Evolving Role of the Nursing Informatics Specialist

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Abstract. The scope of nursing informatics practice has been evolving over the course of the last 5 decades, expanding to address the needs of health care organizations and in response to the evolution of technology. In parallel, the educational preparation of nursing informatics specialists has become more formalized and shaped by the requisite competencies of the role. In this chapter, the authors describe the evolution of nursing informatics roles, scope and focus of practice, and anticipated role responsibilities and opportunities for the future. Further, implications and considerations for the future are presented.

Keywords. Nursing informatics specialist, role function, connected health, data science, big data, personalized medicine, clinical intelligence, virtual care

1. Introduction

By 2018, 22 million households will use virtual care solutions, up from less than a million in 2013. Average (healthcare) visits among these adopter households will increase from 2 per year in 2013 to 6 per year in 2018, which include both acute care and preventive follow-up services in a variety of care settings—at home, at retail kiosk or at work. [1]

Nursing informatics roles have taken many forms in focus and function over the last decades; suffice it to say that they have not been consistently described or defined in terms of scope of practice. At the time of this writing it is clear that role of nursing informatics specialists will continue to evolve at an increasingly rapid rate in the coming years. The unfolding of new health care paradigms will bring greater connectivity between care providers and patients, include a wide array of emerging technologies and an increasing emphasis on data analytics will make the integration of informatics competencies into every area of nursing an imperative.

2. Brief history of roles of the past and present

The earliest and most common types of informatics work assumed by nurses has included: oversight of organizational workload measurement systems, project leadership, systems educator, and nursing unit or departmental information technology resource. In many instances, these roles were enacted on the basis of a specific identified organizational need and were often secondments to the Information Technology Department. It was not unusual for these roles to have the designation of

"IT nurse" [2]. As role responsibilities and job titles have been widely varied, so have the qualifications for each. The need for more specificity and consistency in nursing informatics roles has been recognized for several years [3, 4, 5].

The advent of formal education programs for nurses interested in specializing in informatics has occurred in conjunction with increasing sophistication in the use of information and communication technologies (ICT) in clinical practice settings. Today, nurses have the option to pursue specialization and credentials at a variety of levels including graduate specialization and specialty certification. Advanced credentials and certification (e.g., Certified Professional in Healthcare Information and Management Systems - CPHIMS) have afforded nurses the opportunity to achieve credibility and legitimacy regarding the specialty informatics knowledge and skills they bring to bear in nursing practice and academia and healthcare in general [6]. This credibility has been recognized with the development of executive level positions such as the "Chief Nursing Informatics Officer" (CNIO) in some countries. The position of the "Chief Medical Informatics Officer" (CMIO) is much more prevalent and deemed essential in medium and large health care organizations while the C-level nursing counterpart remains less common. Several authors [7-11] have described the role and competencies for these senior informatics positions, yet the valuing of these positions remains limited among health care provider organizations.

In addition to the evolution of formalized training programs for nurses interested in informatics, the specialty of nursing informatics has continued to evolve and has become recognized in local jurisdictions, nationally and internationally. Groups of like-minded nurses have organized into special interest groups affiliated with larger interdisciplinary organizations (e.g., International Medical Informatics Association - Special Interest Group on Nursing Informatics (IMIA-NI-SIG)). Organizations such as the Canadian Nursing Informatics Association (CNIA), the American Nursing Informatics Association (ANIA), the Nursing Informatics Working Group of the European Federation for Medical Informatics (EFMI-NURSIE) are examples of forums for nurses to network, collaborate and profile their work in informatics. The existence of these specialty organizations has served to further legitimize the work of nurse informaticians and provided a venue for advancing regional, national and international efforts in nursing informatics. Through conferences, meetings and the offering of educational sessions, virtually and face to face, these networks of nurse informaticists have collectively advanced the practice and science of nursing informatics. A case in point is the International Nursing Informatics Congress and post-conference, now held bi-annually and hosted by countries across the globe. Outputs of these meetings include publications such as this one; benefitting nursing informatics specialists and the nursing profession worldwide.

At the time of this writing, we find nursing informatics specialists in virtually every clinical practice setting. The roles and focus of their work endeavors are wide and varied. The titles of "informatics nurse", "nurse informatician", and "nursing informatics specialist" are but a few of the titles applied to nurses working in the field. Many of the roles of the past and present have been more extensively described elsewhere [2,12]. For the purpose of this chapter, the authors use the title of *nursing informatics specialist* to provide illustrations of the potential focus of these roles current and future.

Roles to date have largely focused on supporting acquisition, implementation and evaluation of clinical information systems in health care organizations. As noted by McLane and Turley [4], *"informaticians are prepared to influence, contribute to, and mold the realization of an organization's vision for knowledge management*" (p.30).

Nurses have been in pivotal roles at every step of the systems life cycle and instrumental in the success of deployments at every level of an organization. From the provision of executive oversight, project management, systems education and training, and analytics, nurses in clinical settings have become core to organizations' information management infrastructure and support.

In addition to health care provider organizations, nursing informatics specialists can be found in the employ of technology vendors, retail outlets, and consulting firms while many others have created their own entrepreneurial enterprise. Over the last few decades, technology vendors, hardware and software, have come to appreciate the invaluable contribution of nurses to the development, sales and deployment of their solutions. Throughout the world, nurses are also engaged in academic pursuits to advance the knowledge base of nursing informatics through the conduct of research.

Efforts are underway in many countries to advance the adoption and integration of entry-to-practice informatics competencies into undergraduate nursing programs. Notwithstanding some of the ongoing gaps in the provision of informatics content in undergraduate nursing education, many courses and programs have been taught in a variety of post-secondary education institutions over several years by nursing informatics specialists. In fact it is not unusual for many nurses to develop an interest in informatics through a single course and subsequently pursue further studies and employment opportunities.

Since the early 90's many graduate level courses and degrees, certificate and certification programs have been developed and offered world-wide. Nurses have pursued these opportunities recognizing the necessity of informatics knowledge and skills now and particularly into the future, as they face an increasingly connected world of digital healthcare. To a large extent, the core competencies of the nursing informatics specialist have become essential for all nurses and expectations of the specialist role will continue to evolve even further.

3. Emerging roles for nursing informatics specialists

The healthcare sector continues to evolve in the application and use of technologies to support the delivery of care. Factors including: a) rising health care expenditures, b) the increasing incidence of chronic disease, c) the ubiquity of technology, d) an aging demographic, e) personalized medicine, f) mobile and virtual healthcare delivery, g) the emergence of consumer informatics, h) genomics, i) big data science, and connected health are and will continue informing the evolution of nursing informatics roles.

One of the main challenges we have to cope with is the difference in growth rate that is exponential for the new technology and knowledge yet is still linear for changing human behavior, learning, organizations, legislation, ethics, etc, A linear growth rate is mostly represented by a function in a form like $y(x) = ax+b$. An exponential growth rate is mostly represented by a function in a form like $f(x) = ka^x$. For example: In an exponential world where the information is doubling every year, 5 exponential years would equal to 2^5 or 32 linear years which has a massive impact on the management of professional knowledge. In reality, we estimate that knowledge development in healthcare, which has doubled every century until 1900, is now estimated to double every 18 months. And the pace is getting faster. This means that when nurses finish their education, the knowledge they gained might be already outdated. The traditional way of developing procedures, protocols and care pathways, sometimes requiring a year to develop, are outdated when they are finalized and are

insufficient to guide future practice. The only way forward is to integrate and embed the new knowledge in electronic patient records using algorithms and decision support systems so that practice remains aligned with new knowledge and insights. The impact might be that best practices can change very quickly and what is viewed as best practice before your holiday leave might be different upon your return to work. Making the connection between these different dimensions of time will be a key-role of the evolving role of the NI specialist.

A second challenge is that clinical practice in the future will be largely team based. The nature of teams will include interprofessional teams, patients and their relatives and a wide range of virtual devices (internet of things - IoT) that are all connected. Teams will work across boundaries of organizations and will be organized around a particular patient. We still have to come up with new labels for naming these temporary virtual interprofessional patient teams. Practically it will mean that nurses will be (temporary) members of different teams at the same time. This notion of teamwork is in contrast with what we normally see as teams organized in organizations, departments and units. It will challenge how teams will be managed, led, and evaluated. But it will also challenge the communication within teams and the exchange of information.

3.1 Virtual and connected care

The delivery of health services virtually is becoming commonplace in many places around the globe. Virtual care has been defined as: *"any interaction between patients and/or members of their circle of care, occurring remotely,* using *any forms of communication or information technologies, with the aim of facilitating or maximizing the quality and effectiveness of patient care"* [13, p 4].

The most common modalities of virtual care are currently in use in telemedicine. Telemedicine has been largely used to conduct remote medical consultations, assessments and diagnosis (e.g., teledermatology, telestroke, telepsychiatry) through the use of computer technology and associated peripheral devices including digital cameras, stethoscopes and opthalmoscopes, and diagnostic imaging. More recently, the tools of telemedicine have been extended to the provision of remote nursing monitoring and assessment particularly for individuals with chronic diseases such as congestive heart failure (CHF) and chronic obstructive pulmonary disease (COPD). The nurses providing these tele-homecare services are not necessarily informatics specialists but the design and management of the monitoring tools, infrastructure and support services may be provided by them in the future.

Another emerging area of nursing informatics practice will likely focus on the use of remote monitoring technologies such as sensors and alerts embedded in structures (e.g., flooring, lighting, furniture, fixtures) and appliances (e.g., stove, refrigerator) in the homes of citizens. These tools offer the promise of supporting seniors to maintain a level of independence in their own homes longer, particularly those with cognitive or sensory impairments. Such devices might trigger direct messaging to providers, lay and professional, flagging potentially harmful situations and affording early intervention as necessary. Different types of sensors (e.g., sleep, activity, falls, ambulation, continence, fluid and electrolyte) will also contribute new supplementary data to health information repositories, offering the possibility of linking to other data sets and provide new insights to the well-being of individuals in the community especially the aged and those living with chronic illness.

With the increasing use of consumer health solutions such as patient portals and smartphone apps for self-monitoring and management of health and disease, nurse

informatics specialists will likely play a key role in their support and development. From the perspective of application design and usability, and training, nursing input and informatics expertise will be important to ensure appropriate and safe use of these tools. As individuals and their families become more active participants in their care through the use of applications and devices to connect with providers, they will likely also need expertise and support from the nursing informatics specialist.

3.2 Knowledge generation and innovation

The traditional ways of new knowledge generation is through research and the dissemination of findings in research journals. Knowledge is consumed by researchers and clinicians who transform it into relevant guidelines and care pathways. The time between the generation of research findings and application in the real clinical work can take several years. It is generally estimated that it takes an average of 17 years for research evidence to reach clinical practice [14]. Therefore clinicians are not always aware of existing evidence. In a landmark study, McGlynn et al. [15] evaluated the use of evidence-based guidelines in 30 conditions and 439 indicators for the use of the same. They showed that clinicians (doctors, nurses) only apply 50% of them in their daily practice. The use varied from 80% for structured conditions such as cataract to 10% for unstructured conditions such as alcohol addiction. There is also a lot of research demonstrating that nurses lack knowledge related to common procedures. Dilles study illustrated [16] that nurses lack sufficient pharmacological knowledge and calculation skills. Baccalaureate prepared nurses' pharmacological knowledge averaged between 60% and 65% of the level expected. Segal et al. [17] analyzed the use of hip arthroplasty care pathways in 19 Belgian hospitals finding a high variability in providing evidence-based interventions. While post-op pain monitoring is in 100% of the care pathways, pre-op physiotherapy was only present in 25% of the care pathways.

In the future of connected health, there will be direct links to knowledge generated by specialists from around the world. New knowledge will be automatically integrated and embedded into electronic patient records, and include new algorithms for decision support systems. It is interesting to note that Hearst Health Network, one of the largest media and communication groups in the world, is taking a leading role in healthcare. They started an intensive collaboration among strong health knowledge companies such as First Databank (FDB), Map of Medicine, Zynx Health and Milliman Care Guidelines (MCG). FDB is a United Kingdom company specialized in integrated drug knowledge to prescribe medication, follow-up drug interactions, improve clinical decision making and patient outcomes. Map of Medicine was created in the UK for clinicians by clinicians. It offers a web-based visual representation of evidence-based patient journeys covering 28 medical specialties and 390 pathways. Zynx Health offers a similar story from the US to provide evidence-based clinical decision support system solutions at the point of care through electronic patient records. MCG produces evidence-based clinical guidelines and software and is widely used in the US, UK and Middle East. Other examples of health information networks are CPIC (Clinical Pharmacogenetics Implementation Consortium) to help clinicians understand how available genetic test results could be used to optimize drug therapy, the International Cancer Genome Consortium (ICGC) which facilitates data sharing to describe genomic sequences in tumor types among research groups all over the world. In the information models, such as archetypes and Detailed Clinical Models (see section C chapter 1) offer summaries of evidence for specific clinical concepts.

Likely one of the most significant areas of focus for nursing informatics specialists in the near term is data science and the use of "big data". Big data has been defined as: *"large amounts of data emerging from sensors, novel research techniques, and ubiquitous information technologies"* [18, p. 478]. Access to big data unveils a whole new sphere of informatics opportunities related to health and nursing analytics. According to Masys [19], big data is *"that which exceeds the capacity of unaided human cognition and strains the computer processing units, bandwidth, and storage capabilities of modern computers".* The future development of nursing capabilities in data science will essentially lead to an entirely new cadre of nursing informatics specialists whose work will focus on deriving new nursing knowledge from not only electronic health record data, but also the data from sensor and remote monitoring technologies, patient portals and mobile apps described above. The implications of -omics data such as genomics, metabolomics, and proteomics, being included as part of the electronic health record in the near future, should be taken into account. Nurse informatics specialists will be pivotal in assisting to identify potential ethical and practice implications in the use of these data.

Using big data, the knowledge generating process might be reversed into practice-based evidence where data from electronic health records, patient portals, sensors etc. are uploaded into large databases that identify patterns and clinical interesting correlations. An example of the power of analyzing large datasets is the Vioxx-case (rofecoxib). Although a clinical trial initially showed no increased risk of adverse cardiovascular events for the first 18 months of Vioxx use, a joint analysis of the US FDA and Kaiser Permanente's Healthconnect database of more than 2 million person-years of follow-up, the NSAID arthritis and pain drug was found shown to have an increased risk for heart attacks and sudden cardiac death. [20] After the findings were confirmed in a large meta-analysis, Merck decided to withdraw the drug from the market worldwide in 2004.

With the proliferation of these emerging data sources and databases, the nursing informatics specialist will play a key role in the use of these data to inform quality and safety improvements in every practice setting.

3.3 Sharing knowledge and communication

In the realm of the new normal of connected health, nurses will work in temporary teams around patients. Within these teams it will be essential that goals are clear and shared, that roles are defined and accepted and that the way of working is clear to everyone. It requires systems for coordination and communication to ensure the continuity of care. Reid et al. [21] defined continuity of care as: "*how one patient experiences care over time as coherent and linked; this is the result of good information flow, good interpersonal skills, and good coordination of care*". They make a distinction between information continuity, relational continuity and management continuity. Information continuity consists on one hand in the exchange and transfer of information among health care providers and to patients and on the other hand how the knowledge of the patient is accumulated. It is about their specific knowledge, preferences, expectations, social network. With the existence of the new technology of the quantified self, it is important that these new data are effectively integrated and connected. Relational continuity consists of the trusted relationship between patient and healthcare provider. Increasingly advanced practice nurses are assuming this pivotal role within the health team. Management continuity is referring to a consistent and coherent approach to the health problem across organizations and

boundaries. The Belgian healthcare system offers an interesting example of this: General Practitioners are stimulated (financially) to prescribe generic drugs. Hospitals are stimulated to negotiate discounts with pharmaceutical companies leading to brand named drug choices. Although they might chemically be identical, for the patient they often are not as they have different names. Like drugs may be different in size and color leading to more medication errors as patients may take two pills without being aware that they are the same drug.

Although nurses spend a lot of time documenting care, the accuracy of nursing documentation has been found to be poor. In a study within 10 Dutch hospitals, Paans et al. [22] found that within 341 patient records the accuracy of documentation of diagnoses was poor or moderate in 76% of the records. The accuracy of the intervention documentation was poor or moderate in 95% of the patient records. Only the accuracy for admission, progress notes and outcomes evaluation and the legibility were acceptable. The work of Connected Health should support the documentation systems of nurses and other health professionals. The use of structured documentation methodologies and standardized terminologies should improve the quality of the patient record and improve the capacity for comparability of care processes and outcomes across the care continuum and within patient care groups.

3.4 Impact of connected health on the Scope of Practice of Nurses and Advanced Practice Nurses (APN)

In Connected Health, the scope of practice of nurses will change. For example, based on time and motion studies, it has been shown that nurses spend 5-7% of their time [23, 24] collecting vital sign data. In the future this work will be assimilated by sensors and other devices. However, nurses' work will be more focused on analyzing the data and evaluating thresholds for action (e.g., alerting rapid response teams). Another example is the use of sensors for pressure ulcer monitoring [25]. The used sensors will provide information about patient temperature, skin humidity, pressure points and position. These data will generate a whole new set of information for review and action including pressure intensity map and humidity intensity maps. These data would lead to more precise management of pressure sores. Other examples of data gathering that will change the focus and processes of nurses' work include: barcode scanning for checking identity of patients, patient and device tracking systems, and robotic dispensing of medication.

Patient access to their own records and partnering in their own health will change the roles of physicians, nurses and hospitals drastically. The work of nurses will increasingly shift from a direct care provision to the role of knowledge broker in helping patients to understand care alternatives, manage their health, and navigate information access.

4. Impact of connected health on the evolving role of the Nursing Informatics Specialist

Connected health will alter the future role of the nursing informatics specialist and require a new set of competencies. To a large extent these competencies will build upon existing competencies but have an increasing emphasis on information use rather than technology use. Table 1 provides a summary of the anticipated new competencies

and role responsibilities that are likely to be necessary for Nursing Informatics Specialists in the emerging world of connected health and the IoT.

Table 1. New competencies related to the future role of nursing informatics specialists

New Competencies	New Roles
Knowledge Innovation and Generation	• Provide guidance and support to others (nurses, patients) in the application and use of emerging knowledge (e.g., clinical decision support, Practice-Based Evidence (PBE), genomics, expert and patient/citizen knowledge) • Inform-teach others (clinicians, teams, patients) about new knowledge and knowledge innovations relevant to specific situations • Provide direction and support to others in the use of international guidelines and knowledge • Contribute internationally to new knowledge generation and innovations ensuring the inclusion of relevant team member and patient perspectives and expertise
Monitoring the use of new technology	• Monitor and maintain vigilance over data/technologies to identify those that add value to a given health situation. • Recognize that nurses, other clinicians and patients may engage and assume responsibility independently and or interdependently for specific data (e.g., remote monitoring, self-monitoring, wearables, appliances). • Recognize the emergence of patient self-service and relevance of patient expertise in specific situations.
Value judgement & quality assessment	• Provide guidance as to the value and relevance of specific data and information as derived from single or multiple sources for any given set of circumstances, or health situations.
Change Management	• Identify the broader scope and considerations for change management in the context of connected health (e.g., virtual and physical participants/partners) • Recognize the extended complexities of technology adoption in the context of connected health.
Communication & Documentation	With increasingly complex and personalized approaches to health care, participate in the identification and/or development of new: • models of clinical documentation • methods of communication • data standards • terminology standards • data sources • data models • data repositories
Data Analytics	In addition to traditional quantitative and qualitative analyses, support and participate in the development and use of new approaches and methods of data analytics for: • knowledge generation (e.g., natural language processing, experiential data) • reporting outcomes • demonstrations of value (e.g., patient-caregiver perspectives, health and financial outcomes) • predictive and retrospective analyses

5. Conclusion

The future Nursing Informatics Specialist will function in the context of virtual care delivery, be informed by data aggregated from a multiplicity of sources and real-time knowledge generation that will inform individualized care. In addition to the competencies required to date, they will be required to support other clinicians and patients and families as they assume new roles and use data analytics to interpret and appropriately apply new knowledge. With the IoT, connected care will pose as yet unknown challenges for the Nursing Informatics Specialist in the future; what is certain is that the role will continue to evolve from the role scope and responsibilities known today.

References:

[1] Wang H. (2014). Virtual Health Care Will Revolutionize The Industry, If We Let It. April 3, 2014. Forbes.
[2] Nagle LM. (2015). Role of informatics nurse. In K.J. Hannah, P. Hussey, M.A. Kennedy, & M.J. Ball (Eds.), Introduction to nursing informatics (pp. 251-270). London: Springer-Verlag.
[3] Hersh W. (2006). Who are the informaticians? What we know and should know. J Am Med Inform Assoc 13(2):166-170
[4] McLane S & Turley J. (2011). Informaticians: how they may benefit your healthcare organization. J Nurs Adm 41(1):29-35.
[5] Smith SE, Drake LE, Harris JG, Watson K & Pohlner PG (2011). Clinical informatics: a workforce priority for 21st century healthcare. Aust Health Rev 35(2):130-5. doi: 10.1071/AH10935.
[6] Health Information Management Systems Society(HIMSS) (2016). Health IT certifications. Retrieved September 28, 2016 from: http://www.himss.org/health-it-certification
[7] Harrington L. (2012). AONE Creates New Position Paper: Nursing Informatics Executive. Nurse Leader 10(3): 17-21.
[8] Remus S & Kennedy M (2012). Innovation in transformative nursing leadership : nursing informatics competencies and roles. Nurs Leadership 25(4):14-26.
[9] Kirby SB. (2015). Informatics leadership: The role of the CNIO. Nursing 2015 (Apr):21-22.
[10] Cooper A. & Harmer S (2012). Strategic leadership skills for nursing informatics. Nurs Times 108(20): 25-6.
[11] Simpson R. (2013). Chief nurse executives need contemporary informatics competencies. Nurs Econ 3(6) 277-87.
[12] Murphy J. (2011). The nursing informatics workforce: Who they are and what they do? Nurs Econ 29(3), 150-3.
[13] Women's College Hospital Institute for Health Systems Solutions and Virtual Care (WIHV) (2015). Virtual Care: A Framework for a Patient-Centric System. Retrieved from: http://www.womenscollegehospital.ca/assets/pdf/wihv/WIHV_VirtualHealth Symposium.pdf on April 14, 2016.
[14] Morris ZS, Wooding S, Grant J. (2011). The answer is 17 years, what is the question: understanding time lags in translational research. J R Soc Med 104(12):510-20.
[15] McGlynn EA, Asch SM, Adams J, Keesey J, Hicks J, DeCristofaro A, Kerr EA. The quality of health care delivered to adults in the United States. N Engl J Med. 348(26):2635-45.
[16] Dilles T, Vander Stichele RR, Van Bortel L, Elseviers MM. (2011) Nursing students' pharmacological knowledge and calculation skills: ready for practice? Nurse Educ Today 31(5):499-505.
[17] Segal O, Bellemans J, Van Gerven E, Deneckere S, Panella M, Sermeus W, Vanhaecht K. (2011) Important variations in the content of care pathway documents for total knee arthroplasty may lead to quality and patient safety problems. *J Eval Clin Pract.,* Aug 23, p.11-5
[18] Brennan P. & Bakken S. (2015). Nursing Needs Big Data and Big Data Needs Nursing. *J Nurs Scholarship* 47(5):477–484.
[19] National Institutes of Health Big Data to Knowledge. (2014). Workshop on enhancing training for biomedical big data. Retrieved from: http://bd2k.nih.gov/pdf/bd2k_training_workshop_report.pdf.

[20] Graham DJ, Campen D, Hui R, Spence M, Cheetham C, Levy G, Shoor S, Ray WA. (2005). Risk of acute myocardial infarction and sudden cardiac death in patients treated with cyclo-oxygenase 2 selective and non-selective non-steroidal anti-inflammatory drugs: nested case-control study. Lancet 365(9458):475-81.
[21] Reid R., Haggerty J., McKendry R. (2002). Defusing the Confusion: Concepts and Measures of Continuity of Healthcare. Canadian Health Services Research Foundation.
[22] Paans W, Sermeus W, Nieweg RM, van der Schans CP. (2010) Prevalence of accurate nursing documentation in patient records. J Adv Nurs. Aug 23, p. 1365-2648
[23] Mendonck K., Meulemans H., Defourny J. (2000), Tijd voor zorg: een analyse van de zorgverlening in de gezondheids- en welzijnssector, VUB Press, 126pp.
[24] Hendrich A, Chow MP, Skierczynski BA, Lu Z. (2008). A 36-hospital time and motion study: how do medical-surgical nurses spend their time? Perm J. 12(3):25-34.
[25] Marchione FG, et al., (2015). Approaches that use software to support the prevention of pressure ulcer: A systematic review. Int J Med Inform, 84(10):725-36.