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Autor: Shaha, Maya

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The Science of Nursing – What It is About and Its Development

Maya Shaha*

1. Introduction

Scientific disciplines deal with the systematic development of knowledge by using standardised and recognised ways, the provision and collection of knowledge of a distinct field. The scientific discipline aims at addressing problems that surface or at solving them. Within science, knowledge is organised into theories or concepts. In nursing science, the so called metaparadigm concepts constitute the most abstract level of knowledge. These metaparadigm concepts are person, environment, health and nursing. At this level, the term person refers to any person within the science of nursing, be that the patient who may receive some care or the nurse who may provide care. The term environment refers to the person's situation and context, which may include a family and friends, the work environment or the care environment. Similarly, the environment also encompasses nurses' work environment, their background or the healthcare system. The term health refers to the cause that leads to the necessity of care. Health in that case incorporates health issues that have short term or long term effects. Finally, the term nursing refers to the nurses' work specifically that individuals obtain or need due to health issues. With the help of these terms, nursing science can be circumscribed and delineated (Rodgers, 2005).

For a scientific discipline to be recognised as such, a clearly defined focus is needed as well as a clearly delineated mission. The aim of the scientific discipline needs to be clearly visible and well known. In order to develop knowledge belonging to a scientific discipline, rigorous and credible research is essential. These studies are usually financially supported via tertiary funding bodies. In science, specific theories or other forms of structured knowledge are developed. Linking knowledge is another important part so that it can be used by researchers and scientists to innovate the field of science. It is also necessary to create links between theory, research and practice so that theory, research and practice themselves can be innovated and developed further (Meleis, 2012).

Nursing is not only a scientific discipline, but also a profession. A profession can be defined as: "an organised set of institutions, roles, and [people] whose business it is to apply or improve the procedure and techniques of the discipline" (Rodgers, 2005: 120). As such, nursing also has to fulfil other criteria than

those above and respond to the need to develop knowledge for nursing practice. In turn, this body of knowledge informs practice and is implemented. For the further development of nursing science and practice, it is essential to link research, theory, philosophy and practice (Meleis, 2012). Below, nursing science will be briefly described across the decades since its inception. It will also be aimed at demonstrating that nursing is both a science and a profession. By providing this overview, the role of nursing science can be better understood and its importance for today's healthcare systems delineated.

2. Nursing Science since its Inception

The works and studies by Florence Nightingale famously constitute the corner stone of nursing science. Florence Nightingale has introduced new knowledge about hygiene into the care of wounded soldiers in the Crimean war. Through careful observation and diligent recording, Florence Nightingale demonstrated that new knowledge in the hands of well-trained caregivers leads to superior health outcomes. Based on this success, Florence Nightingale continued in her way and established structured training for caregivers across the United Kingdom as well as influenced the construction of hospitals and other care institutions (Alligood, 2013; Rodgers, 2005; Woodham Smith, 1991). Prior to Florence Nightingale, nursing was executed on the one hand by persons trained in institutions with religious background or persons who did not really have a formal training and more likely were considered healers (Donahue, 2011; Nadot, 1994; Nelson, 2001). Written documentation of these early efforts was rare and if at all had emerged in close conjunction with religious contexts (Donahue, 2011).

* University of Lausanne, IUFERS, Rue de la Corniche 10, 1010 Lausanne.

E-mail: maya.shaha@unil.ch
www.unil.ch



Maya Shaha, PhD, RN, is senior lecturer at the University Institute of Higher Education and Research IUFERS of the University of Lausanne. Her expertise is in nursing theory and qualitative research methodology, in oncology and palliative care, and inter-professional collaboration. Her research activities include conducting and directing (inter-) national scientific projects in the field of nursing sciences. She also supervises Masters of Science in Nursing and doctoral students in nursing science and medicine in Switzerland and abroad. Since January 2012 she serves as a member of the National Advisory Commission on Biomedical Ethics.

However, the success of Florence Nightingale, which coincided with the advent of numerous advances and serious progress in the medical field, called for an additional group of health professionals other than physicians. These other health professionals, namely nurses, acted as assistants to physicians and provided comfort and support to patients and their families (Donahue, 2011). Subsequently, the field of nursing grew and it became evident that specific knowledge was needed to provide adequate preparation to the nurses (Donahue, 2011; Roy, 2015). Knowledge is essential for nurses so that the situation at hand can be assessed thoroughly and in its complexity. Subsequently adequate and tailored interventions can be applied to help manage the situation, to guide the patient and provide support also to the family. Ultimately, the intervention should be evaluated to identify room for improvement so that quality of care increases (Meleis, 2012; Roy, 2015). Emerging from these early efforts, the discipline of nursing has grown an ever increasing body of knowledge including theories for nursing practice (Donaldson & Crowley, 1978; Roy, 2015). The development of knowledge is the key to the development and growth of the science (Meleis, 2012).

Over the decades, a number of different periods can be identified through which nursing science has evolved. Depending on the involvement of the medical profession, on the possibilities for nursing training and practice, and on society's demands from nursing science, different foci can be identified (Table 1).

3. Inception of the Science

Around the same period of time that Nightingale documents her studies and introduces change, medical science moves forward in leaps and bounds. There are new discoveries about the functioning of the human body and ways to intervene in case of diseases. Nursing, at this time, is dominated by medical science. This discipline provides the body of knowledge on which nurses base their actions and interventions. The specificity of nursing was recognized, but development of a unique body of knowledge to nursing was not fostered (Risjord, 2010). Research was rare among nurses. They occasionally participated in epidemiological research that aimed at providing more insight into human functioning. Physicians constituted the predominant members of boards of nursing schools and, in effect, physicians ran the schools (Braunschweig & Francillon, 2010; Donahue, 2011; Nelson, 2001; Roth & Ludwig). Nursing schools were often affiliated to hospitals. The quality of education was variable, and nurses underwent an apprenticeship with learning on the job (Braunschweig & Francillon, 2010; Risjord, 2010).

4. Definition of Nursing

The knowledge base of nursing continued to draw on medical and other related sciences such as biology, sociology or psychology. However, a few nurses were either asked or decided by themselves to reflect on nursing, its content and its scope of practice (McEwen & Wills, 2007), thus the development of an unique body of knowledge for nursing was initiated. More research was conducted than before with an interest in educational and nursing context issues. The first interventions were developed, tested and implemented also with the help of specific funding (Risjord, 2010).

Nursing schools were moved from being affiliated to hospitals to become parts of universities. As a result, the education of faculty needed to be adjusted to university level. Doctoral programs were needed for faculty. However, as nursing schools were in their infancy at universities, doctoral programs were thought outside nursing, notably in education (McEwen & Wills, 2007). With the move of nursing schools to universities in the United States predominately, the influence of medical science was reduced (Roy, 2015).

5. Scope of Nursing

Nursing theories continued to be developed to describe nursing phenomena and to obtain explanations. These theories were abstract and provided guidance for nursing research, education, and also practice. In some instances, the theories had been developed to provide a curriculum for nursing education, and to promote course content selection and learning (Risjord, 2010). For example, Sister Callista Roy had been asked by her doctoral advisor and the school of nursing where she was working, to develop a theory to guide curriculum development (Alligood, 2013). Specific nursing knowledge became more important, and the influence of medical and related science continued to drop. Research was proliferating, but continued to focus on biological, social and medical aspects of the human being (McEwen & Wills, 2007). The definition of nursing proposed by Virginia Arvenal Henderson was adopted by the International Council of Nurses. This definition states that: "The unique function of the nurse is to assist the individual (sick or well), in the performance of those activities contributing to health or its recovery (or to peaceful death) that he would perform unaided if he had the necessary strength, will, or knowledge. And to do this in such a way as to help him gain independence as rapidly as possible." (International Council of Nurses, 2004).

Nursing education remained university-based, but now doctoral programs in nursing were also insti-

Table 1. Timeline of Knowledge Development in Nursing Science [based on McEwen and Wills (2007: 30), on Meleis (2012), and on Alligood (2013)].

Timeline	Nursing science	Nursing as a profession	Era	Knowledge sources	Impact on theory	Impact on research	Education
1848 onward	Inception of the science	Assistance to the medical profession	Silent knowledge	Dominance to medical profession	Hardly any theory development	Focus on epidemiological data	Nursing schools closely associated with hospitals
1940 onward	Definition of nursing	Assistance to the medical profession	Received knowledge	Drawing on other disciplines	First steps into theory building, use of theories from other disciplines	Focus on education, methodological debates, appearance of the journal of Nursing Research	Nursing education moved to universities
1950 onward	Definition of nursing and its scope, curriculum development	Basis for profession is laid down.	Subjective knowledge	Developing a new understanding of nursing	Theory building to describe and explain the role of nurses, introduction of different scopes of theory, introduction of practice theory	Focus on biological, social, and medical theories to explain human phenomena	Consolidating tertiary nursing education, doctoral nursing education programs
1970 onward	Moving science forward, becoming aware of the science-practice gap	Nursing science is expected to provide a body of knowledge for practice. Nursing is also perceived as an art.	Procedural knowledge	Evolving into a scientific discipline	Proliferation of theory building, guidance of the discipline, research and education, courses on theory analysis and application	Focus on patients, therapeutic relationship between nurse and patient, focus on statistical analytic procedures	Doctoral nursing programs
1980 onward	Finding was to link science to practice	Nursing science is perceived to not adequately represent practice. Nursing is also perceived as an art.	Constructed knowledge	Integrating nursing specific types of knowledge such as intuition and knowledge about self	Theory building with a focus on supporting practice, development of middle range theories	Focus on patients' experiences of disease situations, inclusion of families, theory development	Proliferation of graduate nursing programs
2000 onward	Extending the scope of practice, overcoming the science-practice gap,	Nursing is perceived as a professional discipline according to Donaldson and Crowley (1978) and as such nursing is a science and an art.	Transformational knowledge	Developing new nursing roles for nurses as part of the interdisciplinary healthcare team	Theory building based on research and with a focus on supporting practice, development of middle range and situation-specific theories	Focus on collaborative practice, health promotion and wellness	Proliferation of nursing interventions, effectiveness and interdisciplinary research

tuted. The American Nurses Association issued a position paper that required baccalaureate education as a minimal degree for nurse leaders, administrators, and supervisors. It was maintained that nursing education needed to be university-based.

6. Moving Science Forward

Although specific knowledge for nursing was developed, theories from other disciplines were still "borrowed" or "integrated". Debates about the core of

nursing surged, and the delineation of nursing from other scientific disciplines was questioned. In relation to other scientific disciplines, nursing differed substantially also due to the close association with nursing practice. It was debated whether nursing was an applied or a basic science, a profession or a scientific discipline (Risjord, 2010). This debate promoted the development of specialised theory-based knowledge, derived from and applicable to practice, so that the requirements of nursing practice could be

fulfilled (Donaldson & Crowley, 1978; Meleis, 2011). A number of theories were developed, and nursing diagnoses were initiated (Roy, 1975).

7. Finding Ways to Link Science with Practice

Theories developed in nursing before this period were considered too abstract and removed from practice. The influence of these theories remained limited, emphasising the need for theories with relevance to practice. More concrete theories, called middle-range theories, emerged, which were considered to better respond to practice needs (Liehr & Smith, 1999; Peterson & Bredow, 2009; Smith & Liehr, 2014). The emergence of qualitative research methods supported the aim to develop knowledge relevant to practice. At the same time, Cochrane initiated the movement of "Evidence-based practice (EBP)". The aim of EBP was to integrate and to provide this new knowledge to practice for use (Roy, 2015).

Besides nursing being established at university level as in the United States, societal changes led to the emergence of new nursing education programs on the Masters level such as the Master of Science in Nursing or Clinical Nurse Specialists. With the advent of these roles, the hold of the medical science on nursing disappeared (Risjord, 2010). To strengthen the unique role of the nurses, care plans were introduced into education and practice (Roy, 2015).

8. Extending the Scope of Practice

Today, nursing education is university-based almost world-wide (Roy, 2015). There is a unique body of knowledge to nursing that continues to grow (Meleis, 2012). This body of knowledge is now part of nursing education on all levels (Moehle, 2003; Risjord, 2010; Roy, 2015; Willman, 2000). Research encompasses quantitative as well as qualitative methods with a distinct emphasis on mixed methods and the use of technologies (Institute of Medicine., 2010; National Academies of Sciences, 2016).

Healthcare faces a growth of the elderly population, globalisation and migration. These changes are accompanied by increasing costs in healthcare that question healthcare delivery including workforce aspects. More and more, care encompasses the person needing care as well as the family. Therefore, new models of care need to be developed and implemented that take into account acute and chronic care, or long-term care. A revised definition of nursing has emerged provided by the American Nurses Association (ANA). According to the ANA, "Nursing is the protection, promotion, and optimization of health and abilities; prevention of illness and injury; alleviation of suffering through the diagnosis

and treatment of human response; and advocacy in the care of individuals, families, communities, and populations." (ANA, 2003: 6 in Meleis, 2011, chapt. 2). Therefore, nursing encompasses prevention and promotion of well-being as well as aspects related to disease and illness (Pepin, Ducharme, & K  rouac, 2010; Peterson & Bredow, 2009; Smith & Liehr, 2014).

9. Nursing Science in Switzerland

In the world, notably in the Anglo-Saxon world, nursing has emerged in the late 19th century. In Switzerland, the first nursing schools emerged at the same time (Nadot, 1994). These were affiliated with hospitals. Nursing was taught as an apprenticeship and there was learning on the job. At this time, the medical science dominated nursing education and employment (Braunschweig & Francillon, 2010). Changes occurred again from the 1960ies onward. During the time of the inception of the science, the definition, the scope of nursing, and moving science forward that manifested in the Anglo-Saxon world, medical science continued to dominate nursing in Switzerland. Only small steps toward independence were taken. A ground breaking leap forward was obtaining membership for Swiss nurses in the International Council of Nursing (Braunschweig & Francillon, 2010). Gradually, the publications of nurses in the Anglo-Saxon world became accessible also for nurses in Switzerland. The development of nursing specific knowledge became important and was more and more integrated into nursing education. For example, Sister Liliane Juchli provided a comprehensive textbook for nursing education and Verena Meier published on developing care plans. Nevertheless, nursing education remained at the level of apprenticeship. However, during the period of moving science forward, first forays into nursing research emerged. The development of nursing-specific knowledge through research continued in finding ways to link science to practice. A few nurses obtained Masters or doctoral preparation at universities outside of Switzerland. Upon their return, they developed educational programs that were closely linked to Masters Programs in nursing elsewhere. Nursing theories were also developed. Another important change was only introduced in the period of extending the scope of practice. At last, nursing education was moved to the tertiary level, and is now taught at universities of applied sciences health in Switzerland (Roy, 2015). In addition, the first institute of nursing science emerged at the University of Basel offering Master and doctoral programs. An institute of nursing science in the French part of Switzerland was opened eight years later, notably at the University of Lausanne. Nursing research is proliferating.

10. Nursing as a Science

Nursing has evolved over the decades from an apprenticeship with nurses learning on the job to a science requiring a university degree. Historical development has led to this situation, which was also due to the fact that society has requirements towards nursing. To fulfil these requirements and expectations, nurses today need to be very well educated. The increase of elderly persons in society, the manifestation of new diseases, new discoveries and related new knowledge, workforce issues as well as cost issues in healthcare, call for university-education and the development of a unique body of nursing knowledge. Thus, it will be possible to respond to society's needs.

What makes nursing unique is its body of knowledge and not the execution of specific tasks. For this body of knowledge, theory is essential as it offers guidance for research and practice and promotes science (Fawcett & Desanto-Madeya, 2013; Rodgers, 2005). The scientific discipline of nursing has grown over time emerging from these interactions (Risjord, 2010; Roy, 2015). Nevertheless, nursing theory remains a contentious area. There are two poles on either side of the continuum. Nursing theory is expected to provide description, explanation, prediction and prescription for nursing practice. In contrast, nursing theory represents the uniqueness of nursing and, therefore, is supposed to provide an encompassing view of the nursing discipline including knowledge generation and application. The controversies raised by these two poles continue to influence the role of nursing theory in nursing education (Risjord, 2010).

However, based on the introductory criteria of a science, it can be concluded that nursing today world-wide has a unique body of knowledge. There

are nursing theories published over the decades that continue to influence nursing practice. Nursing theory is developed. Research is conducted to illuminate, enhance or promote nursing knowledge and its implementation into practice. Pluralism of methods is advocated and employed. There are prestigious fellowships that support nursing research in particular. However, there are big differences specifically among funding mechanisms depending on the respective country and also within countries themselves. Nursing is defined and has a clear mission, namely providing support for patients and their families in health-related problems or for prevention and the promotion of well-being (Meleis, 2012).

Nursing research has evolved from being isolated efforts of individuals to group efforts with interdisciplinary collaboration. Representatives from clinical practice as well as from patient or family-groups are being more and more integrated into research projects. Channels of communication such as scientific conferences or peer-reviewed scientific journals as well as other means have been established promoting the dissemination of nursing-specific knowledge (Meleis, 2012; Rodgers, 2005).

Hence, the question whether nursing is a science or not has already been answered (Fitzpatrick & McCarthy, 2016). A scientific discipline proposes an area of interest of its own for research, education and practice. This area of interest is demarcated from other scientific disciplines (Donaldson & Crowley, 1978).

Nevertheless, further development of nursing theory and knowledge is needed in order to address future needs and to provide support to manage workforce-related issues such as penury and the challenges of limited financial resources. ■

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