialist nursing education, advanced education and research, management education. As well as skills training, this must include understanding of the underlying concepts of information management.

In her 2006 paper 'Nursing Information and skills' Dr Marion Ball identified a major problem frustrating this change '…schools of nursing must move decisively to ensure that the theoretical foundations they offer have practical application in the real world'.[i] Dr Ball went on to identify the need for academia to train nurses differently in order to prepare them for, *inter alia,* technology-enabled environments.

A "Bold Transformation" of Nursing Education

A specific discussion of the changes needed in nursing education was led by Dr Connie Delaney and Dr Marion Ball who argued that what was needed was a "bold transformation" of nursing education. The essentials of transforming nursing education require that the culture of nursing as we know it accepts change – and more especially, accepts and understands the need for that change. In Table 1 we outline some of the changes that the group saw as necessary.

All of the above involve a degree of transformation from the present towards what we believe is, at least, part of the future. Certainly a set of objectives that, if embraced worldwide by 2020, would possibly be the greatest nursing education achievement since Florence Nightingale. There are a number of groups either within nations or multi-national that are trying to work towards this or similar goals. For the purpose of this report we shall outline one: the TIGER (Technology Informatics Guiding Educational Reform) project.

The aptly named TIGER initiative[ii] – 'tiger' as in *leap forward, focus, speed, target, survival* – is taking place in the USA and is linked with the USA's 10-year goal of achieving electronic health records for all citizens. The purpose of the TIGER Initiative is to create a vision and action plan that will prepare the next generation of nurses to practice in an informatics rich healthcare environment that promotes quality care, patient safety and evidence based practice. The initiative calls for a three year action plan across seven steps, and brings together the Alliance of Nursing Informatics, an umbrella organization of 20 major nursing informatics groups with the larger nursing community, the federal government and the vendor community.

Advances in Science and Technology Including ICT

Advances which were identified as especially relevant to the group's discussion included advances in genetics (leading to individualized "designer" healthcare), heroic surgery leading to survival with disability, autonomous and robotic systems, global communications and information infrastructure, and high performance computing. Some of these had already been discussed under other headings.

To meet all these challenges nursing has to change. In her plenary closing address at IMIA-NI 2006 Dr June Clark identified the need for nursing to move from the "nursing is doing" culture to a "nursing is knowing" culture.[iii]

Dr Virginia Saba described work that she[iv] and colleagues at Georgetown University, USA have been undertaking to update their Home Health Care Classification (HHCC) project. The classification is now called the CCC to indicate its extension to cover all fields of nursing.

Going Forward

A number of initiatives are taking place within nations and it is mainly at IMIA type forums where success stories surface for appreciation by international nursing and nursing informatics practitioners. Clearly the latter are the believers – to be able to persuade the former to at least understand, is the next great leap forward.

As responses to many of the changes discussed hinge very much around education, it is timely that any suggestions towards possible solutions are noted at this time. Two clear message emerge from the group 2 subject viz:

1. That change is happening and possibly at a pace, width and depth that requires solutions sooner rather than later.
2. That traditional education methods, and in particular the curricula of basic nursing education are not adequate for preparing the new nurse for the challenges that will be faced during the current millennium.

In addition, and interwoven with any move towards an upgraded education is the clear need to ensure adequate nursing content in information systems and to embrace world-wide standardization of nursing terminology. 'If we cannot name it, we cannot control it, teach it, finance it or put it into public policy.'[v] Moreover, the continuing of hand-written notes maintains the difficulties of measuring and evaluating nursing practice.

However a number of initiatives have recognized this problem and are attempting to do something about it. Perhaps the following few words can help to sum up the problem and the need – 'We must teach for the future. This means teaching to find rather than to know, question rather than answer, achieve rather than accomplish, inspire rather than inform'.[vi]

What CAN We Do? The Way Forward

In summing up the group's thoughts and discussions, it was agreed that in concert with the IMIA-NI Strategic Plan (currently in draft format) a number of goals should be targeted for completion by 2015. This to ensure that both the health consumer and the professional nurse will understand and appreciate the gains to be made by further embracing informatics. These goals are set out below.

Complete Strategies to Take Us Out to 2015

- Certification of Nursing Informatics experts.
- Recognition by all countries of Nursing Informatics as a nursing specialty.
- Survey of Country Members regarding the current state of Nursing Informatics.
- Continuing the support for the buddy systems.
- Seek participation from IMIA member countries that do not have a Nursing Informatics involvement nor representative.
- Expanding the website.
- Develop links with the nursing associations through ICN.
- Build an alliance with national nursing informatics associations.

A Leadership Group of IMIA-NI members has been formed to enable the Working Group Chairs to advise members and to move forward in concert. Clearly these small initiatives on their own are only scratching the surface. To embrace the full quantum of changes identified in the early stages of this paper will require a great deal of coordinated international work. The ability to recognize excellence in change management in any one country should not be a reason not to embrace those gains. It is appreciated that governments of them-

selves, in funding health initiatives, tend to be mindful that money spent within a nation is for the good of that nation. Somewhere, somehow, IMIA-NI and their IMIA associates have to break down those barriers and treat the borderless world as it emerges into a greater degree of globalization.

Endnotes

i. Marion Ball EdD Fellow, Centre for Healthcare Management, IBM, Baltimore, USA.
ii. http://www.tigersummit.com.
iii. June Clark DBE PhD RN RHV FRCN Professor Emeritus, Swansea University, Wales, UK.
iv. Virginia K Saba EdD RN FAAN FACMI Distinguished Scholar, Nursing Informatics Centre, Georgetown University, Georgetown, Virginia, USA.
v. Norma Lang RN PhD FAAN FRCN Philadelphia Pennsylvania.
vi. Patricia Flatley Brennan PhD MSN BSN Professor, University of Wisconsin, Madison, Wisconsin.

Healthcare in the Year 2020 – Practice and Policy

Moya CONRICK (Australia), Graham WRIGHT (UK),
Aleksander RADENOVIC (Croatia), Evelyn HOVENGA (Australia),
Insook CHO (Korea) and Kimikazu KASHIWAGI (Japan)

Abstract. Among the key issues facing the nursing profession as we moves towards the year 2020 are politics, policy and practice. This paper addresses these areas, as well as considering legal challenges and the question of whether nursing will exist as we currently know it. Moves away from hospital-based care towards more community-based and preventative care are considered, together with various scenarios describing possible futures.

Keywords. Nursing informatics, future, policy, healthcare models

Issues of Practice and Politics

Politics and practice are closely linked with the many other issues for the profession to consider as we move towards the year 2020. The age profile of the world's population is shifting as life expectancy increases. The Australian figures suggest that the largest increase will be in the over 85 group, which will increase from 1% in 2002 to between 6 and 9% by 2051; a massive 500–700% increase. [1] It is also known that the health care portion of Gross Domestic Product continues to climb and will probably need to rise as the aging population rises. The average age of nursing practitioners is increasing and this will also impact on health systems around the world.

Many countries are looking to manage this looming crisis by using early discharge and hospital avoidance strategies. [2] In-home care and the exploration of "smart housing", extended community roles, a greater focus on health promotion, prevention, early identification and intervention and extended roles in rural and remote areas. According to Menadue, [3] there seems little doubt that expert nurses will work in roles that allow for increased clinical discretion, responsibility and autonomy. Services appropriate to people's needs will have to be delivered as close to the home as possible and this must be based on a seamless system that enables information to be shared among health professionals to promote the continuity of care. This will necessitate improved integration and coordination across the healthcare system, with common protocols with single points of entry and closer links and partnerships between private

and public services. With this climate in mind the group thought that three major questions need to be considered. In the year 2020:

- will nursing exist as we know it?
- will countries be compelled to move, for economic, political, or other reasons, to more community and preventive care and less hospital-based care?
- how will these changes/direction impact nursing informatics?

To address these issues the group decided it had to consider the legal, political and policy challenges that will impact on nursing practice and the outcomes we desire for the profession. We discussed the broad issues to be addressed/solved and considered current and known future scenarios especially as they related to people and resources. We also realized that they were many future scenarios some of which we can predict with some confidence others would be unexpected and unplanned. We know that technology is getting smaller, faster, integrated and ubiquitous but what unexpected technology will impact on nursing and informatics in the future. Our deliberations elucidated many, many questions but the answers were much more illusive. These are considered further below.

Legal and Political Barriers and Challenges That Impact on Nursing Practice

Boundaries of practice as defined by legislation impact on nursing and nursing informatics. One of the most enduring challenges is that legislation has not caught up with information and communications technology (ICT) and with new technologies emerging at such a rate perhaps it never will. Some of the major issues identified by the group were drug legislation changes that need to be made for example nurses particularly those in remote area/bush nurses regularly contravene legislation in their routine practice by prescribing medication. We also have nurses dispensing drugs that are pending a doctor's signature. In our semi-digital world many governments are scrambling to pass legislation that will enable digital signatures to be accepted as legal signatures. Until this happens it will continue to hold back the implementation of fully integrated medications systems.

Call centers are increasingly being used by governments as a way to reduce hospital and general practitioner visits and therefore reducing costs. These centers were opened using Registered Nurses but the substitution of Registered Nurses for trained telephonists soon began. Most of these centers are using decision support systems in which the reliability and validity is largely untested. Again the nursing role is eroded; nursing knowledge dismissed and the outcomes on patient safety remains unknown. The image of nursing is also at stake because consumers believe that they are talking to "nurses" and that the guid-

ance comes for a Registered Nurse. We also mused over the question "Are laws made to protect people or to facilitate political agendas to be enacted?". What do know is that national constitutions, dictatorships, common law etc all impact on nursing and nursing informatics and that rather than nursing being a profession that self regulates, in many countries nurses are restricted in what they do and say by others who regulate their practice.

Nursing continues to practice on "folklore" or myths that became accepted practice rather than embracing evidence based knowledge. [4] Undoubtedly gaps exist in that knowledge but we have no systematic method to address that and progress is slow. It gets to the heart of the perennial question of "What is nursing?" Nursing continues to have blurred boundaries of practice and these boundaries continue to be eroded and changed. This should not be confused with flexibility in nursing practice and these issues must be addressed but without a clear knowledge base this will continue to be problematic for us.

The medical dominance of healthcare and the health agenda continues. Nursing must become more visible in healthcare and the question asked above must be answered if nursing is to continue as we know it. Some examples are; the Nurse PhD who is not permitted to use the title Dr in Prague; the many media interviews and ongoing debate on healthcare in which nursing is relatively absent. Some of this lack of recognition we have bought upon ourselves by acting in a subservient manner which leads to lack of respect by both other health professional and clients and a often very negative portrayal of the profession in the media. This is compounded by a lack of evidence of the benefits of nursing practice/services and an invisibility of nurses' contribution to health care. Again however, nursing must shoulder some of the responsibility as a perusal of nursing documentation will reveal a lack of documented nursing outcomes. No outcomes – maybe no reason to value nursing. We must redress this as a matter of urgency.

Not only does nursing have an image problem within other professional practitioners and in some sections of the public and media there is an ongoing lack of recognition by Governments. Many health departments appear to pay lip service to nursing and most are unaware of what nursing is and does and of the many specialties within the nursing profession In some instances this is stunningly demonstrated: for example a National Health Department's draft paper, written on their countries healthcare system for the international community, failed to mention nursing as part of the system! Governments must be lobbied or the invisibility and disinterest in nursing needs in the digital world with continue to stifle our practice. Legislative restriction to practice needs to be investigated particularly with the changing scope of nursing practice for example nurse practitioners and the punitive European legislation that controls nursing practice.

Politics and the health of nations are inescapably linked and in some cases WHO declarations are used as a political tactic. The globe has been dominated by empires in the past such as English, Dutch, current American and the influ-

ence of these on international healthcare has been wide ranging. Without doubt this cycle will continue and this may see the rise of Europe, China or India. Changes in global power will have ongoing affects on nursing and nursing practice and nursing must rise to meet these challenges.

Desirable Outcomes, Broad Issues to Be Addressed/Solved

Nursing is the largest professional body in healthcare and is the only profession that works across the continuum-of-care. [5] In terms of the Institutes of Medicine Quality dimensions used to identify benefits that is safety, effectiveness, patient-centeredness, timeliness, efficiency, and equity, the profession should be able to demonstrate and realize benefit above and beyond other professions. This work must be undertaken and preferably by nurses. However, we are yet to take steps for the full integration informatics education into undergraduate curricula and the continuing education of the nursing workforce, although there is a positive movement in that direction in some countries. In the University of Surrey, UK, Health Informatics has been removed as a separate subject and is now integrated in the nursing curriculum. The USA and Australia recognize the lack of exposure of nurses and students to informatics education and project have been undertaken in an effort expose the need to increase nursing informatics capacity. Without these steps the benefits of information and communications technology can never be fully realized.

Nurses work very closely with consumers; establish trusting and therapeutic relationships with them. In fact in Australia nurses have always topped the Morgan Gallop Poll survey as the most trusted professionals. Nurses work to empower consumers and indeed have a duty to do so. This calls for the optimal use of nursing experience and expertise. Nurses are also at the forefront when it comes to integrating Governments policies to achieve a healthy population and a sustainable health system. They monitor health status consumer lifestyles, behavior, diet habits and in countries such as the England they undertake the majority of chronic disease management. The Practice Nurses in England undertake the majority of Chronic Disease Management use this to inform policy initiatives and health funding. Consumer self-medication, environmental factors and genetics are areas that will increasingly impact on healthcare and the manner in which nurses interact with patients. Following political decisions regarding health, social welfare, environmental changes and public health initiatives the impact these have must be monitored to gauge the impact these have on the health status of the community. It is interesting to see how politicians rely on nursing to implement and support their health policies and yet their policies regarding nursing and the regulations that impede the profession.

In many countries there has been a change focus from ill health to reducing demand for services. Nonetheless health promotion and preventative programs

in some countries are still not free at point of delivery whereas treatment for illness is, sending an incongruent message about healthcare.

Although nursing is well placed to take a lead in the healthcare nursing is hamstrung by institutionalized nursing communities and a dearth of nursing leadership where horizontal violence is pervasive and low self esteem and low confidence leads to and results from authoritarian behavior. We need to change the ingrained institutionalized nursing practice to focus on the care of individuals. Nursing's obsession with competencies, 'doing skills' and activities, forms, charts and ticking boxes that is, meeting institutionalized requirements rather than meeting patient needs is endemic. The concentration on the "doing" also overshadows those softer skills such as the psychosocial, educational and counseling that consumes so much of a nurses time and are fundamental to the profession but which is seldom documented or acknowledge in nursing workloads.

Current and Known Future Scenarios

We know that we have increasing specialization of nurses and variable boundaries of practice and competencies. This is impacted by the confused and confusing legislative authorization to undertake specific activities for example a nurse may have an international license to undertake defibrillation procedures but that license is not recognized nationally. Some nurses are able to prescribe certain drugs others are not.

There are many factors that will impact on the profession but which are outside of nursing's control. The affects of global warming and the greenhouse effect with their resultant environmental impacts such as earthquakes, floods, storms have a huge bearing on nursing as nurses are called into the front line as part of emergency response teams. Nurses are also on the front line in public health responses such as the SARS and bird flu outbreaks.

We know that nurses are not exempt as the population ages. We also know that we are facing a huge blow-out in the numbers of older people who no doubt will have the chronic illness, co-morbidities and complexities that are for the most part a part of the aging process. We will also have a narrower tax base and less nurses to support their health needs. Already Registered Nurses are being replaced by lesser qualified Enrolled Nurses or nursing assistants and in some cases poorly educated care workers. Research demonstrates the folly of this as the quality of care diminishes and the incidence of adverse events, morbidity and severity of injuries to patients and to healthcare workers increases. All of this of course impacts on the cost of healthcare. For some reason registered nurses stand by as these other categories of people are referred to as 'nurses' and registered nurses are blamed for declining standard that can be directly attributed to these other healthcare workers.

The emerging technologies of genetic profiling and its implications for health care are just beginning to become clear there are many ethical and moral

debates for the profession and as yet these have no begun to any extent. However, we know that there is the possibility of genetic discrimination and such factors that can impact on the patient nurse relationship and the way in which we practice. Another impact on nursing and public health is that of western diets on populous countries such as China with the resultant adverse health effects such as obesity which is already seen in epidemic proportions in the West and an increase in chronic diseases.

At the present time the transient nature of the workforce has seen nurses moving freely between countries but the oil crisis, diminishing supplies and no direct no replacement for this in sight will mean less travel. Although there is an increasing demand for health services we are seeing a reduction in workforce that must be addressed and technology has a large part to play in this. Ubiquitous computing will make this more palatable as technology is ingrained into our daily lives and changing lifestyles. Technology will also impact on citizen empowerment and political debate. The introduction of electronic voting will see an increase in this. However, the ease with which we can access information and the exponential growth of knowledge from scientific research and its communication will lead to infoglut. This will also impact on the quality of available data, information to which clinicians will have at the point of care. Nursing must be strategic in the development of quality nursing knowledge bases which are based on evidence and available when and where information and knowledge is required.

It is probable by 2020 that the information warfare launched by sites like def.com with tools to attack Internet sites will have been successful and the Internet has ground to a halt. It is also possible that despite the implementation of sophisticated safe guards identity crime will flourish and this will have severe impacts on health and healthcare. Health tourism will also include Health thefts as people use false identities to claim healthcare.

Possible/Unexpected Future Scenarios

Although discussed here as possible future scenario a flu pandemic or other type of pandemic seems only a matter of time. Just how prepared governments and health departments are is a matter of conjecture. The threat of nuclear and civil wars and such conflicts are also expected but the use of weapons has changed. We are seeing the deliberate targeting of civilian populations and mass casualties as a strategy to create fear and to further political agendas. Biological warfare and bioterrorism are also part of modern arsenal. The increased acceptance of nuclear power and the proliferation of nuclear weapons inches us closer to nuclear disaster. Diseases unknown at this time will likely emerge and acts-of-god such as meteor strikes seem inevitable. All of these eventualities will demand a nursing response. Nursing will be part of the front line and very

possibly directly affected by these calamities but there seems little doubt that nurse will be supported by technology and dependent on it.

Future Scenarios – Technologies

The personal computer is already threatened and it is probable that multiple devices using computing technology will be preferred. These will be based on voice recognition because of the strides being made in this area. Clinicians may see this as turning full cycle as they return to their verbal tradition and away from the structure that is necessary in electronic records of today. Money may disappear as virtual fiscal transactions become common place impacting on e-commerce and the way in which healthcare financing operates. Super search engines and natural language processing will have a great impact on healthcare and will lead to the demise of structured databases. Intelligent and cognitive agents and hybrid technologies have already begun to infiltrate into our lives and will also take their place in health along side biometric identification and surveillance.

As we said at the outset this exercise has left us with many more questions about the issues *might or will* shape the future:

- How can we influence the political agenda to benefit society and the nursing profession?
- How can technology be used to enable this agenda to be actioned?
- How will these changes/direction impact nursing informatics?
- Will nursing exist as we know it?
- Will countries be compelled to move, for economic, political, or other reasons, to more community and preventive care and less hospital-based care?

In the year 2020 nursing will not exist as we now know it; if it is to exist at all will depend on the answers to the questions raised and challenges mooted in this paper. Technology will be the tool that enables nurses to demonstrate their place in healthcare. However, nursing desperately needs leadership and politically astute leaders to pro-actively take it forward if it is to exist at all in the year 2020.

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What If Nurses Get What They Have Always Sought: Totally Personalized Care? Trends Affecting Nursing Informatics

James P. TURLEY (USA), Peter J. MURRAY (UK),
Kaija SARANTO (Finland), Margareta EHNFORS (Sweden)
and Gyeong-Ae SEOMUN (Korea)

Abstract. We may be moving towards an era where nurses may get what they say they have always wanted – totally personalized care. This paper examines four major trends, i.e. the increasing importance of the genome, the informed patient, the rise of the patient-payer, and the 'instant gratification generation'. Each individually, and in combination, will have potential impacts on the future of health and nursing. The implications of these issues, and others are explored, as well as nursing's readiness to deal with the implications of truly and totally personalized care.

Keywords. Future, Nursing Informatics, Personalized Care, Genomics

Introduction

Many aphorisms exist discussing the future and our attitudes to, or preparedness for, what may come. It is probably true to say that, in some respects, the future will be stranger than we think, but we also must acknowledge that those who can create the future can overlook the restrictions of the past, but not ignore the past.

This paper addresses four major forces influencing nursing informatics, that are changing the future, that will have important impacts on healthcare, that will have effects on nursing and that will need planning for the near and long-term futures. Some of these factors are already with us or are emerging, but nurses in general have, to date, not taken sufficient account of them. If nurses, and nurse informaticians in particular, take account of these factors, then it will still be possible to create a 'should be' future that we would like to see. However, nursing has a history of not taking the future seriously, and if nursing fails to tackle these and other issues, and continues to look to the past rather than to possible futures, then we will continue to have our futures, and our professions and roles, determined for us by others.

Four important healthcare trends are considered in detail in the first part of the paper, specifically nursing and the genome; the informed patient; the rise of the patient-payer; and the instant gratification generation. The latter part of the paper explores the implications of these trends. This paper, while not an exhaustive discussion of the issues, leaves the authors, and hopefully the reader, with more questions than answers. However, it focuses on the critical factors that will impact nursing informatics over the next five to 15 years, and that nurses must address if their desired futures are to be created and other, perhaps less desirable futures, not simply allowed to happen. The sub-title of this paper is 'What if nurses get what they have always sought: totally personalized care?'. We could continue the question with 'will they know what to do with it?'; unless the issues here are addressed broadly, the answer may not be positive.

Four Coming Healthcare Trends

These developing healthcare trends have the power to change healthcare, the roles of healthcare providers and to dramatically interact with the continued rise of information technology (IT). The four trends are: 1) Nursing and the Genome, 2) The Informed Patient, 3) The Rise of The Patient-Payer and 4) The Instant Gratification Generation. These four trends share a heavy dependence on and interaction with IT. As IT increases its impact on our daily activities, heath and healthcare will be woven more integrally into the patterns of daily life of all people.

1. Nursing and the Genome

The ultimate 'personalization' is DNA (deoxyribonucleic acid), which uniquely identifies each individual. DNA is not refutable, that is, since it so uniquely identifies each person, the mere presence of DNA information means that the individual would have to deny his or her own existence in order to deny the veracity of the DNA. Generally, nurses and nursing have not been aggressively involved in seeking out the implications in the impact of DNA and the genome for healthcare practice. However, we already know that, from the genome information, we can determine the disease risks of a given patient, the drug allergies of that patient and to some extent the optimal drug treatments for individual patients. These all fall clearly within the purview of nursing concerns and the science of nursing, and have implications for truly personalized care. This knowledge should clearly translate to nursing care at the bedside or the home [1,2]. These interventions are clearly nursing care.

Single Nucleotide Polymorphisms (SNPs) represent single base changes in the DNA. In these cases, a single nucleotide A (adenine), T (thymine), G (guanine), or C (cytosine), is changed. In human populations, since 99% of the

DNA is identical, diversity occurs within the remaining 1% variation of the human DNA. The majority of these variations are accounted for by SNPs. There are 10 million SNPs in the human genome, one in every 100 to 300 base pairs of the 3 billion base pairs sequenced genome. Of these SNPs, two out of every three are substitutions of thymine (T) for a cytosine (C). An example of a SNP with an A to T replacement results in Sickle Cell Anemia. The improper substitution can be seen in Fig. 1.

Likewise, studies of other SNPs have demonstrated that women who have a Body Mass Index (BMI) below the median and a low plasma High Density Lipoprotein (HDL) can still be at high risk for coronary heart disease. This is the result of a single polymorphism found at P +294 C. While this polymorphism is rare, it is statistically associated with higher lipids and coronary artery disease in women. Currently this research shows a statistical association between the polymorphism and the disease, but it does not describe the physiologic mechanism which causes the disease. While the risk might be slight in the overall population because of the rarity of the polymorphism, the risk is high for the women who have the polymorphism. Regarding the entire group, trends towards higher Very Low Density Lipoprotein (VLDL) and Low Density Lipoprotein (LDL) levels were observed placing them at increased cardiac risk. [4]
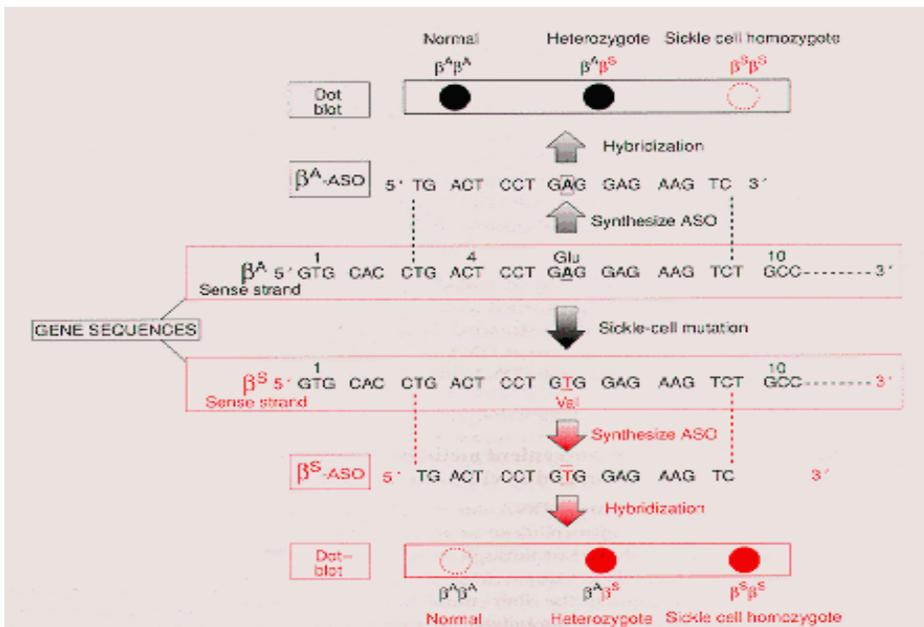

Figure 1. The sickle cell mutation is a single nucleotide substitution (A to T) at codon 6 in the b-globin gene, resulting in a GAG (Glu) to GTG (Val) substitution.

The example shows how one can design ASOs: one specific for the normal (b A) allele and identical to a sequence of 19 nucleotides encompassing codons 3–9 of this allele, and one specific for the mutant (b S) allele, being identical to the equivalent sequence of the mutant allele. The labeled ASOs can be individually hybridized to denatured genomic DNA samples on dot-blots. The b A- and b S-specific ASOs can hybridize to the complementary antisense strand of the normal and mutatnt alleles respectively, forming perfect 19-bp duplexes. However, duplexes between the b A-specific ASO and the b S allele, or between the b S-specific ASO and the b A allele have a single mismatch and are unstable at high hybridization stringency. [3]

In other studies, investigators have found that polymorphism is predictive of β-lactam allergy, which includes the allergies to penicillin and all of its derivatives. [5] The result should provide early and easy identification of people who were allergic to the β-lactam antibiotics. As the test for this SNP become more affordable, it may well become a routine test for people receiving healthcare. Allergic reactions to β-lactam antibiotics is the most frequently seen allergic reaction in healthcare patients. The study used a case control model to isolate the polymorphism. Studies of other alleles have shown a link between childhood asthma and allergies to aspirin (ASA). [6] While the studies do not show a complete explanation for the link between childhood asthma and aspirin allergies, it is clear that a genetic variation is highly associated with these two diseases, asthma and ASA allergies.

Genetic studies have also demonstrated a significant relationship between SNPs and disease which occurs in the apoE gene, in which the presence of the E4 allele is associated with a higher risk of developing Alzheimer's disease than with mutations of the E2. Likewise, there is a relationship between the BRCA1 and BRCA2 mutations which are predictive of breast cancer. A lifetime breast cancer risk for women who carried the BRCA1 mutation is in the range of 50 to 80%. [7]

As we look at the existing research on SNPs, it is clear that this information has a direct impact on nursing education and the practice of nursing, and work has begun to address the need to explore international standards for integrating genomics into nursing education. [8] We can already identify risk factors for patients and potential patients, including women at risk for breast cancer among women at risk for heart disease. Nurses can also identify patients within the patient population who are at risk for antibiotic allergies and children who are at risk for aspirin asthma interactions. Right now, the limiting factor to applying this information is the cost of the micro-arrays which are used in the screening tests for SNPs. These tests are currently dropping to the range below1000 US dollars, and are projected to drop to the range of 100 US dollars in the next few years. While the current cost is high, it is viable for middle-class populations in the developed countries. However, even at a cost of 100 US dollars, the tests would not be within the range of affordability for people in de-

veloping countries. As with all tests of this type, we can expect the price will continue to drop and the tests will become more affordable in the future.

It is expected that, as more genomic information becomes available, the interaction between the genome and nursing practice will continue to develop. We can see immediate impact in the roles for patient education, risk counseling, lifestyle counseling, and family counseling. There will also be an immediate impact in the areas of medication administration and medication effectiveness. Since nursing plays a critical role in medication administration in healthcare facilities, the impact of the genome on the practice of nursing will continue to expand. Currently, UK competencies are available, [9] the Canadian Nurses Association has summarized competencies [10] and in the USA, nursing competencies for genetics and genomics were established in 2005. [11] These issues are nicely summarized by Burke and Kirk. [12]

2. The Informed Patient

In this section, five themes are discussed, specifically: 1) Access to Information, 2) Information Quality, 3) Influences, and 4) Decision-Making and 5) Relation To Clinicians. As information about the genome becomes more available in the popular press, there will be genomic information available to the informed patient to provide interaction between these themes. Clearly, the topic of the 'informed patient' has been in the popular literature for some time. [13–15]

2.1. Access to Information

The World Wide Web has made healthcare information available to people regardless of time or place. Health and healthcare remain either first or second as the most searched categories of information on the Web, and 80% of Americans have used the Internet to search for health related materials. They usually start with a general search engine and do not check either the data nor the source of the information. Seven percent of Americans seek on-line health data on an average day, [16] and similar rates apply in many other major developed nations with high levels of Internet access. While these numbers are higher than those reported by Eysenbach and Kohler, [17] they reflect different research methods and a rapid growth in the Internet in the interim. As we know, however, the quantity of information does nothing to document the quality of the information.

2.2. Information Quality

The issues related to quality of health information on-line were addressed in a special issue of the *International Journal of Medical Informatics* in January 2006. Many of the authors, but especially Rice, [18] addressed the issues of evaluation, credibility and accuracy of health information on-line. A number of

organizations have established criteria to ensure the quality of health-related information on the Web. These organizations include (but are not limited to):

1. AMA Guidelines.
2. (http://www.ama-assn.org/ama/pub/category/1905.html).
3. HONCode Health On the Net Foundation (http://www.hon.ch/).
4. HealthGrades for Clinicians (http://www.healthgrades.com/).
5. WebRing for Consumers (http://m.webring.com/hub?ring=consumer).
6. URAC Certification (http://www.urac.org/).

While these associations certify the quality of health related materials on the Web, we do not know the extent to which consumers seek out these quality indicators when seeking health-related data on the Web. [19] Even if consumers search websites that have these certifications, there is no guarantee that consumers have the knowledge to interpret the information which is available on the sites. [20] So, while the websites may have certified information, we're still left with consumers who may or may not have the proper knowledge to interpret the correct information which is available on the certified websites.

Access to information alone is not sufficient to guarantee that the consumer will be properly informed. However, if the consumer is accessing poor information, that it will be virtually impossible for the consumer to be well-informed. The link between data, knowledge acquisition and the integration of that into a corpus of information that can be used for accurate healthcare decision-making is a volatile relationship. While access to information is growing exponentially, there are two separate but related points that need to be considered. These include the relationship between the access to the information and information quality and the way the consumer learns to integrate new data and information into their existing knowledge base. This becomes a relation between access to information and quality of information and the unique knowledge and learning aspects of each consumer. Researchers who are developing "risk assessment" websites for consumers know the complex relationship between data organization, data display and consumer decision-making. [21]

In the world of the consumer, there are many who influence the consumer's decision-making. These influences include family, friends, media and others. While we would like to think that professionals use scientific information in making their healthcare decisions, we know they are influenced by peers, organizational policy, expediency and, at times, cost. For the consumer who does not have as well developed a scientific base, the influence of these other factors is likely to be greater. How often have we heard a patient state "I had a friend who had that procedurec", or "somebody at work said that…" or "my aunt Martha said that the procedure was too painful to have done…".

While we know that these influences are many and varied, we do not know the relative impact of these influences on any given consumer. [22,23] Consumers are more widely variable in their response to outside influences than are healthcare professionals – or at least we hope so. So, as consumers have access

to more and more health-related information, we will have to be cognizant of the other influences which impact the way the consumer chooses to use health information. This will come together in the area of consumer decision-making.

Emerging technologies do not automatically directly influence nursing and nursing informatics, but instead have a potential impact on future healthcare and nursing informatics. All healthcare professions now rely on advances in biomedicine and technology that influence the use of informatics in healthcare and nursing. Advances in some professional domains in turn influence other overlapping professions and domains, resulting in opportunities to leverage the potential progress and development in healthcare informatics, and consequently nursing informatics.

Continuing advances in technologies will influence healthcare and nursing informatics, including advances in genomics, micro electromechanical systems (MEMS) and nanotechnology, wireless radio standards, information and communication technology (ICT), minimally invasive technology, and sensor technology.

2.3. Consumer Decision-Making

In exploring the area of consumer decision-making, we must examine the locus of control which has been shifting in the past few years. [24] Previously, consumers would allow the clinician to make virtually all of the healthcare decisions, and some would say that consumers did not make decisions. [25] With the rise of managed care, clinicians are free to make healthcare decisions within ranges which were established by the managed care organization. While at first this was seen as a cost-saving measure, may consumers state they were seeking the best possible care and the rationale for the choice of care is not being made by the clinician but by an anonymous managed care organization.

Once the consumers saw the locus of control moving away from the clinician, the consumers became more actively involved in the decision-making process. [26] Currently, the trend is toward a model where the decision-making of the consumer and the clinician actively engage each other in the process of making healthcare decisions. Of course, the range and the amount of collaboration varies with the patient and clinician. This area is highly culturally bound, with some cultures requiring a more egalitarian view, while other cultures require that the patient has little or no say in the healthcare decision-making process.

Studies will be needed to be done to understand the impact of these different decision-making profiles on the outcomes and quality of healthcare. The impact of different decision-making profiles on patient satisfaction may or may not be correlated with the outcome quality indicators.

2.4. Relation to Clinicians

This whole set of issues around the rise of the informed patient is situated within the context of the complexities determining the relationship between the consumer and the clinician; this may be a traditional dependent role, or it may move more to a contemporary quality role. Within these roles, decisions are negotiated. The decision-making process accounts not only for scientific evidence, but also the preferences indicated by the consumer. These preferences involve not only the main effects of the healthcare or action, but also the side-effects and untoward effects which may be the result of medications, surgeries, or other procedures.

The entire decision-making process may be altered as clinicians and consumers seek out new roles and new forms of relationship, which may include seeing the clinician as an employee. This concept will be discussed later.

3. The Rise of the Patient-Payer

In this section, we address changes that are occurring in the financing of healthcare. While much of the discussion is situated in and draws primarily from the situation in the USA, we can see similar trends emerging in many other countries, and so the issues are ones that must be considered globally. These changes will include the rise of co-payments, or what some refer to as' out-of-pocket' expenses. In addition to the rise of co-payments, there is the increase of co-insurance and changes in the scope of healthcare coverage. Finally, we look towards suggested proposals such as 'Medical Savings Accounts' and other mechanisms which also result in higher payments by the consumer for healthcare coverage.

3.1. Co-Payments

In virtually all health insurance programs, and in many countries where funding of the health system is based in whole or in part on insurance schemes, whether they are private insurance, single-payer or a combination of the above, there has been a steady rise in co-payments which the consumer has to make at the time of the visit.

Premiums for employer-sponsored health coverage have surged 87% over the past six years, according to the Kaiser Family Foundation, putting a huge burden on both companies and employees. Family health coverage now runs about $11,500 annually, with workers themselves forking out nearly $3,000. [27].

A few years ago, co-payments were often at the rate of five US dollars or less, and these have increased now to where a co-payment is often in the order of 20, 50 or even 100 US dollars per visit. Co-payments may vary with the type of clinicians seen, for example general practice clinician versus a specialist. Co-payments also vary with whether a clinician is on the program or outside

the program, in network or out-of-network. A new variant on the rise of co-payments has occurred where what used to be a single visit is now broken into multiple visits, each with a separate co-payment charged for each visit. This creates a double rise, as not only is there a rise in the number of visits, but also a rise in co-payment for each of the visits.

In addition to the co-payments for office visits, consumers are seeing the rise in co-payments throughout the healthcare journey, for example, co-payments are increasing for medications. For some insurance schemes, the use of generic medications allows for a lower co-payment. There is often a higher co-payment for medications which are on a selected formulary and even higher co-payments for medications which are not on the formulary. Consumers can find that co-payments can be as much as 100 US dollars per medication per refill period, so that for a consumer who takes multiple medications, the medication co-payment can amount to several hundred US dollars per refill period. (Here, we use the concept of a refill period, because some insurance schemes require that medications be refilled monthly while others refill medications quarterly.)

In addition to co-payments for office visits and for medications, consumers are finding that there are increased co-payments for hospitalizations and emergency room visits. In some schemes, the co-payment for an emergency room visit depends upon whether or not the patient is admitted to the hospital, the rationale being that if a person is not sufficiently sick to be admitted to the hospital, then there was probably not an appropriate need for access to the emergency room. Co-payments for hospitalizations may be based on an initial deductible, or a group co-payment for the services rendered.

Taken together, these co-payments can cost a consumer in excess of 2500 US dollars per year. Of course, the amount and scope of these co-payments will very by insurance scheme, country and deliver system model. What is clear is that the amount of private payment is increasing much faster than the amount of government payment for healthcare insurance. Table 1 and Fig. 2, taken from the most recent OECD data, documents the greater rise in private healthcare spending. These tables document the overall growth in health care spending as part of GDP. It is important to note that the rate of spending from the private sector is rising more quickly than the government sector. This holds true for countries that have single-payer systems and for countries that are fee-for-service based. The overall trend is towards a greater burden of healthcare expenditure to be placed on the consumer.

The increased healthcare expense burden on the consumer has created a policy problem for many governments. One potential solution for this problem in the USA that has been proposed is the concept of "Health Savings Accounts" (HSA). [28,29] HSAs would function in a similar manner to tax-deferred retirement savings accounts. Consumers would be allowed to place pre-tax money into a HSA, which could then be used to cover the co-payments of any type, e.g. medications, office visits, or hospitalizations. For some pro-

Figure 1.1 **Evolution of public and private OECD health spending** [1]
Index 1970 = 100
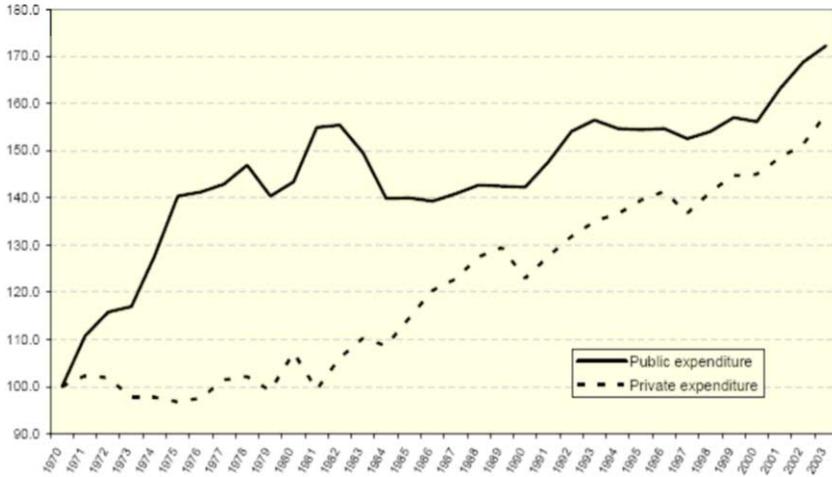
1. Unweighted average of available OECD countries. As a % of GDP.
Source : OECD Health Database (2005).

Figure 2. Unweighted average of available OECD countries.

grams, the money would be allowed to accumulate and be rolled over into fol-
lowing years. [30] As the amount of money and the HSA account became lar-
ger, the consumer would be able to select even higher deductibles and co-
payments. The advantage of increasing the deductible and the co-payments is
that it could eventually decrease the total health insurance bill. This would par-
allel the systems used in automobile and home insurance where higher deducti-
bles and co-payments mean lower insurance premiums. Because HSA accounts
affect the tax policy of the country, it becomes a major policy decision for the
country.

3.2. Changes in Coverage

Historically, health insurance has been of the general form of 'one size fits all',
that is, whether a country has a fee-for-service or a single-payer system, the
basic insurance is the same for all covered people. Another approach to modi-
fying the cost basis of healthcare insurance would be to create a 'cafeteria cov-
erage' model. With cafeteria coverage, not everyone would get the same insur-
ance; you could customize the coverage you wanted and pay for the coverage
you selected. [31]

　　Under this approach, people who had limited disposable income might
choose to have primary care completely covered by their insurance scheme.
Others who were basically healthy might choose to have preventive care cov-
ered in their insurance scheme, while others might choose to have only catas-

Table 1. Per capita health spending for OECD countries

EXHIBIT 1
Per Capita Health Spending In Organization For Economic Cooperation And Development (OECD) Countries, 2002

Country	Total health spending		Absolute difference as percent of GDP, 1992–2002	Average real annual growth per capita, 1992–2002 (%)
	Per capita ($PPP)	Percent of GDP		
Australia[a]	2,504	9.1	1.0[b]	4.1
Austria	2,220	7.7	0.2	2.0
Belgium	2,515	9.1	1.1	3.0
Canada	2,931	9.6	−0.4	2.2
Czech Republic	1,118	7.4	2.0	5.3
Denmark	2,583	8.8	0.3	2.5
Finland	1,943	7.3	−1.8	0.7
France	2,736	9.7	0.7	2.3
Germany	2,817	10.9	1.0	2.0
Greece	1,814	9.5	1.6	4.4
Hungary	1,079	7.8	0.1	3.5
Iceland	2,807	9.9	1.6	4.0
Ireland	2,367	7.3	0.2	7.3
Italy	2,166	8.5	0.1	1.5
Japan[a]	2,077	7.8	1.6[b]	3.6
Korea	996	5.1	0.7	6.7
Luxembourg	3,065	6.2	0.0	3.5
Mexico	553	6.1	0.5	2.2
Netherlands	2,643	9.1	0.7	2.9
New Zealand	1,857	8.5	1.0	3.8
Norway	3,083	9.6	1.4	4.4
Poland	654	6.1	−0.1	4.1
Portugal	1,702	9.3	2.3	5.0
Slovak Republic	698	5.7	—[c]	—[c]
Spain	1,646	7.6	0.4	2.6
Sweden	2,517	9.2	0.9	3.3
Switzerland	3,446	11.2	1.9	2.5
Turkey[d]	446	6.6	2.8[e]	9.2
United Kingdom	2,160	7.7	0.8	3.8
United States	5,267	14.6	1.6	3.3
OECD median	2,193	8.5	0.8	3.4

SOURCE: Organization for Economic Cooperation and Development, OECD Health Data 2004 (Paris: OECD, 2005).
NOTES: PPP is purchasing power parity. GDP is gross domestic product.
[a] 2001.
[b] 1992–2001.
[c] Not available.
[d] 2000.
[e] 1992–2000.

trophic care coverage in their insurance scheme. Likewise medications, prostheses and other medical procedures might be selected into or out of any individual's specific coverage scheme.

Taking the cafeteria coverage model to the extreme, there could be different co-payments in each subsection and different amounts of maximum coverage. So, for example, we could have a situation where parents would choose accident insurance for boys and cosmetic coverage for girls (or vice versa).

Others might choose outpatient coverage for women because they are more likely to schedule and keep outpatient visits while only having surgical coverage for men since they are less likely to make outpatient visits. While these examples may play into stereotypes, they gave examples of what could be possible in a cafeteria model approach to healthcare.

In summary, a few things are clear and need to be taken into account in exploring the future of healthcare. We know that individuals will continue to pay more for health insurance. We know that the health insurance schemes will become more complicated. What we don't know is how these changes in healthcare insurance will affect nursing and nursing practice.

4. The Instant Gratification Generation

"I want what I want and I want it now!" The cry of the toddler is the emblem for the coming generation. Our present generation has become accustomed to 24 hour television, high-speed Internet on demand, and a credit card to buy anything, anytime, anywhere. We are used to traveling the globe with no local currency in our pockets and a piece of plastic that allows us to purchase anything on demand. With all of these changes, we have become accustomed to direct marketing to the buyer. We have television advertisements and Internet advertisements which can be increasingly customized and will inform us of our preferences for books, automobiles, lifestyle, alcohol use and the latest prescription medications. We expect the 24 hour convenience store, regardless of the country we are in. We are used to 24 hour access to groceries, petrol, online help and other services. The selection and access to goods and services is now a 24/7 business. Healthcare has traditionally been an 'around-the-clock' business but never a 24/7 business.

Consider: when is the last time you:

1. Got a medical doctor to visit on the same day to asked;
2. Were asked what time YOU wanted a visit;
3. Got healthcare WHERE you requested;
4. HOW you wanted the service delivered;
5. Were asked what you were willing to PAY; or
6. Were given options with prices?

While we have always recognized that healthcare is a service industry, it has never met the same criteria as any other service industry. It is beyond the scope of this paper to assess the unique position of the healthcare industry; however we must raise the question of whether the unique position of healthcare will continue to stay that way in the future. More likely, healthcare will be seen as just another service industry, but increasingly geared to the demands of the 24/7 schedule that we expect from other service industries. This change has the potential for being the most disruptive to nursing and nursing practice. Nursing has traditionally seen itself embedded within a hierarchical structure of

modern healthcare. The expansive public health nursing and distributed nursing care that developed countries had for the past 30 and 40 years ago is now a fraction of its former self. Nursing has retreated from patient homes and moved to the institutional franchise. While there are still remnants of distributed nursing, they continue to contract in most countries.

So, What Does It All Mean?

We consider that, as these forces interact, we will see the rise of four major themes. These things include: 1) The Personalization of Healthcare, 2) On-demand Healthcare, 3) Inversion of the Power Profile, and 4) Sales/Purchasing of Nursing Care. These changes will have a major impact on healthcare and how healthcare is delivered in the future. While the impact will not be limited to nursing care, our charge is to understand how these changes may impact nursing care and nursing informatics.

Personalization/Individualization of Healthcare

The impact of the genome on future healthcare cannot be overestimated. As the cost of diagnostic tests based on SNPs decreases, we will see the use of micro-arrays as a ubiquitous influence in future healthcare diagnostics and treatment. Our understanding of medications will be customized to the individual genome. We will not treat hypertension by trial and error, but rather use the genome to know which medications will work best for any given patient. Likewise, we will not challenge people with penicillin and its derivatives relying on the patient's memory to know whether or not they have allergies these medications. Rather, simple screening procedures using a micro-array will let us know the risks of these medications to each patient.

   As we look at disease risks and disease profiles, we will expand beyond family history and lifestyle. While the influence of lifestyle is clear and will become more acute, the documented risk factors will come from the genome itself. If anything, this will increase our understanding of the interaction between the genome and social and environmental risk factors. We can find out which patients will respond to dietary modifications, which will need exercise modifications, which will need medications, and which patients will need a combination of the above. The nursing role and risk prevention, detection and early intervention will continue to increase. While this has been a traditional part of nursing care, the increased precision of the genome and the need to measure quality outputs will require a much more scientific understanding of how to motivate patients to change their behaviors and alter their environments. It will take some time to understand what this increased burden will mean for assessing quality nursing care.

   As we look at the broader range of treatments we will eventually look to treatments that go beyond our traditional medications of the present. When we

know that a disease such as sickle cell anemia is the result of the change of a single allele, the question will be how to reverse that mutation. Even though the disease is found by a mutation of a single SNP, that SNP must be corrected in every cell of the body. While we not able to do that today, it will become a future goal for medicine. In addition, as we understand more about the genome, we may look at ways to mitigate the expressions occurring from certain alleles. Even if we cannot completely change the allele back to its non-modified state, ways may be developed to modify any untoward expressions from that allele. It is unclear what role nursing will play in all these forms of genetic therapies – but nursing must begin to discuss the implications.

The personalization of healthcare will come from sources other than just the genome. [32,33] We have become comfortable with targeted marketing. As we already see from websites such as Amazon.com, we will increasingly see websites stating "people who have bought this product have also purchased...". So what will happen as targeted marketing moves into healthcare? Will we ever get to the point of seeing marketing such as "people who have had that surgery, have also purchased these services...”? While we may not look forward to such marketing or see it as desirable, it does not seem to be an unreasonable option for our future.

In personalized care, the question must be asked "what will nurses bring to the table"? Will nurses start to think about their practice in terms of skills? How much will nurses charge for a back rub, an IM injection, or use of any other skill? How will nurses think about packaging sets of skills into a marketable package? Physicians have traditionally set prices for performing sets of skills. A surgeon charges X-number of dollars for an appendectomy and X-number of dollars for laceration repair. Nurses have not traditionally packaged skills together for a set price.

Nurses could think about marketing their knowledge. Nurses could charge X-number of dollars for one hour educational session on diabetes, or charge X number of dollars for genetic counseling. If nurses saw themselves in such a consulting role, they might learn to package units of knowledge and figure out what to charge for each unit. While this might be somewhat difficult at first, there is nothing inherently alien to the professional practice of nursing.

On-Demand Healthcare

As discussed above, healthcare has traditionally been a round-the-clock business, but it has not operated as a 24/7 business. Middle-class people around the world have become accustomed to 24 hour convenience stores and 24 hour ATM's. This 24-hour access to service is a common component of the 24/7 on demand service cycle. We are beginning to see that healthcare is adapting to 24/7 service cycle. [34,35] In some cases, nursing-based healthcare clinics are operating in grocery stores and pharmacies. Typically these operations are open for 16 hours a day, while the supporting grocery and pharmacy stores are open

24 hours a day. If there is sufficient demand, it would be a simple extension to see these clinics expand their hours to a 24-hour cycle. Currently these clinics are seen to be a fully distributed access to primary care and not a focus for acute or hyper acute care. Walmart has now moved into the healthcare arena with clinics in their stores. [36]

A totally different healthcare model could be based on an ATM concept. Twenty years ago, no one would have believed that all banking services could be shoe-horned into a simple ATM. Yet many people complete all of their banking needs at ATMs and with Internet-based banking. If banking can make such transformation, why cannot healthcare? This is not to say that all healthcare services would be delivered by ATM. However, the "walking-wounded and worried-well" may indeed be able to have many of their needs met by an ATM. We know that many laboratory tests can be done on a device the size of a CD-ROM. With a comprehensive AI-based decision support behind it and access to patients' electronic records, many simple diagnoses could be completed by such an ATM-based device. The major question would be whether the device would dispense medications or an electronic prescription would be sent to the pharmacy. However, if the ATM were located inside a pharmacy... Problem solved!

In the 24/7 world, there are different measures of quality. So, if I select an item from an Internet retailer and have it sent directly to me, I have two aspects of quality. The first aspect will be the quality of the item which I ordered. For that I will look to the manufacturer, but also I will look to the description of the item from the Internet retailer. The second aspect of quality will address the delivery of the item in a timely manner. If I paid for two day shipping, I will expect delivery within 48 hours. If I accept regular or free shipping, I will still expect the item to be delivered in a timely manner, say five to seven working days. If the delivery of the item is delayed too long, the quality of the entire purchase will be rated very low regardless of the quality of the item shipped. So, the quality of the goods and the quality of the service will be combined into a total overall quality model. It is unclear how these understandings of quality of service in a virtual world would affect our understanding of the quality of healthcare delivered by ATM or by the Internet.

Inversion of the Power Profile

As noted above, the cost of health care and healthcare insurance is rapidly shifting to the consumer. Instead of the costs of healthcare being hidden by "the insurance will pay for it", the consumer will see that indeed the consumer is paying for it. While the consumer may pay for it from a Health Savings Account, the consumer will be increasingly aware of the total cost of healthcare and more cognizant of the part that the consumer is paying for.

As a consumer is paying for more, and healthcare becomes more mediated through ATMs, Internet or healthcare kiosks in grocery and pharmacy stores,

there is likely to be a change in the relationship between the consumer and the clinician. Just as the consumer who makes purchases from Internet department stores has to become more knowledgeable about goods which are being purchased, so will the modern consumer be become more knowledgeable about the aspects of healthcare which are being purchased. It is likely that the consumer will see the clinician as a client or as a consultant to the consumer who is purchasing healthcare.

In doing so, there'll be an immediate change in goals and goal setting. Since the consumer is paying the bill, the consumer's goals will be paramount. Any goals that the clinician may have will become support for, and/or secondary to, the goals of the consumer. This will have an impact not only on the short-term and long-term goals of healthcare, but also on the way quality and quality measures will be understood by both the consumer and the clinician.

What becomes clear from this is that the patients will be in control. The patients now seen as consumers will dictate the goals and directions of healthcare. Given this, it is unclear how the traditional health professions will relate to each other in the future. Will nurses and physicians see themselves in a competitive struggle for the consumer's business? Will there be new forms of power struggle between nurses and physicians? Or will nurses and physicians realize that they need to team to gather to win the consumers healthcare business? This will create a complex new world not only of social but also legal relationships. It will also redefine the evidence that is needed to constitute evidence-based care.

In summary, all of these reflections are based on a knowledge-rich environment. Some of the knowledge will be computationally intense. Other knowledge will be widely distributed and accessible from any point on the globe. Healthcare knowledge will need to be available to clinicians and consumers at the time of care, whenever and wherever the care is needed. There will be a great need to have healthcare information modeled in a way that is accessible to the consumer. There will be a greater need to have professional healthcare knowledge in a form which is computationally more efficient and available regardless of location.

Conclusion

We have explored a number of issues around possible futures for healthcare and nursing and, by extension, for nursing informatics. Many of these issues can be seen as facets of one emerging trend, i.e. the development of truly personalized healthcare. While some of the possible futures we have explored may not come to fruition, or ones that do emerge may not be our desired futures, they are all reasonable extrapolations of current trends and developments. Nursing organizations, nurse education, and individual nurses will all be influenced, and will all need to be engaged in debates about our possible futures.

Perhaps most importantly, if totally personalized healthcare develops, as the rhetoric of nursing has for so many years seemed to desire, will nurses know what to do with it?

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Health Care in 2020

Charlotte WEAVER (USA), Rosemary KENNEDY (USA),
W. Scott ERDLEY (USA), Jeongeun KIM (Korea), Polun CHANG (Taiwan),
Ulrich SCHRADER (Germany) and Margaret MAAG (USA)

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. Nrses 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; devise 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 devises 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 devises 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 devise 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. Schulz' 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 devise. 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, O_2 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

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

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-

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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Why Nursing Needs to Explore and Shape Its Own Future – Closing Summation and Remarks

W. Scott ERDLEY (USA) and Peter J. MURRAY (UK)

Abstract. This meeting was not the first, nor hopefully the last, of its kind to address a set of issues of very real concern – the future of healthcare, nursing and, in particular, nursing informatics. This summation reviews the purpose of the NI2006 Post Congress Conference, briefly reviews the preparatory work (which resulted in three days of intensive discussions for all participants after spending up to a week involved in a major international conference and associated meetings), the themes of each group and threads evident within the final reports included in these proceedings, observations as to issues not mentioned, and closing with suggestions of possible direction(s) and or course(s) of pre-emptive actions relevant for the international nursing informatics community.

Keywords. Future, Nursing Informatics, Health care

Introduction

As previously indicated, this meeting was not the first, nor hopefully the last, of its kind to address a set of issues of very real concern – the future of healthcare, nursing and, in particular, nursing informatics. The origin of this effort was grounded in a consideration of possible futures, near and far (20–50 years out), as influenced by some of the technologies and other developments that might significantly impact on nursing and healthcare. The authors, after considerable debate, postulated (rightly or wrongly) that other people and other developments had in the past determined much of what nurses, and nursing informatics specialists, do and/or perform. Therefore, it would seem, nurses were not very good at determining their own vision of what the profession could or should be. Our discussions also led to a recognition of the many changes in society, at both local and global levels, as well as emerging possible threats (global pandemics, for example) requiring some degree of contingency planning and therefore impacting healthcare.

Three additional issues also influenced our collective cogitation – first, a consideration of imagining potential futures (via scenario planning and similar techniques, with retrospective reviewing along with exploring possible stages to reaching that future) as a very real means through which we might frame

such a project. The second was that many writers and filmmakers have, over the years, postulated a myriad of different futures. These could provide some of the 'what if' scenarios helping participants with the imaginative work. Lastly, a website was established for a 'History of the Future' project (http://differance-engine.net/ni-futures/), of which this NI2006 Post Congress Conference is but one important aspect of the larger picture.

The rest of this summation reviews the purpose of the NI2006 Post Congress Conference, briefly reviews the preparatory work (which resulted in three days of intensive discussions for all participants after spending up to a week involved in a major international conference and associated meetings), the themes of each group and threads evident within the final reports included in these proceedings, observations as to issues not mentioned, and closing with suggestions of possible direction(s) and or course(s) of pre-emptive actions relevant for the international NI community.

Purpose of the NI2006 Post Congress Conference

The NI2006 Post Congress Conference discussed the possible future nature and scope of nursing, nursing informatics and healthcare, framed by likely developments between the present (2006) and 2020. This was felt to be opportune focus for discussion, given the ongoing work on development of the IMIA Strategic Plan ('Towards IMIA 2015') [1], and the revision of IMIA-NI's own Strategic Plan. The fundamental premise, as previously discussed, underlying the NI2006 Post Congress Conference was the perception that much of the current scope of nursing informatics comes from a *post hoc* and not anticipatory reaction to wider developments, a view not necessarily advocated or accepted of all participants, however.

Discussions drew on materials that had been prepared by participants, in particular by the leaders of each sub-theme. Although the year 2020 was a guideline date to think about, groups and leaders were encouraged to think further into the future and, if they felt it appropriate, to use scenario-planning as the basis for the discussions in their groups.

As outlined in earlier papers, five sub-themes were identified prior to the NI2006 Post Congress Conference, with the descriptions of the sub-themes provided using deliberately loose constructs so as to limit potential biases and liberate, rather than restrict, participants' thinking. Overlapping of issues within some themes was not unexpected, especially, for example, between groups 1 and 5, and in fact was encouraged. The sub-themes have been described in detail in these proceedings. Group 1 addressed technology developments as applied to healthcare and or nursing. Group 2 considered changes in society at national and international levels. Healthcare in 2020 related to practice and policy was the topic for Group 3. Philosophical and 'theoretical' issues, as related to healthcare, nursing and nursing informatics, were the focus for Group 4.

Finally, Group 5 explored IT evolution to 2020 and its potential impact on healthcare and informatics. Of equal importance to the success of the NI2006 Post Congress Conference were the members participating in these focused group discussions. The groups contained a wide diversity, both experiential and geographical, of participants, with many different parts of thew world represented, as well as many levels of experience and skills in nursing informatics, including practicing nurses, educators, researchers, as well as people who were not nurses, but who have contributed significantly to the development and promotion of nursing informatics. This diversity helped propel the discussions and the development of ideas within each group.

Themes and Observations from the Submissions

In this section of the paper, we rehearse the issues that emerged from the groups, and that have been discussed in detail in other papers, and show the emergence of common themes across many of the groups.

Group 1 engaged in scholarly discussion concerning future technology developments as applied to healthcare and particularly nursing. Throughout the report, Group 1's observations of emerging technologies remained key to their discussion; genetics, small unobtrusive monitoring devices, the use of information and communication technologies as tools to not only facilitate but also promote communication among all parties of the healthcare process, and the increase in minimally-invasive interventions to include a strong nursing component. Similar issues, in particular the growing, and generally under-appreciated, importance of genetics in all aspects of healthcare, emerged from Group 4's deliberations.

A key thread emerged regarding ubiquitous healthcare (u-health) and the role of nursing in this new arena is fundamental and required for success and growth. Nursing's role will evolve as nurses become 'information-mediators' in a broader-sense than currently engaged in today. All technologies will ultimately focus on the consumer through 'behind-the-scenes' data collection, which in turn will also allow nurses to analyze these data to improve care; again, an issue explored within Group 4. A strong and distinct thread throughout this paper is the need for healthcare to acknowledge an increased presence and or pervasiveness of information technologies as key components of quality healthcare. This sort of acknowledgment will help propel nursing, and healthcare, to increase use of these tools. To develop nurses with these types of skills the nursing education process will require a fundamental change to integrate these technology-sorts of tools as necessary elements for success. These necessary changes were also examined in detail by Group 2, who strongly expressed the need for fundamental changes to nurse education if the challenges of the near future, let alone the distant future, are to be met.

Group 2 examined societal change at both national and international levels. Key topics included in their discussions ranged from global demographic changes to environmental changes to industrialization and advances in science and technology. An interesting view on globalization was one of the underpinnings of this group that the key aspect of globalization consists of both inertia and country-unique demands of the process. In other words, as globalization of the world continues to evolve, it is not this that belies uniqueness but how the momentum is maintained uniquely for each country. Each of the topics addressed by this group relates to this fundamental issue of globalization, in the sense of loss of boundary and population mobility are influences shaping healthcare and nursing.

As lifespan increases across the globe, so will management and maintenance of patient health expand, in scope and importance. The role of providers and nurses in particular, will expand to help meet this and other healthcare needs. Of necessity will nurses turn to information technologies to help or facilitate care for these and other populations. Acceptance of these sorts of tools will make the process a bit smoother, to be sure. Environmental changes, both short and long-term, will also require nurses play a major role. Excellent examples include chronic care of refugees as well as emergency assistance in global environmental disasters. Significant advances in a large area of healthcare (genomics, remote and or robotic surgery, heroic surgery, and growth of global infrastructure supporting communication and information exchange) also impact, positively and negatively, the process of globalization.

Nurses will participate in this overall process once education is brought up to speed. Education of healthcare providers (nursing in particular) needs to integrate health informatics because nurses will be left behind if not adequately trained in use and potential of these tools. Solutions for change problems are required sooner than later; part of the solution is education current with change as much as possible. Without education commensurate with the information changes nurses will not be adequately prepared to meet the future, no matter how far 'down the road' one peers.

Group 3 looked at the influence of practice and policy on healthcare as we move towards 2020. Various changes related to 'climate' impact the role of the nurse such as increased aging of the population as well as population growth in general and also increased aging of the nursing workforce. These sorts of changes impact both practice and politics of care giving by nurses as well as the overall development and growth of healthcare. There was discussion involving the legal definition of nursing practice and how technologies will impact and or influence this practice in terms of quality and speed of care.

Other issues at the table of discussion in Group 3 included the blurring of nursing practice boundaries related to evidence based practice versus folk practice, issues also addressed within other groups. The role of nurses with respect to efficient use of their expertise via call centers use of protocols with non-nurse or non-health personnel, and, the continued dominance of medicine

in healthcare challenging nursing to prove itself through efficient use of data as well as correcting perceived image problems.

All of this discussion led Group 3 to postulate certain broad-based outcomes desirable of nurses in the future. The need to integrate informatics into nursing curricula is a fundamental action to support positive care outcomes; keeping up to speed by nurses also will facilitate the overall change in healthcare from a illness treating to illness prevention perspective, both of which impact, too, the close nurse-patient relationship growth. Various future scenarios, and nursing involvement, were also postulated. These various scenarios were related to the aging nurse population, increase use of genetics (in acute as well as long-term interventions), overall impact of global-warming, catastrophes and the role of nursing in such emergencies, as well as the nurse role as impacted by exponential growth of data and information in the sense of patient as well as care-giver.

Group 4's original remit was to explore philosophical and theoretical issues related to healthcare and nursing informatics, although many of the issues that they did explore perhaps would not recognizably fall into such categories. The foci of Group 4, which was clearly identified, were the issues of genomics, informed patient, patient-payer role development, and "instant gratification" generation. The time frame of reference was 5 to 15 years out and not beyond. Clearly genomics is linked to nursing practice, in areas such as medication administration as well as counseling and patient education. This will increase in priority as the future creeps ever closer to reality. The importance of the nurse-patient relationship was examined across five sub-topics (information access, information quality, influences, decision-making, and provider relationship).

The increase in socialization or social acceptance of information technologies will impact healthcare and even accelerate as information technologies continue to accelerate in development and social influence. The overarching context, though, is the relationship between the patient and the clinician. All of these various issues postulated by the group are to be considered in light of this foundation, patient/clinician relationship is everything. A major impact, too, is the changing landscape of health coverage as well as dollars funding healthcare. Influencing healthcare, too, is this idea of "I want it and I want it now", or instant gratification.

The intersection of these variables leads to personalization of healthcare, growth of on-demand healthcare, inversion of power (present is physician-centric, while future is patient-centric), and the concept of selling or purchasing nursing care. The more insightful question proposed by this group, if such care (personalized) is created, will nurses know what to do with it?

The last group, Group 5 explored the IT evolution at 2020 and its impact on healthcare and nursing informatics. As would be expected, there was considerable overlap of the fundamental issues with those addressed by Group 1; however, the papers resulting from each group, while sharing some commonal-

ities, also address some significantly different approaches and ideas. Building on an opening scenario, this group developed several themes – the consumer as employer; consumer employer and environment and new nurse and title (clinical knowledge worker – again, an issue common to several groups). The latter theme was pursued as collectively the group felt there is too much 'baggage' with the current concept of nurse to try to alter or change. So, a new title, befitting new and different responsibilities, was felt to be the best path.

The primary influences in this new future were considered to be wearable sensors as well as ubiquity of health record access and the role of intelligent agents. Building on these two influences the proposed future model of healthcare was very similar to the u-Healthcare model proposed by Dr. Unna Huh, President of the Information and Communications University, Korea at NI2006 in Seoul. A new worker, with a new title, will help promote and define this new healthcare landscape. Included in this landscape are issues related to customized health information; health management, education, and care facility referral, smart homes supporting care, and u-health device purchase assistance to consumers.

Education necessary for this new and exciting nursing role is discussed throughout Group 5's paper and, as has already been indicated, featured in those of other groups. New roles, new education, new responsibilities are themes throughout the picture of the future as necessary for the future to become reality.

What is interesting is the deviation from usual future discussions, a discussion of the past to prevent, or heighten awareness at the very least, similar errors. Speculation as to rationale for this may include an effort (conscious or unconscious) to avoid this (in hopes of new/different future viewing), general direction of discussions did not delve or involve this perspective, and or no one thought of this viewpoint.

Where does this all leave us? Was the NI2006 Post Congress Conference simply an interesting few days of collegial academic discussion in a pleasant environment, or have important issues emerged that need to be addressed by the participants and others? And if so, then who will take forward any necessary actions? The next section of this paper summarizes the issues arising, and suggests some ways forward, as well as making reference to similar exercises undertaken within other contexts.

Where Next After Phoenix Park?

Is the choice of Phoenix Park, Seoul, Korea as the venue for the NI2006 Post Congress Conference apocryphal? Is nursing informatics, like the mythical phoenix, dying in flames and needing to be reborn from the ashes? The answer is probably 'no' to the first question, and 'perhaps' to the second. On the evidence of the highly successful NI2006 Congress, the discussions of the NI2006

Post Congress Conference, the strength of nursing informatics internationally and in many individual countries, nursing informatics is alive and well in many parts of the world. However, as much of the discussion of the NI2006 Post Congress Conference indicated, we are at a stage where nursing informatics needs to carefully examine itself, the current roles and practices of nursing and nursing informatics, and consider how it can re-invent itself (be reborn) to address the changing and challenging needs of the healthcare landscape of the near future.

Others in the field on nursing informatics also recognize the need for 'the nursing informatics profession to alter its course and set new directions' [2]. The paper by Kathleen McCormick and colleagues published in early 2007 by the AMIA Nursing Informatics Working Group (several contributors to which participated in the NI2006 Post Congress Conference, although the main draft of the paper was completed before this) also recognizes the need for the nursing profession to take account of issues such as changing demographics, the rise of genomic medicine, a range of potential threats to society, as well as changing healthcare technologies.

Many other organizations engage in scenario planning to consider possible future developments and the readiness of their own organizations, or other sectors of society, to deal with the changes. We here briefly describe just one; many others can be found. In early 2007, the UK's Ministry of Defense, through its Development, Concepts and Doctrine Centre (DCDC), published 'Strategic Trends' [3], an overview of changes they see as likely in the next 30 years and the impact they will have, together with some probable, possible alternative, and plausible views of the state of the world in 2036. While there is some overlap with the issues discussed in our NI2006 Post Congress Conference, they also specifically highlight some issues that we only touched on. These include:

- the impact of the fact that by 2010, 50% of the world's population will live in cities and urban areas;
- the effects on many areas of global warming and climate change;
- increasing global inequalities, and gaps between rich and poor, with continuation of absolute poverty for many people;
- continuing population growth, and increasing competition for scare resources, such as water, in some parts of the world;
- the continuing impact of communicable diseases in many countries;
- the effects of conflict and global or local crises in displacing large numbers of people;
- increasing pervasiveness of information and communications technologies, with impact of information access; and
- the growing economic power of South East Asia.

Few of these issues are primarily health-related, but all will have local and global impacts on health, on nursing, and on the need for highly skilled nurse informaticians.

Where does all this leave us as we move forward into our ever-changing future? Who will take on the necessary tasks? The NI2006 Congress and the accompanying NI2006 Post Congress Conference are held under the auspices of IMIA-NI, the world body for nursing informatics. Many members of IMIA-NI's leadership participated in the NI2006 Post Congress Conference, and so the results will be considered and contribute to the revision of IMIA-NI's Strategic Plan. However, there are many other issues that will require work within individual countries and through collaborations between organizations in different countries; IMIA-NI is well-placed to facilitate those collaborations and take a global view towards assisting the development of nursing informatics internationally.

Closing Remarks

> Medicine in the early 21st century seems crude and barbaric to us now: foggy MRI scans, broad-spectrum drugs with nasty side effects, and patients who knew more than their doctors. Today's vibrant, dynamic, global 'healthscape' was unimaginable. The blooming of our health system was like the growth of the World Wide Web at the end of the 20th century. Now ubiquitous, powerful, and pervasive, its arrival was silent and largely unnoticed. What surprises historians today is that, as recently as 2020, people expected better health to be delivered by doctors (the medical professionals as they were then known) and by the economic juggernauts of the time, 'the pharmas.' To everyone's surprise, it was delivered instead by technologists riding the wave of the new media (formerly 'the press'). [4]

This quote, drawn from a paper in 2005 to illustrate one person's perception of a future, does address a theme of the NI2006 Post Congress Conference, the new practitioners of health care. There are many pictures of the future; which one will become reality is anyone's guess. However, careful examination of key factors in health, and society, will provide more reasonable and feasible futures than mere guessing and conjecture. The NI2006 Post Congress Conference has been one such forum exploring this topic and only the beginning of such meetings by nursing and other health professionals. Nursing informatics organizations will need to develop mechanisms for continually revisiting this kind of work, perhaps through regular events of this kind, or through online continuing work.

As part of the development of a pool of resources for the NI2006 Post Congress Conference participants to draw on, we developed a Connotea website (http://www.connotea.org/wiki/Group:NI2006 Post-Congress Conference Group 01), which allows gathering in one online space of references and materials that can help to inform the ongoing discussions of the many issues raised. We have also established a 'History of the Future' website (http://differance-engine.net/ni-futures/), which can serve as another area to bring together those

interested in taking forward the work to develop recommendations and actions to support the development of desirable futures in which nurses and nurse informaticians determine their own destiny, and the nature of nursing practice, education and research. This is only the beginning, an important beginning nonetheless. Future work focused on nursing informatics, and health care in general is, and remains, a work in progress, and we invite each and every one of you to be part of those discussions and contribute to the determination of desirables futures.

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The Impact of ICT on Health, Healthcare and Nursing in the Next 20 Years

June CLARK, DBE, PhD, RN, RHV, FRCN
Professor Emeritus, University of Wales Swansea, UK

Introduction

In the world of informatics, 2020 is light years away, and it is a brave (or foolish) person who tries to look that far ahead. I recently came across a book that was published in 1977 – not really so long ago – called *Science Fact*: *Astounding and Exciting Developments That Will Transform Your Life* [1]. Among some other little gems it said:

> "By 1990, developments in technology will mean that most people will be working a 3 day week and will be retiring at the age of 40."

As you may know, the UK government has just published proposals to raise the statutory pension age from 65 to 68 years. But the one I liked even better said:

> "The idea of everyone having a hand held or wristwatch sized transmitter and receiver to communicate with other people anywhere in the world is still in the realm of science fiction and unlikely ever to move out of it."

I think that's what we would now call a mobile phone.

I have recently been working as the only nurse member of a group set up by the Royal Society to consider "The impact of ICT on health and health care in the next decade". It was working in the mind-blowing company of six very prestigious professors of computer science and other experts such as the head of pervasive ICT research at BT (British Telecom) – people who know much more than I do about computers and ICT but who do not know so much about the daily realities of healthcare – that made me think about the perspective that I want to take today. It's not so much "How ICT will impact health, healthcare, and nursing over the next 20 years?" as "How can we use ICT to change healthcare to improve health?"

My focus is on the challenges for nursing – one might even say the barriers that have to be overcome – as we journey towards the Promised Land.

Our report suggests that developments in healthcare technology will drive more dispersed, and much more patient centred healthcare, with greater emphasis on maintaining health and preventing illness than at present, and with much greater patient involvement [2]. We believe that ICT will better enable patients to control their own health and healthcare, and that professionals will have access to all the health information they need for consultations which may take place wherever they are. ICT certainly offers a brave new world for healthcare, and there are great opportunities for nursing.

In this paper I focus on just five of the challenges that I foresee for nursing. For each one I take just one or two examples, drawn mainly from what is happening in my own country, for you to think about.

Challenge 1

The first challenge is to recognise that technological development should be needs led rather than supply driven.

By this I mean the need to focus on developments that will promote cure and facilitate care and not merely on those which appear technically "interesting" or "exciting"; and, in a context of finite resources, on developments which will maximise the health and quality of life for the greatest number of people.

It is a truism that we can put a man on the moon but we cannot meet the basic healthcare needs of millions of people around the word, even in our richest and most highly developed countries.

Later this week one of our work groups will be considering the societal changes that we believe will have the greatest impact on future healthcare and healthcare computing. We will be discussing the impact of demographic changes such as the ageing of populations which will increase the demand for care and shift the focus of disease management from acute to chronic diseases; of social changes such as changes in family structures which challenge our traditional reliance on care by relatives; the impact of improved education which changes people's expectations and perceptions of citizens' rights and responsibilities; the impact of migration and global travel; and others – all of which provide the context which will affect – but I think they should lead – our ICT future.

I'm looking for a change in which ICT makes a difference not only in the ITU but also in the nursing home, for people with mental health problems, for frail elderly people managing chronic illnesses in their own homes. The challenge is to ensure that ICT is directed towards meeting the real needs of society as they emerge over the next 20 years.

The example I want to use here is how assistive technology or telecare might help us meet the challenges of caring for frail older people in their own homes, especially at a time when changes in family structure mean that being old often also means being alone.

I use the term telecare to mean "the delivery of healthcare to individuals within the home or wider community, with the support of devices enabled by ICT" [3]. It has the potential to help societies meet the care needs of their elderly and infirm members, as well as younger disabled or chronically ill people, based on the premise that people in need of care should be able to participate in the community as much as, and for as long as, possible [4].

Shifting the delivery of care from hospitals to community settings is a major imperative for healthcare during the 21st century. As I have already suggested, developments in ICT will both drive and enable more dispersed and more patient centred healthcare. And nursing is all about "empowering people and helping them to achieve, maintain or recover independence" [5]. So telecare brings together the goals of all three.

Telecare includes access to information, physiological monitoring, and management of the environment – ideally an integrated system which supports input from a wide range of stakeholders and offers both proactive (monitoring) capability and reactive support for identified needs.

Sensors placed on (or in) the individual's body or in the environment (e.g. the home) collect data which is transmitted to a control centre which can immediately provide support or advice, trigger a response in the environment (such as turning off a cooker), alert a relative or neighbour, or process and transmit the data to another professional. The increasing availability of mobile and wireless technology will extend the range of equipment available – in our Royal Society work [2] we heard about "smart toilets" which monitor the contents of excreta for dietary content and metabolic imbalances!

The example I take is not the cutting edge. It could be anyone's grandfather in an ordinary town anywhere in the UK, now. First the story of what happens without ICT, then how telecare can help.

Mr Thomas is an 80 year old man who lives alone and has a fall. Some hours later a neighbour finds him and calls the local General Practitioner's (GP) surgery. The receptionist alerts the district nurse who goes to his house. She picks him up, puts him back to bed but can't find anything obviously wrong except some confusion. To be on the safe side she asks the GP (doctor) to do a home visit and he does so the next day. Unfortunately it is a locum GP who does not know Mr Thomas and does not know that he is not normally confused. Before the GP gets there, Mr Thomas has fallen a second time. The GP does not make a diagnosis as to the cause of the fall, but recognising that Mr Thomas is at risk on his own at home, he arranges for him to be admitted to a local care home for a "period of convalescence". (Convalescence from what is yet to be determined, but at least, he thinks, it will act as a "place of safety"!) Unfortunately the staff at the home don't know Mr. Thomas either. He is very miserable, and soon becomes bed-bound. His regular GP, returning from annual leave two weeks later goes to visit Mr Thomas in the residential home, and finds him in a very sorry state. He has extensive pressure sores, probably created when he lay on the hard floor for several hours two weeks before, and

worsened by the fact that he is now bed-bound in the home. He also has bronchopneumonia.

So the GP admits Mr Thomas to the local acute hospital, where he remains for the next three months, just surviving the pneumonia, desperately debilitated by the pressure sores and remaining relatively immobile. But the kind of medical treatment that acute hospitals provide is not what Mr Thomas needs. He becomes what is pejoratively called a "bed blocker," preventing the admission of acutely ill patients and receiving care quite inappropriate to his real needs. The hospital suggests that Mr Thomas should be discharged to a nursing home. By this time Mr Thomas has regained his cognitive function and some of his usual spirit and refuses to go. He says that it would kill him, and he is probably right. His nephew and niece don't want him to be institutionalised either. They request that he be considered for a rehabilitation programme and he is admitted to the rehabilitation unit. The rehabilitation unit does a good job. Two and a half months later Mr Thomas goes home. His sacral sores have finally healed. He is gaining some stamina. Initially he walks with a frame, but he discards that a few weeks later. He is back to writing books and managing well – until the next time!

Now, with ICT and telecare. At the time of his first fall Mr Thomas, like many thousands of elderly people, is wearing a pendant alarm. He summons help immediately, talks to and is reassured by the person at the call centre, who sends round an appropriate carer and alerts the GP. Even though Mr Thomas' regular GP, who knows him well, is on holiday, the locum (and the district nurse) are able to access Mr Thomas health record on the spot, including his last routine "overview assessment"; they know that he does not suffer from dementia and is not usually confused, and an infection is diagnosed and antibiotics prescribed.

The second fall alerts the team to the need for a fuller assessment. This includes discussion with Mr Thomas and his family and advice from the assistive technology department. An interim telecare package is quickly installed in Mr. Thomas home – there is no need to admit him for institutional "convalescence", and the speedy intervention prevents the pressure sores and the bronchopneumonia, so he doesn't need admission to the acute hospital. He goes to the rehabilitation centre but does not stay overnight. Telecare and careful care planning take account of the "supported risks". At the end of his rehabilitation programme his telecare package is reviewed and adjusted. The district nurse keeps in touch, using a planned programme of visits interspersed with telephone contact, ensuring support when it's needed. Mr Thomas remains in his own home, avoiding inappropriate admission to hospital; he treasures his independence, and feels safe in the knowledge that his well-being is monitored and help would be available if ever he needed it.

If Mr Thomas had been suffering from dementia, the difference between the two scenarios would have been even more dramatic. Technology can be used to improve orientation, compensate for short term memory loss, and

minimise risk. The voice of a family member can be used in reminders to eat or take medication. Devices can monitor when an individual places himself at risk, for example wanders at night.

Sensor technologies also enable new ways of managing chronic disease. Body sensor networks allow sensors to be placed on (or inside) the body to monitor many aspects of physiological state, including blood pressure, cardiac functioning, and blood sugar. These functions can be measured continuously to give early warning of abnormalities, even if the patient is miles away from the supporting health professional. This enables both patients and health professionals to avoid the inconvenience of long journeys and means that treatment need not involve hospitalisation. It also enables more and better self-care. The potential savings in nursing time are enormous. It also gives patients much greater control over their care, which research has shown to lead to better outcomes.

The economic benefits are also considerable. A study in Northamptonshire found that over the 21 month evaluation period, people without telecare were four times more likely to leave the community for hospital or residential care. The equivalent cost saving over the 21 months was £1.5 million [6].

I would not want you to think it was easy. Telecare is not yet widely available, at least in the UK, as part of mainstream services; the focus is still on research and development. In our evidence workshops we found that patients and carers saw problems as well as benefits. They were worried about the whole idea of "remote" care and whether it would increase social isolation. They were concerned about practical things like costs, being responsible for expensive equipment, insurance and maintenance. Some carers were afraid it would increase their burden of responsibility, and they didn't want their homes to look like a computer centre.

I believe that telecare will work best as an integrated system which supports input from a wide range of stakeholders and offers both proactive (monitoring) capability and reactive support for identified needs. It should enable people to participate in the community and should not lead to the replacement of human contact. Properly implemented, it has the potential to enhance the quality of face-to-face care, for example by replacing several rushed check-up visits by a community carer with a longer visit which allows them to do justice to the client's emotional needs.

Telecare can facilitate access to existing services, it can expand existing services to encompass health promotion and maintenance, it can create and deliver new services, and it can enable fewer staff to care for more patients It has the potential to contribute to a healthcare system that respects the dignity and privacy of individuals, gives them choices about the circumstances in which they live, and enables them to maintain social relationships [4].

My point is not just about the wonders of sensor technology. It is about recognizing the need to shift the focus of ICT, including the technology and the resources, to where it is most needed, from heroic treatment to health mainte-

nance, from hospital care to maintaining people in their own homes. And it demonstrates how the integration of telecare into nursing practice will enable nursing to make a better contribution to managing the frailty associated with an aging population.

So do we see ICT a driver of change, or an enabler of change? In our working group we discussed this long and hard, and we finally agreed that that it may be both. My challenge for nursing is to ensure that we lead – that we use ICT to create the future – and to serve the purposes that are relevant to our goals.

Challenge 2

My second challenge is to integrate technologies that are well developed and widely used in other fields into routine healthcare practice.

As we collected our evidence, we quite soon came to the conclusion that even if there were no new developments in ICT over the next decade and we limited ourselves to using what is available now, our healthcare system could be greatly improved. In particular, healthcare has been slow to adopt applications that are well established and widely used in other fields, and often quite inexpensive. I am thinking about things like interactive television, MP3 players and portable video players, computer games, and of course the ubiquitous mobile phone.

Recently the Times newspaper carried a report headlined "Lectures? Simply plug in!" which said:

> "Forcing undergraduates out of bed to visit campuses is not the best way to teach, researchers have found. Academics are investigating how they might use digital technology and MP3 players to help students. Lecturers are already using pod casts to supplement lectures… A trial pod cast mixing rap and information will be discussed today" [7].

Telephone helplines, using call centres, with call-handlers supported by algorithmic decision support systems, are now very well established in many countries. In the UK, NHS Direct, a helpline which is an integral part of the National Health Service, now provides health information of all kinds to callers, triages patients to other services, and deals will most of the "out of hours" requests for help.

Of course traditional telephone services are increasingly accessed through mobile phones, but mobile phones nowadays can do so much more. Already they can take pictures, transmit and receive email, and access the internet. Within the next few years much better broadband networks and wireless local area networking (WLAN) will become standard on cell phones, enabling converged voice, video and data services from home, office and street. The issue I raise is this: How quickly will these technological developments which are

driven by other purposes (e.g. mobile entertainment) come to be used in healthcare and become part of the stock in trade of the ordinary nurse?

I will take one very simple example – so obvious that I cannot think why it took so long – text messaging. Young people in particular do it all the time. My mobile phone provider texts me every week to try to sell me some new update. So why did it take so long to realise the potential for sending health messages – both to individuals and targeted groups?

A UK commercial company called Wireless Healthcare (www. wirelesshealthcare.co.uk) has published a report called *101 Things to do with a mobile phone in Healthcare* [8]. It covers, among other things:

- Appointment booking and reminders.
- Patient support for Alzheimer patients, diabetes sufferers, dementia sufferers, the deaf, the chronically ill, addicts, STD sufferers, and post cardiac surgery patients.
- Medication reminders.
- Access to dietary information.
- EPrescribing.
- Patient Paging In Outpatient Clinics.

The Royal College of Nursing recently produced guidelines for school nurses for texting school children [9], based on an investigation of current practice and associated best practice recommendations undertaken by Bernice Baker [10]. The report includes a review of the (somewhat sparse) literature, and of the (minimal) guidance provided by regulatory bodies. Baker notes that in her search of the nursing literature, text based nurse consultation is not sufficiently represented to warrant being defined as a category in its own right. Yet the case studies that she quotes demonstrate how useful this very simple method could be.

More sophisticated is a randomised controlled trial in progress (due to report in 2007) at the University of Oxford to determine the effect on blood sugar control of different strategies of blood sugar monitoring in people with diabetes [11].

The RCT has three groups – a control group in which blood sugar measurements, traditionally obtained, are interpreted to inform medication adjustment in face-to-face consultation with a nurse practitioner, a second group in which self-testing of the blood sugar is communicated by mobile phone and similarly interpreted, and a third group who not only self-monitor their blood sugar levels but relate their personal results to individualised pre-programmed advice in text messages developed by the nurse practitioner.

Once again, the issue is not just the wonders of mobile phone techno-logy, but how its use can be incorporated into nursing.

Challenge 3

The third challenge is that the introduction of ICT into nursing and healthcare is a social, not just a technical task. It's not about ICT as such, it's about change management.

This time I'm going to take as my example ICT developments in the National Health Service in England, and in particular the introduction of the electronic health record. We've heard a great deal about electronic health records this week, and it is clear that different countries are at different stages of development and implementation.

The situation in the UK is particularly interesting for two reasons: Firstly because the English programme is so big: it has been described as "the biggest computer programme in the world ever" [12]. It's not about introducing a system to a single hospital or even a group of hospitals. The UK National Health Service covers 60million people, over a million staff, and hundreds of hospitals and community based services. In addition to the introduction of the electronic health record, the programme includes:

- An electronic appointments booking system.
- A system for the electronic transmission of drug prescriptions.
- A picture archiving and communication system (PACS).
- A nation-wide broadband network to provide the necessary infrastructure.

No wonder there are problems in implementing it, especially within the very ambitious time-scale that the government has set.

The second reason is that political devolution has resulted in separate programmes for each of the four countries of the UK (England, Scotland, Wales and Northern Ireland), and there are different approaches to implementation in each country. So we have something of a natural experiment.

The English strategy is very top-down – driven by procuring systems from a small number of suppliers on very tough contracts and working to very tight timescales, and an EHR based on a spine database. The Welsh programme, on the other hand, is using a bottom up approach, based on developing consensus and securing "buy-in", with the development of a number of projects each of which is clinician led and patient centred; its EHR is initially a summary record which will be built up over time.

Implementation of the EHR involves huge issues of change management in a huge organisation. Time will tell, but it is important that experiences can be shared both within the UK and among other countries so that lessons can be learnt. The account by Scott et al. [13] of the implementation of an electronic medical record system in the Kaiser Permanente organisation in Hawaii offers several pointers – the importance of consultation, communication, leadership, decision making, education and training, and change management.

One of the lessons that are now clear is that in order for implementations like this to succeed, the clinicians who are to use the systems must be involved from the beginning in their design and development. Usually the term "clinicians" is taken to mean physicians. My challenge is the lack of involvement of nurses.

Quote: "The point is that if IT technicians design new electronic systems without knowing and understanding all these little things [about nursing], there is a big chance that the technology will not work as well as it could. That is why it's vitally important that the nursing family is involved from the start in informing the design of new technology, to ensure we get workable systems that successfully address many of the frustrations nurses currently encounter in ensuring streamlined care pathways for patients… What we really need now is for nurses, midwives and health workers to put it on their agenda immediately. They need to examine their current ways of working and start asking questions about how things could be improved in the future.

They need to start planning and training for when the technology comes in, rather than doing nothing and worrying that it's all going to be stressful and horrible.

By working together we can make things work between us, but if we sit on sidelines and carp it could be a self-fulfilling prophecy – and how terrible would that be." Interview with Heather Tierney-Moore [14].

This is, of course, absolutely right. But that quote comes from a recent interview with the nurse who was appointed just last year as the clinical lead for nursing in the Connecting for Health programme – when we were already several years into the developments, and when many of the key decisions had already been made. Only now are nurses in the UK beginning to become aware of what is going on, and only now is any real effort beginning to be put into involving them.

For the last three years the Royal College of Nursing has undertaken a survey among its members about their awareness of IT developments in the NHS. It is important to recognise that it is an on-line survey, so it will be biased towards respondents who are at least minimally interested in ICT – which makes its findings all the more shocking.

In the 2006 survey [15], almost two thirds of respondents said that they had little or no information about NHS IT developments. Although the vast majority of respondents (87%) said they thought it was important that practising nurses were consulted about electronic patient records, and nearly 70% felt that integrated electronic health records will improve their clinical care, nearly three-quarters (74%) said they had not been adequately informed about developments, and a quarter had received no information at all.

The survey also highlighted a major lack of training opportunities. IT training should be made available to most NHS staff, yet over half (57%) had not received any IT training at work over the previous six months. A large majority (88%) of the respondents used a computer daily at work, but over a third shared

a machine with more than twenty people. Having to 'fight' to get access to a computer was an issue for 11% of respondents.

Yet despite the poor level of involvement, respondents were positive about the need to develop IT capabilities in the NHS. Nearly 70% recognised that integrated electronic health records will improve their clinical care; indeed, sixty-three percent felt that without timely access to accurate and complete patient records, the care they deliver could be ineffective or even unsafe.

Why do we have this problem? Why is it that when nurses constitute the largest part of the workforce, and in this case will be the prime users of the systems, they are so little involved in their design and development? Some of the fault lies with nurses themselves, but it is clear that the organisational culture of healthcare disempowers nursing and makes nursing invisible. This is a problem that extends far beyond the field of ICT, and it has been much discussed elsewhere. In the nursing informatics literature, for example, it has been extensively discussed in relation to the development of standardised terminology to describe nursing and the inclusion of nursing data in clinical information systems.

I have two worries. The first is that the lack of involvement in the specification and design of the systems will mean that the systems will fail to "fit", much less support, nursing practice, and therefore will be rejected by nurses. Of course nurses will record the data because they will be required to do so. But my fear is that the EHR, instead of being seen as a wonderful opportunity not only for improving patient care but also for demonstrating the value of nursing, will come to be seen as just another task to be added to the busy nurse's workload, much as paper documentation is seen by many nurses now. And that nurses will, as nurses do, find "ways round it" by continuing to use their old working practices alongside the new.

My second worry is that this lack of involvement will result in a lack of nursing content in the EHR. This risk is exacerbated by the lack, at least in the UK, of an agreed nursing minimum data set and standardised terminology. In these two areas, I am sad to say that UK nursing lags far behind some other countries.

Without appropriate nursing content we will have just an electronic medical record. And we will have lost, perhaps for all time, the opportunity to use the retrospective analysis of aggregated data to develop nursing epidemiology and the identification and measurement of nursing outcomes – two really important goals which now, at last, are within our reach – but only if we get things right. The old mantra holds true – you can only get out what you have put in.

I mentioned that part of this problem is the fault of nurses themselves. In order to get what they need, nurses have to be able to say what they need. And in the UK at least, mainstream nurses understand so little about information management and information systems that even when they are offered the opportunity, they are unable to articulate their needs. The nursing involvement in

the various decision making committees becomes mere tokenism. For example, many nurses see the EHR as merely the computerisation of their existing documentation, which in the UK consists of unstructured narrative expressed in idiosyncratic rather than standardised terminology. I will come back to this in a minute.

In the UK I see an unfortunate separation between the very small group of nurse informaticists who see themselves as informaticists rather than nurses, and mainstream nurses who see computers as something only for "techies"(technicians) and nothing to do with real nursing. This is a major challenge for the Royal College of Nursing's Information in Nursing Forum which I have the privilege to chair. Our members are mainly nurse informaticists, but we know that the usefulness of ICT in nursing depends on the other 400,000 nurses who are members of the RCN. I have long admired the work of the American Nurses Association on ICT development in nursing, which goes back more than thirty years, but in the UK we have yet to get it into the mainstream agenda of either the professional associations or the nursing regulatory bodies. We need in all countries, as has been achieved in the USA, for nursing informatics to be recognised as a **nursing** speciality – and perhaps we will talk more about that in our post-conference workshops.

Challenge 4: Re-Thinking Nursing

We know that ICT both drives and enables new ways of working. Apart from all the legal issues concerning practice licensing and regulation, and the requirement to develop new technical and clinical skills, the introduction of ICT means that nurses will be expected to asses and communicate with patients remotely, establish a therapeutic relationship via a technological medium, and project a warm and caring persona in "high-tech-low-touch" environments. These things cannot be achieved without radical changes in working practices. But if ICT is to realise its full potential in nursing we need to ensure that new technology is fully integrated into nursing practice and not seen as an "add-on". This means that nurses need to learn not only new ways of working, but also new ways of thinking about nursing.

The problem is that there are two ways of thinking about nursing. The first way – sadly the model of nursing that currently prevails in most places, even among nurses themselves – sees nursing as a collection of tasks or activities – skilled activities which therefore require some training, and must be undertaken with care and compassion – but activities which are derived from the orders, decisions, purposes and knowledge base of other disciplines, usually medicine. I call this the "nursing is doing" model. Applying it to the use of ICT in nursing explains why it is said that nurses don't need to be involved in design and development and don't need to understand the concepts behind decision support systems – all they need is training to enable them to use them.

The second way sees nursing as the decision making which guides and determines the activities. This is what I call the "nursing is knowing" model. This model is the core of all professional practice: the professional (the doctor, the nurse, or the lawyer) uses his/her knowledge to understand the problems presented by the client and to identify ways of solving them. This model is encapsulated in the American Nurses Association's definition of nursing as "the diagnosis and treatment of human responses to actual or potential health problems (ANA 1980) and the Royal College of Nursing's definition of nursing as "the use of clinical judgement in the provision of care" [5].

This is the model that must underpin the use of ICT in nursing practice. It explains why nurses need access to knowledge sources, why decision support systems are relevant, and why it is important to record appropriate nursing content in the electronic health record – in short, it says (to quote the title of the IN Forum's recruitment leaflet) that "Information is the heart of nursing care" [16]. In this audience, I am sure that I am preaching to the converted.

Nursing is gradually moving, but in some places very slowly, from the first model to the second. My worry is that if ICT is integrated into the first model of nursing, not only will the potential of ICT be lost, but nursing itself will be diminished. What I fear is what some people have called "tick box nursing" i.e. using the technology to prescribe and record nursing activities in a way that requires little or no thinking, knowledge, or clinical judgement. This diminishes professional nursing, de-skills nurses, and accelerates the current trend towards inappropriate delegation of tasks to lesser qualified personnel (who are of course cheaper) – thus turning what is undeniably one of the benefits of ICT into a major abuse.

A while ago my husband was admitted to an Accident and Emergency department with severe breathing difficulties. (It turned out to be late-onset asthma, but we didn't know that until some time later). At the point of admission his vital signs were recorded, and he was given oxygen and salbutamol, and within a short time he was feeling much better, and was transferred to a ward. Soon it was time for the routine task of "doing the obs".

Nowadays, of course, this is computerised, and because "the machine does all the work" the task was in this hospital delegated to a health care assistant. She put the sensor on my husband's finger to measure his "sats" (oxygenation saturation level) and wrote down on the bit of paper she was carrying the figure that appeared on the screen. I could see that the figure was considerably lower than that recorded at the point of admission – indeed, dangerously low. As the lady was about to move on to the next patient, I pointed this out to her, saying that I didn't think the figure could be right, but what was she going to do about it? "Oh", she said, "I just write it down and then staff nurse charts it later. I expect the machine is broken" – and she took the cart away and replaced it with another one, which did indeed give a more realistic recording.

I also asked her why she was writing down the results on just a scrap of paper. "Well the doctor's doing his round" she replied, "so the notes are on the trolley.

I'll give it to staff nurse and I expect she'll fill it in later". The implications for patient safety are obvious.

ICT does challenge professional boundaries, and does enable fewer and lesser skilled staff to manage greater numbers of patients. Given the world-wide shortage of nurses, saving nursing time is an important goal, especially if the time saved by a reduction in the time spent on documentation and routine administrative tasks, can be redirected to direct patient care. The boundaries between medicine and nursing are changing rapidly, and the use of protocols and algorithmic decision support systems has enabled nurses to take on much of the work formerly done by doctors.

But changing working practices does not mean just reallocating roles and learning new technical skills. I believe that the key lies in understanding – and I mean really understanding – the care process, and representing it properly in information systems. This is one reason why the involvement of clinicians in system development is so important. The "nursing is doing" model (which can of course be applied to all healthcare professions) over-simplifies the care process as a linear progression of a series of steps. The way it is represented in care pathways and standardised care plans may confirm this impression.

And in documentation. Within the "nursing is doing" model, docu-mentation is just another (boring) task, which has to be done only because of fear of litigation. Within this model the EHR just means the computerisation of existing documentation to make it more legible and to get rid of all the paper. But the significance of documentation is that it is the visible or tangible representation of the thinking that is the core of professional practice. Computerisation enables much more sophisticated modelling which can incorporate the real complexities, iterations, and interactions of the care process. It is really important that this is reflected in the systems that nurses are offered to record their practice, not only for the sake of the care of individual patients, but also to achieve the goal of "record once, use many times, for many purposes". The work of people like Linda Aitken in the USA [17]), and Walter Sermeus in Belgium [18] demonstrates the power of mining data obtained from nursing documentation, but the results can only be as good as the quality and completeness of the data entered.

There are lots of ways of constructing the model, but this is the one that my colleague Anne Casey teaches, which also demonstrates the place of decision support systems [19] (Table 1).

In the UK we have some particular problems with moving towards this kind of model. We do have examples of good practice, but generally we have huge barriers to overcome. Firstly, there is a basic resistance among UK nurses to the whole idea of standardisation – based on a total misunderstanding of what it means. We know that standardisation is essential for comparison and interoperability, and integral to computerisation. The global informatics community is making great efforts to achieve standards that are internationally agreed. UK nurses rightly   hold dear the concept of individualised patient care,

Table 1. Decision support systems (from Casey)

Practice	The Record	Decision support system
Trigger E.g.: referral, admission, walk-in	Referral communication Record a reason (referral, admission, walk-in)*	
Plan assessment Decide what to assess and how Select tool	Record tool	Suggest assessment tool
Assess E.g.: observe, take history	Record assessment data	Plot Calculate score Suggest possible diagnosis or action or trigger automatic action
Make diagnosis E.g.: Make a judgement (probable diagnosis/es) Validate with patient	Record diagnosis/es	Knowledge source about various diagnoses Suggest expected outcomes, pathway, actions
Agree expected outcomes (goals) E.g.: Using knowledge of what is possible Agree with patient what is acceptable	Record agreed expected outcomes	
Plan E.g.: Decide what to do, when, when, how, by whom, including plan for review, discharge etc	Record planned actions*	Knowledge sources Protocols
Act E.g.: Monitor, treat, care, refer, discharge	Record completed actions* Record variance from pathway Communication re referral, discharge etc.	Guidelines
Review E.g.: Make judgement about outcome and effectiveness	Record outcomes*	

Notes:
1. Although this kind of tabulation suggests a linear process, the ordering may vary (e.g. Trigger can lead straight to Act, Act can lead to Plan Assessment. Steps may be repeated and may take seconds or months.
2. The system support listed is illustrative only and is not comprehensive e.g. At any point the user can look up knowledge sources, or print the record or information for the patient.
3. Items marked * are mandated by the Nursing and Midwifery Council (NMC).

and reject anything that they interpret as standardising practice. But they fail to distinguish between standardised practice and, for example, standardised terminology; despite the UK government commitment to the use of SNOMED-CT, standardised nursing terminologies such as NANDA and ICNP are largely unknown in the UK, and may be actively rejected on the grounds that "we need to use language that patients understand" [20]. In its guidance on documentation, the Nursing and Midwifery Council (the body which regulates nursing in the UK) explicitly rules out the use of templates.

Secondly, while everyone here understands the importance of structure, and the ability to link elements within the record to one another, in the UK current nursing documentation consists largely of unstructured narrative.

Thirdly, we still teach and use the nursing process as a four stage linear process – assessment, planning, implementation, and evaluation. UK nurses do not use – indeed they actively reject – the concept of nursing diagnosis, and they do not include nursing diagnoses in their documentation. We know of course that whatever it is called, problem oriented recording is essential for the identification of outcomes and therefore the improvement of patient safety.

I believe that of course all professional practice involves diagnosis (ie identifying and naming the problem) – the only difference is in what the different professionals diagnose: doctors know about, diagnose, and record diseases (we call them medical diagnoses); nurses know about and diagnose conditions that are described as "human responses" [21] and these are what constitutes nursing diagnoses. But UK nurses are still trapped by the old mantra that "Only doctors diagnose". I am concerned that this inhibits the development of nursing knowledge and therefore the development of the discipline, but in the context of the electronic health record, it increases the invisibility of nursing and prevents recognition of nursing's contribution to patient care.

It also prevents the development of what I call nursing epidemiology – a slightly different spin on Norma Lang's famous comment:

> "If we can't name it, we can't control it, finance it, teach it, research it, or put it into public policy" [22].

We need to know the epidemiology of nursing diagnoses for several purposes. We need to be able to identify the conditions in order to undertake the basic research required to understand them better. We need to know which are the most common in different areas and specialities. We need them to plan services and for policy development. We need them for educational curricula to ensure competency for practice. We need to be able to relate them to management issues such as costs and resource allocation. In the UK certainly we have a long way to go.

The solution to all these problems must lie in education. And I do mean education, not just training. And education for nursing not just for ICT. Nurses need education to understand the concepts behind information systems as well as training to develop the skills required to use them – information management as well as information technology. We need a major revamping of basic nursing educa-

tion to shift from "nursing is doing" to "nursing is knowing" Only in this way can we truly integrate nursing informatics – defined, you will remember, as the combination of information science, computer science and nursing science. And only when this has been achieved will the full potential of ICT for nursing, and therefore for patient care be achieved.

Challenge 5: Rethinking the Nurse-Patient Relationship

The fifth and final challenge is probably the most important of all. What does all this mean for the patient, and in particular the nurse-patient relationship? The nurse patient relationship is the part of nursing that nurses most treasure. The introduction of ICT will certainly change it, and some people fear that it will damage it.

I believe it would be an abuse of technology if the use of ICT led to a "dehumanisation" of care and especially of nursing. In our Royal Society work [2] we identified the development of autonomous and robotic systems as one of the likely developments in ICT over the next decade, and we heard about the humanoid robots and mechanical pets already in use in the USA and Japan to reduce the loneliness of socially isolated people. Robots, like the other kinds of telecare that I have described, can support, but I do not believe that they can ever replace the magic of human contact.

I take just two examples of the ways in which ICT will (or is already) be impacting the nurse-patient relationship – the effect of patients' greater access to knowledge, and the use of ICT during consultation.

Greater access to information is already bringing a fundamental change in health care delivery: from a system driven by the provider to one driven by the consumer. ICT, and in particular the development of the internet, makes available information which was once available only to the privileged few. Family doctors have long complained about the demand that follows each new health scare reported in the newspaper or featured last night on the television, and they are now getting used to patients who arrive with the printout from the internet detailing their condition and the various treatment options. In the UK, where the NHS is expected to provide the best possible treatment without direct cost to the patient, there have been a number of high profile cases where patients have used their knowledge to demand, and obtain, drugs that are very expensive and not yet in general use. Information is power, and the possession and protection of esoteric knowledge has long been used by the professions, particularly in health care, as a source of power and control. With greater information available to the patient, much of the mystique of professional practice will disappear, and the power balance is changed.

Younger and technically–able patients who have high expectations about efficient and effective care that fits with their lifestyle are increasingly using ICT to access the latest information about their condition and care to challenge

professional care providers. They may turn to networks of peers for support and advice, and professional care providers may be used only as facilitators of self care.

The benefits of increased knowledge about how to stay healthy and how to care for oneself and one's family are well recognised. For example in the UK the NHS "expert patient" programme, which is designed to help patients with long-term conditions to take control of their lives, offers a six-week course that helps people develop new skills to manage their condition better. The training is run by people who themselves live with chronic conditions, who lead course attendees through sessions on subjects such as, diet, exercise, fatigue, breaking the symptom cycle, managing pain and medication, and communication with health care professionals. Since the pilot phase was launched in 2002, over 10,000 people have attended EPP training.

One problem of information obtained from the internet is the lack of quality assurance. There are an increasing number of sites run by respected experts such as the NHS Direct On-line Encyclopaedia (www.nhsdirect.nhs.uk) and the Best Treatments site run by the British Medical Journal (www.besttreatments. co.uk). But much of even this information requires interpretation, and I see a powerful "new" role for the nurse as a "knowledge broker", helping patients to access the information they need and to decide how to use it. As patients enter the health care system, nurses will, in addition to teaching them about their disease, help them to understand information about specialists, resources, and alternative treatments. The role is really a very old one – the same as in the days when after the "great white chief" consultant with his retinue had completed his ward round and given the "relevant information" to every patient, the ward sister went round to repeat and explain to each patient what the doctor had said!

There is also a new version of the traditional nursing role of working with vulnerable and disadvantaged people to overcome inequalities in healthcare – this time in helping to overcome what has been called the "digital divide" by working with those who are less able to access or exploit the new technology: e.g. poor and socially deprived people, people who cannot read, people with sensory deficits, and some elderly people.

The second example is the use of point of care recording. Point of care recording involves the intrusion of a computer as a "third party" in the consultation. To the professional with good communication skills, who routinely uses a lot of eye contact etc, handling an ICT device is no different from handling paper – provided that the device is appropriate for the particular environment and that s/he is confident with its use. The device must be as familiar and easy to use as a mobile phone has become to most people. However if the professional has poor communication skills, the ICT device may actively (albeit unconsciously) be used as a "protective" barrier.

Research into the effects of ICT on nursing consultation is sparse, but a recent study in Oregon, USA, which included a nurse practitioner alongside 24 family physicians and used interviews, participant observation and videotaped consulta-

tions [23] identified both benefits and problems. The researchers identified several factors that influenced how the computer was used, and found that their respondents developed three different styles for managing the consultation: some sat away from the computer and listened to their patients or turned the computer around to show patients what they were typing; some simply concentrated on the computer; and some gave equal attention to patient and PC. Those who saw the EHR as a means for collaboration were more likely to share the screen with their patients than who used it more narrowly as a medical record. The technology worked better for some kinds of encounters than others.

Based on their study, the authors have also created a list of ten "top tips" for doing it well. The simple ability to type was noted overwhelmingly as critical. The authors recommend using mobile monitors that both doctors and patients can see, telling patients what you are doing as you type, and not imposing the structure of the EHR on the structure of the interview.

Conclusion

I will end with a story that those of you who come from the UK will undoubtedly have heard before. It's Sean Brennan's story about computerised cows. It's the farmer's story really, and it goes like this: "Since I got my cows computerised", says the farmer, "life is good". "Before I got my cows computerised, I used to have to get up at 4.30 in the morning, rain or shine, and bring all the cows in from the fields to milk them, then take them all out again, then do the same thing all over again every evening. I had to check every teat on every cow for infection. I had to record each cow's milk yield, and adjust the feed accordingly. And then there was all the paperwork..." (For those of you who don't know about country life, you need to know that cows actually want to be milked regularly because their udders get full and uncomfortable, and that milking, even using a machine, is quite a complicated affair. Cows, like breast feeding mothers, can get mastitis, so prevention of infection is very important, and incipient infection must be identified and treated. And managing the economics means monitoring each cow's yield and adjusting the amount of feed.)

"But now", he says, "they do it all by themselves. Each one just saunters over to the milking parlour and gets milked whenever she wants to. How? Well they know that when they get to the milking parlour they'll get fed. Each cow has got a chip – a little tag on their ear. The system knows which cow it is by their chip, checks the last time it was milked, releases the right amount of feed, sterilises each teat, applies the right size of milking cup, and milks each teat one by one. It measures the milk flow and conductivity for each teat and plots them on a graph. The conductivity may indicate infection, and if the computer detects an abnormality – this is really clever – it sends a text message to the farmer, and instead of releasing the cow back into the field, it directs her into a quarantine pen to await the arrival of the vet. As well as actually milking the

cow, the system records her weight, her food intake, her milk yield, her conductivity flows, and her infection rates".

Now what has this to do with healthcare and the electronic health record? Well it's not just the wonders of the technology, marvellous though that is. And it's not just about recording data. It's about using technology to support the care (i.e. milking) process with decision support, alerts, and behaviour modification. And the aim is to make the milking process (the care process) safer and more efficient for the cow, and to make life easier for both cow and farmer. That's how I want ICT to be for nursing and healthcare.

I've argued that the impact of ICT on health, healthcare and nursing depends less on the technological developments themselves than on how we use them and integrate them into nursing practice. If we are to realise their potential, ICTs must:

- Meet real needs.
- Be fit for purpose.
- Support the care process.
- Be understood by users (professionals, patients, and carers).
- Be integrated into routine practice.

Rapid advances in ICT are revolutionising healthcare across the world. It could be argued that ICT is merely a powerful technological support to traditional ways of providing care, which will remain unchanged except for improvements in efficiency, safety, and effectiveness. Alternatively ICT could be seen as a trigger for the pursuit of a totally new healthcare paradigm that is focussed on a different kind of relationship a true partnership with patients who will be much more involved in and take control of their own health and healthcare management. I support the latter perspective.

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Schedules for the Post Congress Conference of NI 2006

When: June 14 – 17 June, 2006
Where: Phoenix Park Resort, Gangwon Province, Korea
Theme: Nursing Informatics 2020: Towards Defining Our Own Future

	June 14 (Wednesday)	June 15 (Thursday)	June 16 (Friday)	June 17 (Saturday)
07:30–08:00		Plenary Meeting and Presentations by Group Leaders	Breakout Group Meetings	Plenary meeting and Summary Report by Group Leaders
08:00–09:00				
09:00–10:00				
10:00–11:00				
11:00–12:00			Plenary Meeting and Progress Report by Group Leaders	
12:00–13:00		Lunch		
			Lunch	Departure from Post Congress Conference Site
13:00–14:00		Breakout Group Meetings		
14:00–15:00	Travel to Post Congress Conference Site		Breakout Group Meetings	
15:00–16:00				
16:00–17:00				
17:00–18:00		Dinner & Free Time	Dinner & Free Time	
18:00–19:00	Dinner			
19:00–20:00	Orientation and Introduction			

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List of Participants

Dr. Marion Ball

Professor/Fellow, School of Nursing Johns Hopkins University/IBM
USA

Ms. Robyn Carr

Director, IPC & Associates
New Zealand

Dr. Polun Chang

Associate Professor, Institute of Health Informatics and Decision Making
National Yang-Ming University
Taiwan/ROC

Dr. Insook Cho

Assistant Professor, College of Nursing Inha University
Korea

Dr. June Clark

Professor, School of Nursing Swansea University, Wales
UK

Dr. Amy Coenen

Associate Professor, College of Nursing University of Wisconsin-Milwaukee
USA

Dr. Moya Conrick

Lecturer, School of Nursing Griffith University
Australia

Dr. Connie Delaney

Dean and Professor, School of Nursing University of Minnesota
USA

Dr. Margareta Ehnfors

Professor, Dept. of Health Sciences Orebro University
Sweden

Dr. Anneli Ensio

Director of Research, Dept. of Health Policy and Management University of
Kuopio
Finland

Dr. W. Scott Erdley

Clinical Associate Professor, School of Nursing University of Buffalo
USA

Ms. Michelle Honey

Senior Lecturer, School of Nursing University of Auckland
New Zealand

Dr. Evelyn Hovenga

Professor of Health Informatics, Faculty of Business and Informatics Central
Queensland University
Australia

Ms. Elvio Jesus

Coordinator, Nursing Research Group of Madeira Serviço Regional de Saúde
Portugal

Dr. Kimikazu Kashiwagi

Assistant Professor, College of Nursing National College of Nursing
Japan

Ms. Rosemary Kennedy (SIEMENS)

Chief Nursing Informatics Officer, Clinical Informatics SIEMENS Medical Solutions
USA

Dr. Jeongeun Kim

Assistant Professor, College of Nursing Seoul National University
Korea

Dr. Sun-Mi Lee

Assistant Professor, College of Nursing The Catholic University of Korea
Korea

Dr. Margaret Maag

Assistant Professor, Adult Health University of San Francisco
USA

Dr. Heimar Marin

Professor, School of Nursing Federal University of Sao Paulo
Brazil

Dr. Peter Murray

Founding Fellow, Centre for Health Informatics Research and Development
UK

Dr. Susan Newbold

Lecturer, School of Nursing Vanderbilt University
USA

Ms. Karl Oyri

Nurse Manager and Researcher, The Interventional Centre Rikshospitalet-Radiumhospitalet Medical Centre
Norway

Dr. Hyeoun-Ae Park

Professor, College of Nursing Seoul National University
Korea

Mr. Aleksander Radenovic

President, Croatian Nursing Informatics Association
Croatia

Dr. Virginia Saba

Distinguished Scholar, School of Nursing & Health Studies Georgetown
University
USA

Dr. Kaija Saranto

Professor, Dept. of Health Policy and Management University of Kuopio
Finland

Dr. Ulrich Schrader

Professor, FB 2 Frankfurt University of Applied Sciences
Germany

Dr. Gyeong-Ae Seomun

Assistant Professor, College of Nursing Korea University
Korea

Dr. Satoko Tsuru

Associate Professor, School of Engineering University of Tokyo
Japan

Dr. Jim Turley

Associate Professor, School of Health Information Sciences University of
Texas
USA

Ms. Charlotte Weaver

Chief Nurse Officer, Cerner Corporation Cerner Corporation
USA

Dr. Graham Wright

Professor, CHIRAD University of Winchester
UK

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Group Members and Roles

Group 1: Technology developments applied to healthcare/nursing

Group Leaders:
Susan NEWBOLD (USA)
Karl ØYRI (Norway)

Group Members:
Amy COENEN (USA)
Anneli ENSIO (Finland)
Michelle HONEY (New Zealand)
Elvio JESUS (Portugal)
Hyeoun-Ae PARK (Korea)

Group 2: Changes in society at national and international levels

Group Leaders:
Marion BALL (USA)
June CLARK (UK)

Group Members:
Robyn CARR (New Zealand)
Connie DELANEY (USA)
Sunmi LEE (Korea)
Heimar MARIN (Brazil)
Virginia SABA (USA)
Satoku TSURU (Japan)

Group 3: Healthcare in the year 2020 – practice and policy

Group Leaders:
Moya CONRICK (Australia)
Graham WRIGHT (UK)

Group Members:
Insook CHO (Korea)
Evelyn HOVENGA (Australia)
Kimikazu KASHIWAGI (Japan)
Aleksander RADENOVIC (Croatia)

Group 4: What philosophical and theoretical issues will help us?

Group Leaders:
Peter J. MURRAY (UK)
James P. TURLEY (USA)

Group Members:
Margareta EHNFORS (Sweden)
Kaija SARANTO (Finland)
Gyeong-Ae SEOMUN (Korea)

Group 5: IT evolution to 2020: the potential in healthcare and informatics

Group Leaders:
W. Scott ERDLEY (USA)
Rosemary KENNEDY (USA)
Charlotte WEAVER (USA)

Group Members:
Polun CHANG (Taiwan)
Jeongeun KIM (Korea)
Margaret MAAG (USA)
Ulrich SCHRADER (Germany)

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