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Development and implementation of nursing science at Swiss Universities (University of Basel, University of Lausanne)

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1. Why academic Nursing?

Like other Western countries, the Swiss health care system is confronted with challenges related to demographic and societal changes. These include an aging population, increasing prevalence of individuals living with one or more chronic conditions, shortages of healthcare providers and increasing healthcare costs (Biller-Andorno, 2015). Importantly, scientific discoveries are providing new avenues for treatment (e.g. personalized medicine, nanotechnology) (Schweizerische Akademie der Medizinischen Wissenschaften (SAMW), 2012; http://ec.europa.eu/research/industrial_technologies/nmp-nanomedicine_en.html, accessed 2016 July 11). In parallel there are increasing numbers of community dwelling persons living with multiple comorbidities who are becoming increasingly dependent on nursing care (OECD/European Commission, 2013) and this is also reflected in increasing intensity of nursing care in hospitals, long term care institutions and home health care settings (Bayer-Oglesby & Höpfinger, 2010). Transitions between healthcare settings remain a major challenge as they increase the risk for poor clinical outcomes (e.g. medication errors, unplanned re-hospitalizations, caregiver burden) and increased

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health care costs (Naylor, Aiken, Kurtzman, Olds, & Hirschman, 2011). Notably, the current construction of the acute care oriented health system has not been effective in responding to these challenges so far. Thus, the recent health policy strategy from the Federal Office of Public Health "Gesundheit 2020" and the Swiss Conference of Health Directors (GDK) have called for innovative approaches to tackle these challenges. They call for a strengthened Swiss health-care system via investments as for instance: development, implementation, and testing of new models in primary care; health promotion; patient safety and quality; empowering patients; and a healthcare workforce with more and better qualified professionals (Bundesamt für Gesundheit (BAG), 2013; Künzi et al., 2013; Swiss Conference of Health Directors and Federal Office of Public Health, 2012).

In Switzerland, nurses comprise the largest group of healthcare professionals and provide care in hospitals, long-term care institutions, home care and other settings. Presently, nurses educated at the tertiary level remain a small group in Switzerland (OBSAN 2011) yet academically-prepared nurses are increasingly becoming key members of interdisciplinary teams driving health care innovation at all levels of the healthcare system in close collaboration with other disciplines. They contribute to innovative approaches to clinical care, nursing education, policy and healthcare management by drawing upon diverse resources across clinical, translational, and health systems research.

Nursing science contributes to the development of novel solutions by providing the critical evidence supporting care. For instance, nursing science demonstrated that lower staffing levels are associated with higher mortality in surgical patients across Europe (Aiken et al., 2014). Further, longer shift length is associated with lower patient safety in hospital settings (Griffiths et al., 2014), and poorer working environment is associated with lower perceived quality of care in nursing homes (Zuniga et al., 2015) pointing to nursing being a relevant factor to consider in patients' safety and quality efforts. Moreover, evidence shows that interdisciplinary care models including an Advanced Practice Nurse (APN) result in improved health care outcomes and health care utilization outcomes (e.g. reduced mortality, hospitalization, length of stay) (Morilla-Herrera et al., 2016). APNs are nurses working in front-line clinical care with expanded clinical competencies who can take responsibility for a broader scope of practice. In addition to their clinical competencies they also have acquired scientific and system-change competencies during their Master's education. APNs drive

new models of care in different clinical settings and are thus crucial for innovation in clinical practice settings (De Geest, 2015).

2. History of academic nursing at Swiss universities

In contrast to North-America, Australia and other European countries, Switzerland is a relative newcomer in establishing nursing science as an academic discipline within the university landscape. In 2000, nursing science was first established as an independent academic discipline in Switzerland with the launch of the Institute of Nursing Science (INS) in the Faculty of Medicine of the University of Basel. In 2007, the Institut Universitaire de Formation et de Recherche en Soins (IUFRS) was founded within the Faculty of Biology and Medicine at the University of Lausanne. The last 15 years have thus been characterized by capacity increase in nursing science in Switzerland not only in university settings, yet also by the start of several nursing science programs within the Swiss Universities of Applied Sciences (UAS), as well as the establishment of nursing science units within University Hospitals (e.g. USB, Insel, USZ, CHUV).

The initiation of the two university-based nursing science institutes (INS-Basel, IUFRS-Lausanne) resulted from visionary preparation and planning of the respective faculties of medicine at UNIBAS and UNIL as well as their affiliated university hospitals. Several key nursing organizations were instrumental in supporting this development through lobbying and policy work.

In Basel, the Foundation of the Swiss association of Nursing Science (launched in 1995) and the Swiss Nurses Association were the driving forces in the launch of the INS as part of the Department of Public Health of UNIBAS' Faculty of Medicine. The INS is linked via Academic Service Partnerships (ASP) to the University Hospital of Basel, the University Hospital Insel in Bern, and the Association of Nursing Homes in Basel. ASPs enable and support strong structural links between universities and health services aiming to achieve higher levels of innovation by integrating research, education and services (De Geest et al., 2013).

The IUFRS was created in 2007 through a consortium of six institutions: UNIL, University of Geneva, Centre Hospitalier Universitaire Vaudois (CHUV), Hôpitaux Universitaires de Genève (HUG), Haute Ecole Spécialisée de Suisse Occidentale (HES-SO), Swiss Nursing Association (ASI-SBK) and La Source Foundation, with an academic anchor at UNIL and CHUV administrative infrastructures.

Admittedly nursing science was not new to Switzerland before 2000, as nurse scientists who had obtained PhD degrees from the United Kingdom or the United States had already conducted nursing research studies in the 1990s (Glaus, 1993; Kappeli, 1995; Kesselring, Dodd, Lindsey, & Strauss, 1986; Kesselring et al., 2001). Importantly, nursing science in Switzerland has had a strong clinical focus from the start, contrasting with developments in Germany where the focus of nursing science was primarily on management and education, and rather disconnected from clinical care. Nursing science institutes at Swiss universities developed a clear strategy focusing research and education activities on the core of nursing, i.e., frontline clinical care. This strategy was and is essential for nursing science being making a relevant contribution to Swiss health care by educating nurses for expanded clinical roles (e.g. ANP), by generating knowledge that fuels innovation in clinical practice environment, or by providing evidence and leadership in healthcare policy.

The research portfolio of both university nursing science institutes generates relevant findings that can guide clinical care health policy in Switzerland, while also being internationally competitive in focus and productivity (<https://nursing.unibas.ch/nc/forschung/projekte/>; <http://www.unil.ch/index.html>, accessed 2016 July 11).

In June 2016, a total of nine professors in nursing science are appointed at Swiss universities. Seven of these professors are female. At the University of Basel there are two full professors, one tenure-track assistant professor, and two non-tenure track assistant professors (<https://nursing.unibas.ch/institut/mitarbeitende/>, accessed 2016 July 11). At the University of Lausanne there are one full professorship, one associate professorship and one assistant professorship with tenure track (www.unil.ch/sciences-infirmieres). Importantly, some of these professors have joint appointments with the University Hospital Insel Bern, the University Hospital of Basel, and CHUV, while one assistant professor in Basel has a direct link with the Swiss nursing homes. These joint appointments are part of the 'Academic Service Partnerships' mentioned before (De Geest et al., 2013).

3. Bachelor's and Master's education in Nursing Science

Both UNIBAS and UNIL currently offer only graduate education (Master of Science (MSc) in Nursing and PhD in Nursing Science) (INS - Universität Basel Institut für Pflegewissenschaft Masterstudium Pflegewissenschaft, 2016; IUFRS – Université de Lausanne Institut universitaire de formation et de recherche en

soins, 2016). Undergraduate nursing education leading to a Bachelor of Science (180 ECTS) is offered since 2004 at the University of Applied Sciences of Western Switzerland (HES-SO) (in French and German) and since 2006 in the German-speaking part of Switzerland (BFH, 2016; FHSG, 2016; ZHAW, 2016). From 2000 till 2014 the INS at UNIBAS offered an abbreviated Bachelor's in Nursing Science (60 ETCS) program as a bridge for nurses with a basic nursing degree into the Master's program. This program is no longer offered since 2013 given the well-established Bachelor's education at the University of Applied Sciences.

Master's programs in Nursing Science curricula prepare graduates for Advanced Practice Nursing roles. The capacity for Master's in Nursing Science education has significantly increased in the past 10 years in Switzerland. Master's in Nursing Science curricula are offered at Swiss Universities since 2000 at UNIBAS (INS, 2016) and since 2009 at UNIL (IUFRS, 2016). While both universities' Master's programs are clinically oriented and have a significant part of their curriculum being dedicated to scientific and clinical training, they vary in some aspects in view of the structural embedment and other organizational characteristics linked to the inherent differences in development in nursing science between German speaking Switzerland and Romandie. More specifically, the Master's program at UNIBAS is solely positioned at the university. Master's students at UNIBAS program will acquire 120–180 ECTS (depending on the competencies they bring from their respective Bachelor's program). The Master's program at UNIL is offered in collaboration with UAS and students will acquire 90 ECTS as part of their Master's education. The finality of both Master's programs is Advanced Nursing Practice, however, since the curriculum reform in 2014 at INS, also a research track is offered to prepare nurses for a research career. Students in both university Master's programs have the benefit of being part of Faculties of Medicine and profit from access to advanced clinical training, partly inter-professional, as well as access to recognized international interdisciplinary research environments during their studies.

In addition to the UNIBAS Master's degree in Nursing and the UNIL – HES-SO Master's degree in Nursing, the three partnering Universities of Applied Sciences (BFH; FHS St. Gallen; ZHAW) are offering a joint MSc program in Nursing Science (90 ECTS) in German-speaking Switzerland since 2010. A Master's in Nursing Science curriculum is offered also by a private University of Applied Sciences (Careum) in Zurich (90 ETCS) since 2009 (Kalaidos Fachhochschule Schweiz, 2016).

3.1. Master's in Nursing Science at UNIBAS

The Master's program in Nursing Science at the University of Basel started in 2000 and was the first curriculum in the German speaking world offering Advanced Nursing Practice education. The INS curriculum, accredited in 2009, has been the blueprint for other Advanced Nursing Practice curricula in Switzerland and beyond since. The curriculum builds on the ANP competencies as described by (Hamric, 2014) WHO competencies for health care workers of the 21st century (World Health Organization, 2005) as well as on the international guidelines for ANP education (Institute of Medicine, 2010).

Courses offered reflect new developments in health care delivery (e.g. E-health, genomics in nursing, big data). Blended learning is increasingly used as a teaching method. Moreover, the INS strives toward inter-professional education in line with national and international priorities for higher education for health professionals. Master's students have the opportunity to do research internships in established research projects and experience academic research activities on-site. For their Master's thesis, students are embedded in research teams at INS or in Academic Service Partner institutions, providing a strong scientific support system. Furthermore, based on a survey across INS alumnae/i expressing a strong need for further clinical training and ANP role support after graduation, two important innovations as part of the curriculum reform were launched. More specifically, clinical education was increased to 150 hrs of mentored on-site clinical training in the student's own field of clinical expertise. In order to support students in their future role as Advanced Practice Nurses in inter-professional healthcare teams, a module facilitating the systematic on-site development of a future ANP role in collaboration with key stakeholders was created and very successfully implemented for the first time in the academic year 2015–2016.

The entry criteria for the Master's in Nursing Science study program at UNIBAS are a basic nursing degree (Bachelor's or higher education) and fulfilling educational requirements by the university (i.e., a Matura or a Bachelor's degree or equivalent). Students need to have 2 years of clinical experience after achieving professional qualifications, as training for Advanced Practice Nursing requires a solid clinical basis. Good English proficiency is also favored. Access to the Master's program is limited to a maximum of 30 study beginners each year (numerus clausus). Students who enter the Master's program with a Bachelor's degree in nursing science will need to acquire less ETCS compared students who enter with a basic nursing degree in combination with Matura. The number of

ETCS that are exempted depends from the content of the student's Bachelor's degree program.

Currently 78 Master's students in Nursing Science are registered at UNIBAS. These students are predominantly female (88%) and have a mean age of 34 years old (range 26–54). The majority (73%) of them work part-time, in diverse care settings. Master's in nursing science students at UNIBAS come from different parts of Switzerland (e.g., 21% canton of Zürich, 30% Berne, 20% Basel, 10% Lucerne/Solothurn/Aargau) (internal administrative data). Every year, also students from Germany, mainly Freiburg i.B., join the program (14%). 45% of students follow the full-time study program, the remaining 55% pursue a part-time model, which can be adapted according to personal preferences, working obligations and family planning.

A total of 186 nurses graduated successfully from the Master's in Nursing Science program at UNIBAS until now. According to an internal evaluation in 2015, more than 50% of INS graduates work as Advanced Practice Nurses or in similar clinical roles; and work in different settings, such as for instance, in university and other hospitals (60%), long-term institutions and homecare (15%), and/or as educators and researchers in universities and universities of applied sciences (25%). Forty percent of all master's theses of the Master's students who graduated at UNIBAS have been published in the scientific literature. Another submission of the paper is pending for another 26% of the graduates.

3.2. Master's in Nursing Science at UNIL

The Master of Science in Nursing Science (MSc SI UNIL and HES-SO) was introduced in 2009 at the Institut Universitaire de Formation et de Recherche en Soins (IUFRS). This programme is also based on ANP model has been accredited in 2012. Graduates attain competencies enabling them working as a clinical nurse specialist – which is one of the established APN roles.

The Master's in Nursing Science curriculum comprises 90 ETCS accumulated over 4 semesters full time (<https://www.unil.ch/enseignement/en/home/menuintst/masters/sciences-infirmieres.html>, accessed 2016 July 11). There is no 'numerus clausus' for the Master's in nursing science program at UNIL. Entry criteria include having attained a Bachelor's in Nursing Science (or equivalent) and at least two years of full-time clinical experience as a registered nurse and English proficiency.

The majority of the Master's students work part-time and mainly come from French-speaking cantons as well as from Ticino. To date, 90 students have successfully completed the program. Following obtaining their Master of Science in Nursing (MSc) degree, 43.4% of graduates work in clinical practice and 45.7% in Universities of Applied Sciences (UAS).

3.3. Continuing education towards Nurse Practitioners education at UNIBAS & UNIL

In response to the need for continued advanced clinical education as reported by INS Master's alumni working in clinical practice as ANPs, the postgraduate program Diploma of Advanced Studies ANP-plus (ANPplus) was developed. This successful program, which started in 2012 at INS (<https://nursing.unibas.ch/weiterbildung/fort-weiterbildung-am-ins/das-anp-plus/>, accessed 2016 July 11) prepares nurses for a nurse practitioner role (i.e. specific type of ANP role to take expanded responsibilities (scope of practice) in primary care, in care for chronically ill & the elderly). Further initiatives towards nurse practitioner education are underway in Switzerland. Currently, discussions are underway involving UNIL, HES-SO, and the University of Geneva to develop an inter-institutional collaboration fostering inter-professional health education at the Masters' level for nursing and allied health professions.

4. Doctoral Education in Nursing Science

The first Swiss PhD in Nursing Science program was initiated in 2004 at UNIBAS. Four years later, in 2008, UNIL also initiated a PhD in Nursing Science program. Both Master's degree of UNIBAS and UNIL provide the entry level for PhD education in nursing science. Also Master's in Nursing Science graduates from the UAS can enter in the PhD in Nursing Science programs at UNIBAS and UNIL yet specific rules apply at UNIBAS (see below).

Currently, 16 students have successfully completed their PhD in Nursing Science studies at INS-UNIBAS, and 12 additional candidates are currently registered in Nursing PhD programs. Eight students have successfully completed their PhD in Nursing Science at IUFRS-UNIL. An additional 12 candidates are currently pursuing their PhD studies. The total number of enrolled PhD Nursing students at UNIBAS and UNIL combined is expected to grow to 30 by 2020.

PhD graduates from UNIBAS and UNIL work in research-oriented roles (either as postdocs or university assistant professor positions), teach in UAS or nursing schools, work clinically in APN roles, or assume positions in health policy. The demand for PhD-prepared nurses remains high in light of the

need for teaching and research roles at UAS and the need for leadership roles in to drive innovation in different domains of the Swiss healthcare system.

4.1. PhD in nursing science at UNIBAS

The Faculty of Medicine at the University of Basel has different 'Promotionsfächer', one being Nursing Science. Successful PhD students obtain the degree of "Dr. sc. med. Pflegewissenschaft". The PhD in Nursing Science at UNIBAS is embedded in an interdisciplinary platform for PhD education for health sciences within the Faculty of Medicine at UNIBAS, i.e., the PhD Program Health Sciences (PPHS) (<https://pphs.unibas.ch/>, accessed 2016 July 11).

The PhD Nursing Science program at UNIBAS consists of the development, realization, and evaluation of a scientific project and participation in course work for a total of at least 12 ECTS and 18 ETCS when also registering for PPHS. The number of ETCS can be higher depending on former training. More specifically, the entry of Master's degree graduates of the UAS in the UNIBAS PhD program has been outlined in a document specifying the pathway for admission to the PhD given the discrepancies in scientific preparation between Master's students of UAS and UNIBAS. UAS students when accepted in the UNIBAS PhD program in nursing science will have to acquire 24 additional ECTS during their PhD education. Professors of UAS can be part of doctoral committees at UNIBAS.

It is expected that a PhD student successfully completes his or her PhD within three years, with part-time options extending the total time frame from four to five years maximally are possible. PhD research topics should be strongly aligned with the research portfolio of the INS (i.e., self-management in chronic illness, patient safety and quality, new care models, and genomics in nursing), in order to guarantee close collaboration and mentoring during supervision and expertise in the evaluation of the dissertation. PhD students at the INS can profit from a robust research infrastructure and can also benefit from the research infrastructure of the faculty of medicine (e.g. clinical trial unit) as well as from the many formal and informal academic collaborations the INS has developed with leading foreign universities (<https://nursing.unibas.ch/institut/institut-fuer-pflegewissenschaft/jahresberichte/>, accessed 2016 July 11).

4.2. PhD in Nursing Science at UNIL

The PhD Program in Nursing Sciences (PhD) at UNIL is anchored at the Doctoral School of the Faculty of Biology and Medicine along with the Medical Doctoral Degree (MD-PhD), the Interdisciplinary Life Sci-

ences PhD and the Neurosciences PhD. The Faculty of Biology and Medicine grants the degree "PhD in Nursing Science" after successfully completing the program. It includes the development, realization and evaluation of a scientific project and 30 ECTS with some exceptions made for prior research training and experience. Students are expected to complete their study within three years. In some cases, this may be extended to 5 years based on part-time studies. The UNIL-IUFRS has a strong ongoing collaboration with the HES-SO that contribute to the research capacity building of the UAS. UAS faculty can serve as members of PhD committees.

Further, PhD nursing students benefit from established collaborations with other UNIL Institutes, such as the Institut Universitaire de Médecine Sociale et Préventive (IUMSP). Collaboration with other UNIL Faculties and departments (e.g. Faculty of Social Science and Policies) provide enriching experiences for PhD students. This is accompanied by numerous links with clinical departments within the university hospitals (CHUV, HUG). The IUFRS benefits from invited professors and international scientific collaborators from the United States, Canada, Australia, United Kingdom, Germany, Austria, Sweden and the Netherlands. The active participation in the Swiss Cochrane Group as well as the Joanna Briggs Institute positions the IUFRS for translating research into practice. IUFRS is establishing a formal research infrastructure for nursing science via academic service partnerships with Cantonal University Hospitals in Lausanne (CHUV). These partnerships provide access for clinical and multisite research.

4.3. SPINE: A nursing specific educational infrastructure for nursing science PhD students in Switzerland

Different educational platforms for PhD education have been developed in Switzerland at the national or local level (e.g. Swiss School of Public Health; PhD Educational Platform Health Sciences (PPHS-UNIBAS), and the Doctoral School of the Faculty of Biology and Medicine (UNIL)). However, no educational platform existed that specifically targets PhD in Nursing Science education at a national level in Switzerland. Thus, the Swiss PhD Platform in Nursing Science Education (SPINE) was designed as an educational platform aiming to specifically enhance doctoral-level nursing education in Switzerland. SPINE was officially established in 2014 (start 2015) with funding from SUK and as a joint venture between UNIBAS and UNIL. SPINE fosters doctoral nursing education in line with European and international standards (Heinimann, 2013; Henly et al., 2015; League of European Research Universities (LERU),

2010, 2014; European Commission, 2011). SPINE, in line with the aim of SUK, provides structured supervision and training of PhD in Nursing doctoral students which contributes to scientific socialization (e.g. courses, networking). It leverages existing research and educational infrastructures to provide opportunities to PhD nursing students that enhance their scientific and leadership efficiencies. Envisioned outcomes are first, to enhance the scientific rigor of PhD nursing education in Switzerland and subsequently, to grow the available pool of highly skilled nurses able to improve research capacities, teaching and training, and provide leadership to address current and emerging national healthcare issues.

SPINE consists of 4 instruments, i.e., a) summer courses, b) doctoral student research day, c) doctoral student courses, and d) supervision. It offers thematic training through intense summer courses focusing on topics relevant to cutting-edge nursing and allied healthcare research, such as "Developing Behavioural Interventions for Older Adults", "Big Data for Better Patient Safety" and "Genomics and Science of Symptom Management." The summer schools foster intellectual exchange, collaboration, and networking with the inclusion of faculty and doctoral nursing students from other countries who are interested in the program offerings.

In the fall 2015 SPINE invited doctoral nursing students to organize the 1st Annual SPINE Doctoral Student Research Day, titled: "Building Bridges in Nursing Science; exchanging research - enhancing knowledge." The aim of the doctoral student research day is to encourage and mentor doctoral students to present their research projects, develop communication skills, and benefit from peer reviews and senior researchers' feedback, which help deepen the academic rigor of doctoral nursing education and provide essential skills in forging a research career.

Doctoral nursing students affiliated with SPINE can also benefit from doctoral level courses. Specific course offerings perceived as highly relevant and needed for the majority of PhD in nursing science students of UNIL and UNIBAS are under development. A survey has been performed among PhD students to inquire what would be most relevant content. Overlap with course offerings of other PhD programs or platforms is avoided (i.e. PPHS, SSPH+). Examples of topics under consideration are mixed methods and implementation science. Courses are offered in an online or blended learning teaching format allowing students, independent of geographic location, to take part in the course. In order to support PhD students for a successful and productive own research pro-

gram, one day courses focusing on specific competencies or transferable skills are also part of SPINE. For instance, in the coming year these one-day courses will focus on research administration including budgeting, developing research infrastructures at the level of a research team and at an institutional level.

Qualified supervision of doctoral students is an essential component of a successful PhD program. Standards, metrics, and quality indicators are needed in view of academic requirement for supervisors, responsibilities, supervisor-student relationship and the need for a co-supervisor. Investment in quality and quantity of doctoral supervision is therefore an integral part of SPINE. SPINE created a "Supervisors Committee", consisting of a network of doctoral supervisors, which elaborates quality standards for PhD supervision and addresses regularly-occurring issues that emerge during doctoral education, promotes exchange of good practice, and gives opportunities for additional training. Network members meet regularly and exchange on experiences.

SPINE is a unique inter-university collaboration to develop capacity in nursing science. Students not only profit from the instruments offered by SPINE but also have access to all senior nursing science

experts in Switzerland. Through the international linkages of the SPINE program the Swiss doctoral nursing students are also exposed and are able to profit from input of international leading nursing science experts. Swiss doctoral nursing students are part of a common culture created through SPINE and collaborate on several initiatives. Students' feedback so far indicated they particularly appreciate the opportunity for networking and the quality of teaching from the faculty.

Conclusion

While nursing science is a relatively new discipline, the past 15 years have been characterized with major capacity building for Master's and PhD education in nursing science. Nursing science at Swiss universities has a strong clinical focus. There are two university institutes, i.e. the Institute of Nursing Science (INS) in the Faculty of Medicine of the University of Basel and the Institut Universitaire de Formation et de Recherche en Soins (IUFRS) at the University of Lausanne. Both institutes work in close collaboration especially in view of PhD in Nursing education through the Swiss PhD Platform in Nursing Science Education (SPINE). Nursing science at Swiss universities aims at creating innovation for Swiss health care through its educational and research programs. ■

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