

Strengthening the Oncology Nursing Workforce in Low- and Middle-Income Countries to Address the Growing Cancer Burden

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Introduction

This paper calls to action all stakeholders involved in cancer control, treatment, education, and research including ministries of health and education, non-governmental organizations, funders, and cancer advocates. Cancer has become a major non-communicable disease (NCD) in low- and middle-income countries (LMICs), where there is an inadequately prepared and insufficient nursing workforce. Therefore, it is imperative that ministries of health, nursing associations, academic institutions, and health care delivery organizations take steps to address this growing problem.

Successful cancer care requires a team approach, and knowledgeable oncology nurses play a crucial part in a functioning team. The goals of reducing cancer incidence, improving survival, and providing better palliative care cannot happen without the efforts of these nurses. Oncology nurses working in the community and at the bedside can deliver needed patient, family, and community education, implement early detection programs, administer treatments, identify complications, provide palliative care, and lead and collaborate on clinical research. Well-prepared oncology nurses have demonstrated a wide-ranging impact across the spectrum of cancer care in high-income countries (HIC). To benefit from this expertise, LMICs will need workforce capacity-building efforts to educate nurses in cancer care initiatives; efforts that require time, money, and political commitment.

The Growing Cancer Burden

Worldwide, cancer is a growing problem with an estimated 14.1 million newly diagnosed cancers and 8.2 million cancer deaths in 2012 (Ferlay et al. 2013). This increase stems from a growing and aging population, increased use of tobacco and alcohol, a greater prevalence of unhealthy diets and physical inactivity, occupational and environmental hazards, and the ongoing risk of infectious agents such as human papilloma virus and hepatitis B and C viruses.

Once primarily a problem of high-income countries (HICs), the burden of cancer has increased for LMICs, which now have 58 % of all new cancers and 65% of cancer deaths (Ferlay et al. 2013), with an estimated 22 million cancer deaths expected in the next two decades (World Health Organization 2014a). In most LMICs, cancer awareness remains low, access to screening and early detection services is limited, stigma hinders patients from seeking care, treatment availability is limited, and poverty restricts patients' ability to access and receive treatment if it is available. As the communicable disease burden declines in LMICs and NCDs such as cancer move to the forefront, the health systems and healthcare workforce in these countries are unprepared to meet the needs brought on by this shift.

The momentum to address the growing cancer burden in LMICs is building. The Institute of Medicine (IOM), the International Agency on Cancer Control (IARC), World Health Organization (WHO), the Union for International Cancer Control (UICC), and the United Nations (UN) General Assembly have all raised international attention to the growing cancer problem in LMICs. The Global Task Force on Expanded Access to Cancer Care and Control in Developing Countries (GTF.CCC) issued a call to action in 2010 that served to challenge the assumption that cancers will remain untreated in poor countries (Farmer et al. 2010). Their subsequent publication provides a blueprint for action in resource-constrained settings as part of efforts to improve health systems (Knaul, Frenk, and Shulman 2011).

This paper builds upon these efforts and focuses on the critical role that nurses with appropriate education can play in providing care to cancer patients across the entire cancer continuum, (see Figure 1) helping to improve cancer control in LMICs, and creating additional point of access to cancer care, particularly in settings where specialized care is rare and existing resources are strained.

In LMICs, insufficient nurse-to-patient ratios contribute to lower quality patient care, nursing burnout, and poor outcomes (Balbay et al. 2011; Baykal, Seren, and Sokmen 2009; Roger and Abalo 2014) highlighting the need for efforts to expand the nursing workforce. Nurses working in LMICs, however, face many challenges that make nursing an unattractive profession: low pay, poor working conditions, poor career structures, a lack of opportunities for professional development, conflicts with other professionals, and a feeling of inadequacy or stigma related to their work (Baykal, Seren, and Sokmen 2009, 368-375; Dovlo 2007; Awases, Bezuidenhout, and Roos 2013; Kanchanachitra et al. 2011; Nair and Healey 2006). Consequently, LMICs suffer from continuous nurse migration to HICs to find better pay and work conditions, exacerbating already dire local human resource shortages (Brush 2008; Prescott and Nichter 2014; Mackey and Liang 2012).

By highlighting the ways nurses can contribute to improving oncology care in LMICs, this report addresses the issues facing the workforce and includes recommendations to illustrate how health and educational systems can be used to strengthen the expertise and expand the role of oncology nurses in LMICs. Nursing education, the nursing practice environment, and opportunities for role expansion and research are not keeping pace with the growing need (de Carvalho et al. 2013). It is our intention that this paper serves as a *call to action* to focus attention and resources on the need for education and training of oncology nurses in LMICs.

Cancer Continuum

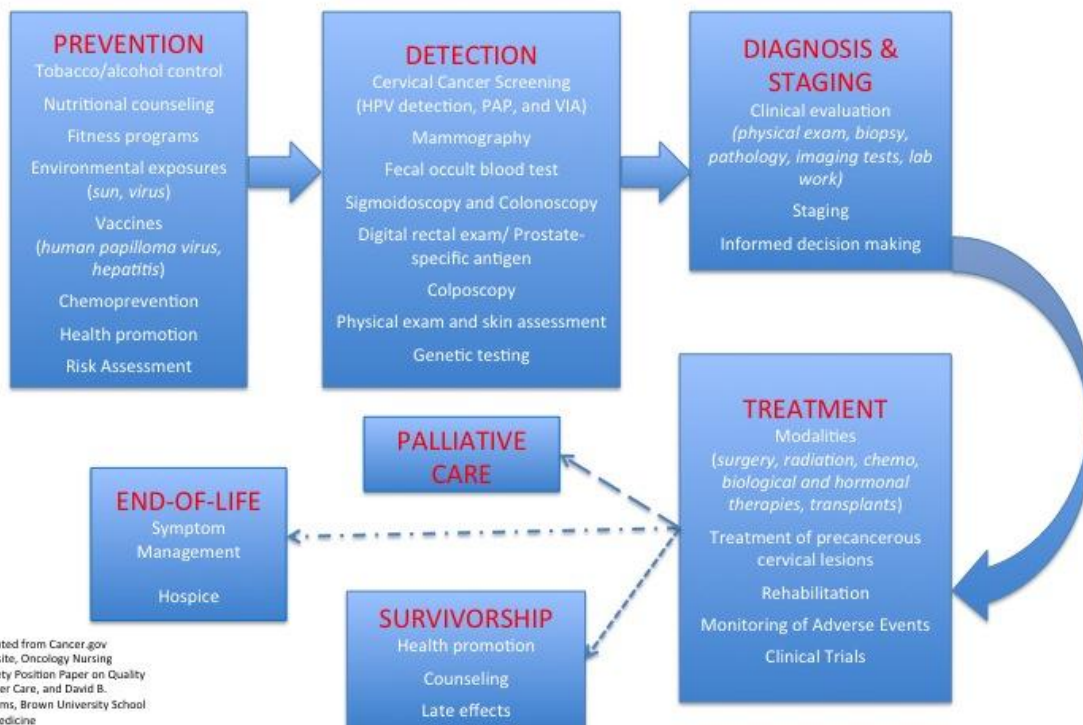


Figure 1. Cancer Continuum

Nursing's potential contributions to cancer care: What can be done in LMICs

In all aspects of the fight against cancer, nurses participate dynamically as part of an interdisciplinary team. A well-prepared oncology nursing workforce includes: generalist nurses who are prepared at the basic level and provide health promotion, risk assessment and care for people receiving cancer treatment in their general practice; specialized nurses whose primary focus is the delivery of cancer care and care for mostly people with or at risk for cancer; and advanced practice oncology nurses who provide cancer care at the Master's level of education or higher (see (Canadian Association of Nurses in Oncology 2006). Oncology nurses with Master's and Doctoral education contribute in advanced practice, education and scientist roles.

Adequately educated nurses can play many vital roles across the cancer control continuum; however, not all countries utilize nurses to their fullest capacity. As part of their Global Action Plan for NCDs, WHO recommended that nations "[optimize] the scope of nurses' and allied health professionals' practice to contribute to the prevention and control of non-communicable disease, including addressing barriers to that contribution" (World Health Organization 2012a), and there are many opportunities to maximize the impact of oncology-trained nurses in addressing the cancer burden.

Nurses' intimate knowledge of patient populations make them an obvious partner among oncology specialists to address the increasing public health burden of this group of diseases. Nurses trained as specialists in oncology could address public health cancer risks, such as smoking and obesity, as well as cancer-causing environmental and occupational hazards in their local areas. Oncology nurse researchers in LMICs could collaborate with epidemiologists, medical anthropologists, environmental health scientists, public health professionals, and health economists to gather the much-needed data to measure the efficacy of cancer prevention activities, cancer incidence and prevalence, and outcomes of people treated for cancer.

This section will outline what has been done in oncology, from prevention through end-of-life care and survivorship, by nurses working in countries of various resource-levels and what can be done in LMICs specifically to improve cancer-related outcomes across the globe.

Prevention - the unique role of nurses

One-third or more cancer diagnoses can be avoided by reducing risk factors such as tobacco use, improving diet and levels of physical activity, lowering alcohol consumption, eliminating workplace and environmental carcinogens, reducing exposure to radiation, immunizing against hepatitis B and C viruses, the human papilloma virus (HPV), and preventing infection with helicobacter pylori and schistosomiasis (World Health Organization 2014b). Nurses are uniquely positioned to successfully implement prevention interventions to address these risk factors –both at the individual and community level–given their accessibility to and active role in the communities. Disease prevention and health promotion have long been a part of nursing's scope of practice. Nurses are trained to keenly assess and identify risk factors and they have the communication and teaching skills to work with individuals, families and communities to change behaviors to reduce risk factors (Ayres 2009; Rwamugira and Maree 2012; Twinn 2001).

A Cochrane Review of 16 studies about tobacco cessation conducted in various HICs shows evidence that when attempting to quit smoking, the likelihood of reaching that positive outcome is increased when nursing-specific interventions are utilized (Rice and Stead 2013). Emerging research demonstrate that nurses are instrumental in providing effective smoking cessation intervention in LMICs as well (World Health Organization, 2012b). In vaccination programs, nurses also have been instrumental in educating the public about the importance of

vaccinations and implementing these programs in LMIC for viruses such as HPV, the cause of cervical cancer, and HBV, associated with increased incidence of liver cancer. A school-based, opt-out HPV vaccination program in Rwanda utilizing nurses reduced the two-decade delay in vaccine introduction between HICs and LMICs to five years (Binagwaho et al. 2012).

Screening and Early Detection - opportunities for expanded care

In order to improve outcomes, prevention must be coupled with screening and early detection measures. Early detection decreases the overall costs of cancer treatment (CanTreat International 2010; Wadler et al. 2011). With additional training, nurses can perform the broad range of interventions that contribute to screening (Lourenço, Mauad, and da Costa 2013; Twinn 2001), early detection and even treatment of precancerous lesions (World Health Organization 2012a). With nurses performing these activities, the few available physicians and oncologists can focus on tasks that require their specialized skills (Joshi et al. 2014; Magrath and Sutcliffe 2014).

In LMICs, a patient's first encounter with the health system is often with a community health worker (CHW) at the dispensary (community) level; however, CHW and nurses' knowledge of cancer, cancer risk factors and signs and symptoms in many LMICs is low (Mutebi et al. 2013; Akhigbe and Omuemu 2009; Wadler et al. 2011; Andsoy and Gul 2014). Oncology specialized nurses placed throughout the country could dramatically increase the number of cases diagnosed in early stages. In addition, oncology nurses can educate community health workers about cancer, thereby allowing them to raise awareness and appropriately refer a patient for further evaluation ((Abuidris et al. 2013; Mutebi et al. 2013). Furthermore, nurses can increase adherence to screening guidelines since nurses are viewed as trusted members of their society (World Health Organization 2012a). Thus, nurses can more efficiently act as a patient navigator through the continuum of care, linking the patient to local health systems and decreasing the delay in care (Henderson and Kendall 2011; Ngoc Nguyen et al. 2008).

Various programs have demonstrated that nurses can successfully play a vital role in screening. Studies in HICs have shown that nurses can perform flexible sigmoidoscopy or colonoscopy with ratings in patient satisfaction, safety, and effectiveness similar to those for procedures done by general surgeons and GI fellows (Schoenfeld et al. 1999; Koornstra et al. 2009; Verschuur, Kuipers, and Siersema 2007; Hui et al. 2015). These findings suggest that appropriately trained oncology nurses in LMICs could assume this level of care as part of the task shifting that has already been demonstrated to be successful, e.g., for colposcopy. However, challenges related to scope of practice for oncology nurses in LMICs remain.

Research findings in the Philippines, Indonesia, and Malaysia have all demonstrated that clinical breast exams done by nurses are a sustainable form of early detection and primary screening (Pisani et al. 2006; Devi, Tang, and Corbex 2007; Kardinah et al. 2014). In promoting general breast health awareness, nurses are a well-suited professional group to de-stigmatize disease within their respective communities (Abuidris et al. 2013). Equipping nurses in LMICs with knowledge about breast health and skills in clinical breast examination could contribute to reaching the goal of down-staging the presentation of breast cancer in these countries (Anderson et al. 2011).

The Cervical Cancer Prevention Program in Zambia demonstrates the value nurses can provide in cervical cancer control as well through a "Screen and Treat" program (Mwanahamuntu et al. 2011). Similar programs have been successfully implemented in other LMICs including India (Sankaranarayanan et al. 2007).

Treatment- roles in surgery, chemotherapy, and radiotherapy

Nurses around the globe play a vital and central role in the delivery of all cancer treatment modalities including surgical, radiation and medical oncology (Quinn 2008).

For patients undergoing surgical intervention, nurses teach patients what to expect before, during and after procedures. The nurse is critical in assessing the patient during the post-operative period, monitoring wound healing, preventing infection, managing pain, and facilitating return to activities of daily living. Surgical interventions such as mastectomy, orchiectomy or colectomy may require nurses to assist patients to adapt to an altered physical or emotional functioning. Surgical nurses in LMICs are participating in multidisciplinary training to improve surgical outcomes in people with cancer (Price, Sergelen, and Unursaikhan 2013). Despite this evidence, nursing management and care of patients undergoing surgical intervention remains sub-optimal in many countries, due to lack of adequate resources and targeted nursing education. For example, in Paraguay, post-operative pediatric neurosurgical management failed to prevent high infection rate leading to early mortality for children with brain tumors (Baskin et al. 2013). Well-educated pediatric oncology nurses are in a critical position to support efforts to improve neurosurgical interventions in LMIC.

Although radiation therapy is an important component of cancer control (El Saghir et al. 2011), of the 139 LMICs categorized by the World Bank, almost half (55) have no radiation facilities and only four have adequate equipment (Datta, Samiei, and Bodis 2014). Nurses who work in radiation oncology units clinically assess and educate patients about radiotherapy, addressing patients' fears and providing information about potential side effects. Nurses need to be knowledgeable about the specific radiation field so they can educate patients to identify side effects early so steps can be taken to avoid complications, treatment delays or concluding radiation treatment prematurely as has been demonstrated in Indonesia (Stoker et al. 2014).

Nurses who work in medical oncology practices in LMIC countries are often not only administering but preparing chemotherapy (Stefan 2014; Wiernikowski and Barr 2014) and generally without personal protective equipment (PPE) or a biological safety cabinet (Palmer-Wickham et al. 2010; Kingham et al. 2013). They need to be meticulous in this practice, particularly in math calculations to reconstitute chemotherapy agents, compute body surface area, and assure appropriate dosing that is consistent with treatment protocols. Unfortunately, many nurses in LMICs are not formally trained in chemotherapy administration and would like further education on the subject (Challinor et al. 2014).

Due to the lack of education, protective equipment, and available trained pharmacists in many locations around the globe, chemotherapy preparation and administration poses a significant risk to nurses. Training for the safe handling of hazardous drugs is essential to protect both the nurses and their patients and families (World Health Organization 2013a). Personal protective equipment including chemo-tested gloves, disposable gowns, masks with eye shields or goggles and a biosafety cabinet must be available and properly utilized to best protect nurses within the parameters of their location (Palmer-Wickham et al. 2010; Day et al. 2014; Neuss et al. 2013).

It is important to note that chemotherapy preparation is ideally the scope of the pharmacist and should be conducted in appropriate pharmacy facilities even in LMIC (El Saghir et al. 2011). In fact, the inclusion of an oncology-trained pharmacist is a cost-effective way for a LMIC setting to improve chemotherapy preparation and handling, nurse and patient safety, as well as inventory control, patient and family education, hazardous drug waste management and pharmaceutical cost savings (Wiernikowski and Barr 2014). Nonetheless, the reality in many LMIC is that there is either a shortage of educated pharmacists or safety equipment and nurses ultimately are responsible for both preparing and administering chemotherapy and need, therefore, to be properly

educated about safety measures. Efforts are necessary to involve other professionals, such as engineers, in developing low cost, effective chemotherapy preparation facilities and equipment.

Treatment- Providing supportive care in all modalities

Patients undergoing therapy benefit from supportive care or the prevention and management of adverse effects of cancer and its treatment (McCorkle et al. 2011; Hong et al. 2014; Selman et al. 2009). Oncology specialized nurses are skilled at conducting a comprehensive assessment of the health and supportive care needs of patients with cancer. In addition, oncology nurses are able to educate and provide psychosocial and spiritual support by sharing and applying their knowledge of cancer, treatment modalities, and treatment side effects (Aranda and Yates 2009; Canadian Association of Nurses in Oncology 2006).

Cancer and treatment-related symptoms are major stressors in patients with cancer. Symptom burden experienced by cancer patients in LMICs may be even worse than the experience of patients in HICs as supportive care, including symptom management, is often a low priority in these locations and essential medicines (for example to control pain) may be unavailable (Cardoso et al. 2013; Yao et al. 2013). However, lack of information and education about cancer treatment and managing its adverse effects are major barriers to effective cancer treatment in LMICs as supportive care is often inadequately addressed in these countries (Anderson et al. 2011; Holland, Watson, and Dunn 2011; da SilvaI et al. 2012).

Various studies have reported that patients who do not receive adequate symptom management can experience an increase in psychological distress, treatment delays or non-compliance, a prolonged hospital stay, and negative effects on the quality of life (Aranda and Yates 2009; Borneman et al. 2010; Laugsand et al. 2011; Chan, Richardson, and Richardson 2011). Educating patients so they have a better understanding about their treatment could enhance adherence to the treatment and in turn, result in better treatment outcomes (Halfdanarson and Jatoi 2010; Shelton et al. 2011; Secginli and Nahcivan 2011).

Previous studies in HICs have reported the positive effects of nursing interventions on managing symptoms (Van der Meulen et al. 2013; Borneman et al. 2010; Hão 2014) minimizing the consequence of cancer treatment (Jefford et al. 2011; Borneman et al. 2010; Gates, Seymour, and Krishnasamy 2012) and promoting quality of life (Haase and Braden 2012; Bakitas et al. 2009; Lo et al. 2012) among patients undergoing cancer treatment. Oncology nurses are the closest to the patient undergoing treatment for cancer and therefore have the unique opportunity and privilege to advocate for and support the patient and their family. They also have a significant role in assuring the highest quality of care is delivered to achieve the best possible outcome (Lamb et al. 2011; Saini et al. 2012).

An opportunity to improve outcomes through research and evidence-based practice

Nurses have a unique perspective on health care systems that can effectively contribute to research and evidence-based interventions that inform service delivery, education and training, and policy recommendations. Nursing research has significantly impacted health promotion and disease prevention in LMICs for health issues such as HIV/AIDS (Curran et al. 2012; Heffron et al. 2012; Lee et al. 2010), maternal and child health (Edmonds, Paul, and Sibley 2012; Foster et al. 2010), and mental health (Lin et al. 2011) and can have a similar impact on oncology care. Nursing research, and multi-disciplinary research lead by a team of nurse, physician, statistician and others, could assist in developing strategies for development of resource-appropriate best

practices. Additionally, nurses could make pivotal contributions to translational research for the development of evidence-based practice.

The WHO Global Forum for Government Nursing and Midwifery Officers (the Global Forum) calls for nursing and midwifery research on efficacy and cost-effectiveness of interventions, translational research, and collaborative partnerships for funding research and innovative projects (World Health Organization 2012b). To enhance nurses and midwives capacity to address NCDs such as cancer, the Global Forum suggests research focused on expanding settings for implementing interventions, integrating risk assessment with clinical practice, surveying the prevalence of risky health behaviors and training that enhances knowledge and skills on cancer and its risk factors (World Health Organization 2012b). Advancing nursing research in LMICs will not only enhance the cadre of cancer researchers (Price et al. 2012), but has the potential to improve service delivery, training, policy and health outcomes ((De Raaf et al. 2013; Ruccione et al. 1991).

Due to challenges stemming from the hierarchy of power, the lack of resources, mentors and subject matter experts, limited oncology education and training opportunities, and lack of funding, nurses interested in research in LMICs usually have fewer opportunities compared to colleagues in HICs (Edwards et al. 2009). They must also confront the perception that nurses are not fit to be researchers, and the lack of integration of research with service delivery, treatment and care. Capacity building for nurse-led research in LMICs is critical in elevating nurses as research scholars (Sullivan et al. 2014), translating nursing research into evidence-based practice, and recognizing nurses as potential policy makers (Shariff 2014), thus improving health outcomes.

Palliative Care and Hospice- Nurses' role as advocates for end-of-life care

Palliative care supports cancer patients and their families throughout the trajectory of illness. It might become even more significant in countries where late stage diagnosis, e.g., (Toure et al. 2013) and low resources for treatment are most prevalent.

As with care during treatment, nurses assess, identify and manage not only pain, but also the physical, psychosocial, spiritual, and cultural needs of patients and their families at the end of life(Leboeuf et al. 2014). Nurses trained in pain management, palliative care, and in helping people manage grief, death, and dying can positively affect the end of life experience, help patients achieve a peaceful death, and help their families cope with loss and grief (International Council of Nurses 2012; Pedreros Mosquera 2014; Wang 2012). These skills are especially critical for nurses in LMICs where the majority of patients present with advanced disease and effective treatments to cure or even control the disease are limited (Cleary et al. 2013; Kingham et al. 2013).

"It is estimated that of the 20 million people needing palliative care at the end of their life, around 80% live in low- and middle-income countries" (World Health Organization 2013b). In most LMICs, however, palliative care is not considered an essential part of cancer care (Silbermann and Al-Zadjali 2013)and the majority of these countries do not meet basic international guidelines for the provision of palliative care (Lynch, Connor, and Clark 2013; World Health Organization 2013b). Barriers to effective palliative care in LMICs include the limited availability of opioids and other medications to manage symptoms, inadequate knowledge, and a lack of country-level palliative care policies or integrated services(Paice et al. 2008; Cleary et al. 2013; Worldwide Palliative Care Alliance and World Health Organization 2014). WHO estimates that 5.5 million cancer patients die in pain annually because they do not have access to opioid medications (World Health Organization 2011a).

Reasons include legal and regulatory restrictions on the use of opioids due to concerns about diversion, addiction and misuse, and cultural perceptions about pain and its treatment (Lamas and Rosenbaum 2012).

Efforts are underway to improve nurses' ability to provide adequate end-of-life care such as the End-of-Life Nursing Education Consortium (ELNEC) curriculum, which has been adapted to serve the needs of an international nursing audience. This curriculum has been utilized to train nurses from LMICs including Eastern Europe, central Asia, and Africa (Malloy et al. 2014). Regional efforts to train nurses are also taking place as with the Institute of Hospice and Palliative Care in Uganda (Hospice Africa 2014).

Nurses in LMICs can act as advocates for improved end-of-life care in their country. They can work with government officials and non-governmental organizations to develop policies that improve availability of opioids. When nurses lead and participate in the development of hospice and palliative care services, access is expanded (Malloy et al. 2011; Lamas and Rosenbaum 2012). Because nurses are oftentimes the healthcare provider closest with the community in which they work, they can help overcome cultural barriers against the use of opioid medications by educating patients, families, and their colleagues (Pirnazarova et al. 2013).

Survivorship

The term "cancer survivors" used in this section is defined as individuals who have completed primary treatment for cancer (Feuerstein 2007). The incidence of cancer has been increasing steadily in the past decade, and so have the number of cancer survivors. In 2012, 14.1 million people were diagnosed with cancer and there are 32.6 million people living within five years of diagnosis globally (Ferlay et al. 2013); however, prolonging the lifespan of these survivors does not necessarily mean that their well-being is certainly improved. Cancer survivors continue to experience late effects of treatment and psychosocial complications after treatment (Siegel et al. 2012; Paskett et al. 2012). It has also been reported that cancer survivors experience a poorer quality of life (QoL) than general populations (Oeffinger, Nathan, and Kremer 2008; Lee et al. 2011). Prolonged experience of all these complications and a poorer quality of life may be detrimental to survivors' health, and in turn increase healthcare utilization and the burden on existing healthcare services (Peuckmann et al. 2009; Yabroff et al. 2011). Although healthcare professionals in HICs have highlighted the use of cancer survivorship care plans (Institute of Medicine 2005)— which aim to assist in providing a patient a smooth transition from active treatment at a cancer center to post-treatment care in the community (Hill-Kayser et al. 2013) — this kind of supportive care service for cancer survivors in LMICs has not been addressed.

Various studies have reported positive outcomes of healthcare services for survivors that are either led by nurses or with nurse involvement. Nurse-led efforts in psychosocial support, and healthy lifestyle promotion have shown benefits for quality of life and behavioral outcomes for patients (Park et al. 2012; Kim et al. 2011) and nurses have been involved in protocol design for post-treatment follow-up care (Howell et al. 2012). Although most of the studies were conducted in HIC, these findings provide strong evidence that nurses in LMICs who received oncology-specific education and training could make comparable contributions to supportive care services for cancer survivors.

Across the cancer continuum and around the world, nurses play an integral role throughout a patient's cancer journey. Nurses must be educated and positioned to practice to their utmost potential in order to improve the outcomes of the patient at all points of care and in all locations (Surbone et al. 2010).

Challenges to Oncology Nursing Education, Training, and Practice

There is a lack of educational pathways to specialization in oncology nursing

WHO estimated in 2011 that the world's health workforce faced a shortage of 2.4 million doctors, nurses and midwives (World Health Organization 2011b) This shortage does not spare the oncology community, and the nursing educational system presents several challenges to developing a larger oncology nursing workforce (Quinn 2008).

Basic nursing education varies globally, ranging from two- to five-year programs which award a technical degree or certificate, a diploma, or a university degree upon completion (Malvarez and Agudelo 2005; Munjanja, Kibuka, and Dovlo 2005), and nurses often receive little to no oncology training in their basic nursing education program.

Nurses in LMICs rely on primarily on-the-job training in oncology and often rotate through the oncology unit, limiting the amount of experience nurses gain in oncology (Morrissey et al. 2014; Molyneux and Howard 2012). Moreover, there are few oncology nurse specialization programs available in LMICs as well as a lack of faculty to teach in such programs, and hospital and healthcare employers in LMICs rarely provide the needed training (Quinn 2008; Price et al. 2012; Akhigbe and Omuemu 2009; Andsoy and Gul 2014).

Specialty certification has the potential to improve the quality of care for patients with cancer. In HICs, studies have shown the positive effects of more highly educated nurses on decreasing hospital mortality (Aiken et al. 2011) and improving outcomes failure to rescue (Kendall-Gallagher et al. 2011). Providing nurses with improved access to information, training, and recognition of specialization could be a major advance in several LMICs, which serve extremely large numbers of cancer patients (Challinor et al. 2014; Cleary et al. 2013).

Most LMICs lack legislation to mandate training pathways for advanced specialized nursing roles, such as an oncology nurse specialist

Worldwide, government spending on health professional education amounts to just \$1 billion, 1.8% of total expenditures on health service (World Health Organization 2011b) leaving few advanced practice or doctoral-prepared nurses to teach in oncology nursing education programs, or implement evidence-based practice changes, with notable exceptions in Saudi Arabia (Almalki, FitzGerald, and Clark 2011), Cuba (Sheldon et al. 2012), and India (Thomas 2012). Advanced practice nurses who graduate from nurse-based training programs in countries such as Ethiopia, Ghana, and Togo have received practical education to address local health issues and treat indigenous disorders (Mullan and Frehywot 2008) thus reducing the impact of the severe shortage of physicians in these countries. This model could be expanded to include education in oncology.

In 2011, WHO's World Health Assembly (WHA) Resolution 64.7 (World Health Assembly 2011) gave WHO the mandate to strengthen the capacity of nursing and midwifery workforce through provision of support to member states on a number of strategies. Subsequent WHO actions included a Global Action Plan for the Prevention and Control of Noncommunicable Disease: 2013-2020 which included a call for improved institutional capacity for nursing training and a wider scope of nursing practice for prevention and control of non-communicable diseases (including cancer), and improved nursing (and other professional) career tracks (World Health Organization 2012a).

Unfortunately, few LMICs have legislation within their Nursing Acts to mandate specialty training, including oncology. The Philippines is an exception, as its 2002 Nursing Act includes a mandate for specialty organizations and the Department of Health to develop a program for nurse specialization (Philippine Nurse 2012). To address this gap, WHO has called for strategies to increase the number of NCD expert nurses and improving nurses' involvement in national health policy NCD discussions (World Health Organization 2013b).

Only some HICs such as Canada and the U.S. have defined standards for the scope of practice for oncology nurses such as those provided by the Canadian Association of Nurses in Oncology/Association Canadienne des Infirmières en Oncologie (CANO/ACIO), the Oncology Nursing Society (ONS) and the Association of Pediatric Hematology/Oncology Nurses (APHON). Unfortunately, in LMICs, the lack of defined standards or scope of practice for oncology nurses highlights the confusion about the specialty (Quinn 2008). Clear guidelines that specify the scope of oncology nursing practice and describe expected duties and skills, can improve nursing education and practice and hence patient care and outcomes.

Providing programs for continuing education can help compensate for prior lack of training

Many LMIC healthcare workers, including nurses, also do not have access to sufficient, current information to promote cancer prevention and care. Furthermore, nurses have very few opportunities to receive continuing education due to time constraints and a lack of infrastructure (Palmer-Wickham et al. 2010; Price et al. 2012). In many HICs such as the U.S., nurses are required to complete a minimum number of continuing education hours in order to maintain nursing certification (Day et al. 2012). Due to generally lower levels of oncology-specific education for nurses in LMICs, the availability of continuing education offers an even more important opportunity for professional development (Day et al. 2012; Conter et al. 2014; Cleary et al. 2013).

As LMIC authorities establish specialization programs, it is essential that certification of completion of specialty training, accreditation, and on-going educational opportunities to increase skills and knowledge are in place for monitoring the expertise of nurses practicing in oncology settings (Ferrell, McCabe, and Levit 2013). Finally, in order to provide evidence-based oncology nursing care, nurses must have adequate specialty education to care for patients with cancer and their families (World Health Organization 2013a).

The nursing practice environment also presents challenges in recruiting professionals to the field and contributing to better patient outcomes

As LMICs acknowledge cancer as a major health problem and begin to explore ways to solve it, task shifting and the expansion of nurses' role is often seen as a way to meet the increasing demand for oncology services – from screening to end-of-life care. In order to effectively meet this demand, nurses must receive the education and training needed to fill these roles, and the regulatory and practice environment must change to support these expanded roles. To date there are increasing calls specifically addressing the pressing need for an expansion of the scope of oncology nursing practice and task shifting in LMICs (Strother et al. 2013; Denburg et al. 2014)

Given the high levels of stress and burnout experienced by oncology nurses (Balbay et al. 2011) as well as problems with inter-professional respect and collaboration (Lamb et al. 2011), there is a need to develop incentives for oncology specialization. However stipends for specialized nurses may not be feasible for LMICs given their significantly limited economic resources. Even if feasible, stipends may not be enough to retain oncology nurses as exemplified by a study in Ghana that found that salary dissatisfaction was not a major

determinant of turnover intention for nurses (Bonenberger et al. 2014). A meta-analysis of the relationship between pay and job satisfaction showed that salary was only slightly related to satisfaction, even in middle-income countries (Judge et al. 2010).

Beyond the impacts on retention of nurses, inadequate working conditions may negate the positive effects of reducing patient-to-nurse ratios through staff expansion (Aiken et al. 2011) or other efforts to improve nursing practice within the context of local cultural norms (Belita, Mbindyo, and English 2013; Songstad et al. 2011).

Finally, strong oncology nursing leadership is needed in LMICs to ensure safe patient care is provided as well as to advocate for local government health policies, and advance sustainable national cancer control programs.

Oncology Nursing Competencies, Curricula, and Training Programs

Competencies that describe the fundamental knowledge and skill required for nurses to perform their job are available for both the specialized oncology nurse (Canadian Association of Nurses in Oncology 2006), as well as for the advanced practice oncology nurse (in countries where such practice exist) (Oncology Nursing Society 2007; Oncology Nursing Society 2008), and can serve as a foundation for developing an education or training program.

Cancer nursing curricula have been developed by several organizations, including the European Oncology Nursing Society (EONS), the Oncology Nursing Society (ONS), the Association of Pediatric Hematology/Oncology Nurses (APHON), and the World Health Organization (WHO). These competencies and curricula largely reflect cancer-nursing practice within HICs, but can be used as a framework for developing competencies and curricula tailored to LMIC settings. When countries lack existing faculty who can teach basic cancer nursing skills, several models have been implemented to transfer required knowledge and build capacity for local trainers, including: in-country short-term intensive training; twinning; regional centers of excellence and collaborations with schools of nursing. In addition, national, regional, and international oncology nursing societies offer continuing education programs that may provide additional opportunities for LMICs nurses to receive additional training at modest costs; however, some of these continuing education programs likely need to be tailored to the realities of oncology nursing in LMIC settings.

Regardless of the specific model or curricula used, it is critical to conduct extensive country-specific program planning (including a learning needs assessment). The assessment should address the types of cancers commonly seen; an analysis of the equipment, supplies and medications that are available; and the knowledge, skills and roles of in-country nurses and other healthcare professionals, and the cultural and social context of nursing practice within the country, region and specific institution. Plans for program sustainability and program evaluation, including an analysis of program cost, should also be included (Wilimas et al. 2003; Sheldon et al. 2013). Furthermore, all oncology nursing training programs in LMICs should consider how to train in-country nurses to serve as future trainers ("train the trainer" approach) to help overcome language and cultural barriers, minimize cost, and allow local experts to continue training after departure of the international faculty (Meneses and Yarbro 2008).

Cost of training

Training costs are directly related to the type of training that is offered. Examples of oncology nursing training programs include: a two-day breast health and breast cancer education train-the-trainer (TTT) program

delivered during an international nursing conference (Meneses and Yarbro 2008) e-learning training using modules on specific topics delivered over several months (Hampshire 2013), a four-week nurse educator course developed in a LMIC setting with bi-monthly web meetings and monthly telephone calls for follow-up support (Day et al. 2011). These programs have varying costs and since donor funding can fluctuate over time, models that are self-sustaining, such as sending the team providing the training into the country to increase reach, as well as exploring feasibility of long distance learning complemented by site visits for skills development, and should include the ability to access resources long term, including access to mentors.

Ideally, the Ministry of Education through a school of nursing or Ministry of Health through a hospital-based program, depending on the local resources and infrastructure, would finance oncology specialization training locally. Creating a framework for oncology specialization that includes higher education professionals, service experts, and nursing educators ensures that difficult practice challenges will be addressed and the availability and accessibility of the specialization program will be assured (Aranda and Yates 2009). While there are several existing oncology nursing curriculums available (WHO Europe, Oncology Nursing Society USA, Pontificia Universidad Javeriana in Colombia), to date, only the one in Colombia has pediatric and adult nursing combined, and only the nurse educator course mentioned above was created with input from LMIC local nurse experts. Therefore, the cost of training will require initial curriculum development to reflect the reality of cancer treatment in the specific LMIC. The ultimate cost and support materials of a post-graduate oncology nursing specialty should be the same as any other post-graduate nursing program in the LMICs, such as maternal child nursing and nursing administration.

Table 1 provides a brief description of examples of different models to provide oncology education to nurses, including key advantages and disadvantages, and examples of existing programs (see Table 1).

Table 1: Oncology Nursing Training Approaches

Approach	Advantages	Disadvantages	Examples
In-country, short-term intensive training	<ul style="list-style-type: none"> Low cost relative to other models Limited commitment required from LMIC institution Potential first step for co-developed longer-term program 	<ul style="list-style-type: none"> Lack of support for trainees following course completion Difficulty in measuring impact Difficulty sustaining efforts 	<ul style="list-style-type: none"> AfrOx Cancer Nurse Training Program in Ghana, Uganda and Malawi International Cancer Corps cancer nurse training Oncology Nursing Society Trish Green Cancer Nursing Training Workshop Fellowships (Fogarty 2012; Sheldon et al. 2013)
Twinning programs	<ul style="list-style-type: none"> Long-term collaboration with potential to effect change in several areas including nursing 	<ul style="list-style-type: none"> Greater expense than short-term intensive training Difficulty obtaining extended commitment from LMIC partner Expertise often provided 	<ul style="list-style-type: none"> AMPATH Oncology/Moi Teaching and Referral Hospital/Indiana University/University of Toronto - Kenya Dana-Farber/Boston Children's Cancer and

		by only one HIC partner	<ul style="list-style-type: none"> Blood Disorders Center - countries in the Middle East and Latin America - Georgetown University Medical Center/ INCTR - Ethiopia (Shad, 2013) - Partners in Health/Dana-Farber Cancer Institute - Rwanda - St. Jude Children's Research Hospital - Brazil, Chile, China, Costa Rica, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Jordan, Lebanon, Mexico, Morocco, Lebanon, Venezuela (Strother et al. 2012; Shad, Challinor, and Cohen 2013)
Regional Center of Excellence development	<ul style="list-style-type: none"> · Long-term collaboration with potential to effect change in nursing practice and education · Emphasis on development of in-country trainers 	<ul style="list-style-type: none"> · Greater expense than short-term intensive training · Extensive planning and ongoing support of in-country trainers required · Difficulty obtaining extended commitment from LMIC partner 	<ul style="list-style-type: none"> - Latin American Center for Pediatric Oncology Nursing Education – Chile (Day et al. 2011)
School of Nursing collaborations	<ul style="list-style-type: none"> · Long-term collaboration with the potential to have major, sustained impact on the education and practice of in-country nurses · Potential professional development opportunities for in-country nurse educators 	<ul style="list-style-type: none"> · Greater expense than short-term intensive training · High-level commitment from Ministry of Health or Education, or other in-country organizations likely needed · Difficulty obtaining extended commitment and long-term financing from LMIC partner 	<ul style="list-style-type: none"> - Children's Cancer Hospital Egypt; Dana-Farber/Boston Children's Cancer and Blood Disorders; University of Massachusetts/Boston; Cairo University
Distance learning	<ul style="list-style-type: none"> · No commitment required from LMIC institution 	<ul style="list-style-type: none"> · Limited internet and bandwidth in most LMICs 	<ul style="list-style-type: none"> - CancerNursing.org - Cure4Kids¹ - OpenPediatrics² - Vidyo

¹ https://www.cure4kids.org/ums/home/public_area/c4k_about/sample.php

² <http://openpediatrics.org/the-application/world-shared-practices-forum/>

Conference-based learning	<ul style="list-style-type: none"> · Large numbers of nurses trained in one location · 2-day intensive time-frame with 2-year follow-up · Taught in conjunction with biannual conference 	<ul style="list-style-type: none"> · Limited to nurse educators known to ISNCC, WHO, UICC, international nursing associations, deans of nursing schools, and selected US nurses with international ties. · Limited to English-speaking nurses · Program limited to basic information due to short time-frame 	<ul style="list-style-type: none"> · US National Cancer Institute funded ISNCC initiative (Ash, McCorkle, and Frank-Stromborg 1999)
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In-Country Short-Term Intensive Training

Several organizations have provided specialist training for oncology nurses by developing intensive short-term training courses in LMICs. In this model, an international faculty of nurse educators spends several days to a few weeks in country at cancer centers, clinics, treatment centers or hospitals training nurses who are caring for patients with cancer. Many of these short-term courses are didactic in nature and focus on addressing the most pressing and practical issues faced by LMIC nurses, such as safe chemotherapy mixing and administration, the management of oncological emergencies, palliative care and pain management. However, other short-term training programs have provided training in other areas, such as patient counseling, cancer prevention and screening, and quality of life.

Twinning

Several organizations have used a twinning approach to implement capacity building for oncology (e.g. (Hopkins, Burns, and Eden 2013), including oncology nurse training programs. In this model, a developed country organization establishes a bilateral relationship with a LMIC partner, and creates sustainable programs by building ongoing strong relationships between medical directors, hospital administrators, nursing and interdisciplinary leaders, and the Ministry of Health (Ribeiro et al. 2008; Day et al. 2011). In some cases, twinning programs have also established partnerships with in-country nongovernmental organizations to support fundraising for the program.

Regional Centers of Excellence

The Regional Centers of Excellence model focuses on establishing an in-country center with local faculty that are dedicated to developing and training nurse educators throughout the region. For example, the Latin American Center for Pediatric Oncology Nursing Education developed by St. Jude Children's Research Hospital International Outreach Program in Chile in 2007 provides an onsite, 4-week, culturally sensitive pediatric oncology nursing course in Spanish (Day et al. 2013; Day et al. 2012). From 2007-2012, 13 Nurse Educators from six countries have completed the course offered by this regional center.

Collaboration with Schools of Nursing

As described above, many nurses in LMICs do not have access to oncology-specific education, and many LMIC countries lack nurse educators (International Council of Nurses 2009). To build a sustainable and comprehensive approach to educating nurses in LMICs, some HIC schools of nursing have worked with LMIC hospitals to co-develop in-country bachelors and masters degrees in nursing. This model often involves a blended combination of online, classroom and in-hospital instruction with components of a comprehensive curriculum that includes case studies, simulation-based practice, interactive videos and hands-on patient care. The model may also include an opportunity for nurses from the LMIC to spend time in the HIC for coursework or observational clinical experiences.

Distance Learning

In-person visits are critical for program planning, program initiation, and building relationships; however, online tools can be used for distance learning and to facilitate ongoing communication and mentoring with LMIC trainees and participants. While online tools are powerful, they may not be appropriate for all LMIC settings where computer literacy and internet access may be limited.

In addition to e-mail and telephone communications, telemedicine and telehealth provide new tools to develop oncology-nursing capacity in LMICs. Telemedicine and telehealth involve using video conferencing, imaging transitions, e-health including patient portals, remote monitoring of vital signs, case studies, continuing medical education and demonstrations of care (American Telemedicine Association 2012)

Several online technology platforms are used and each one for a specific purpose. For example, some platforms (e.g. Vidy), are appropriate for virtual discussions and patient consultations in a HIPAA-compliant environment, whereas other platforms (e.g. OPENPediatrics) facilitate distance learning focused on nursing practices. OPENPediatrics is an interactive training and knowledge exchange platform that uses cloud-based technology to promote worldwide sharing and an exchange of knowledge, create a global community of practice and to connect clinicians to improve the care of children worldwide. Plans are underway to utilize this technology to implement a nursing curriculum for LMICs.

St. Jude Children's Research Hospital's Cure4Kids website is an education and collaboration web site dedicated to supporting the care of children with cancer and other catastrophic diseases worldwide. Cure4Kids provides content for continuing education and web communication tools to support collaborations among pediatric oncologists and health professionals worldwide. All content and services are provided at no cost to the users. The Cure4kids online platform is used to provide continuous one-on-one mentoring on a monthly basis for nurse educators in Latin America.

Continuing Professional Education Programs

Continuing professional education programs include a range of activities such as short courses, journal clubs or seminars designed to update the skills and knowledge of participants. The design and implementation of Continuing Education programs provides an opportunity for faculty at schools of nursing to partner with colleagues who are designing, implementing, and evaluating programs in the field. Many nursing professional societies at the national, regional, or international levels hold conferences or workshops to promote continuing education, and may have reduced registration fees for nurses from low resource countries or travel scholarships (Table 2). Some of these groups have hosted training courses in conjunction with their annual meetings specifically focused on providing training for LMIC nurses (Meneses and Yarbrow 2007). Several barriers such as cost and time away from work may limit participation by LMIC nurses; however, many organizations develop

post-conference resources such as presenters' PowerPoints or videoed sessions that could be used in oncology nurse training programs in LMICs.

A critical component of any intervention for improving cancer control and care in LMICs is outcome measurement, which has been largely missing to date. Without program evaluation there is no way to determine the impact of training efforts and to assess whether the scarce funds available for oncology nursing workforce development are being effectively utilized.

Table 2: Examples of National, Regional, International Professional Society Meetings that include Continuing Education Programs

Organization	Participants	Frequency	Website
African Organisation for Research and Training in Cancer (AORTIC)	Interprofessional	Biennial	http://www.aortic2013.org/
Asian Oncology Nursing Society (AONS)	Nurses	Biennial	http://www.aons2013.com/content.php?slug=welcome
European Oncology Nursing Society (EONS)	Nurses	Biennial	http://www.cancernurse.eu/
International Network for Cancer Treatment and Research (INCTR)	Interprofessional		http://www.inctr.org/
International Psycho-oncology Society (IPOS)	Interprofessional	Annual	http://www.ipos-society.org/
International Society of Nurses in Cancer Care (ISNCC)	Nurses	Biennial	www.isncc.org
Multinational Association of Supportive Care in Cancer (MASCC)	Interprofessional	Annual	http://www.mascc.org/
Union for International Cancer Control (UICC)	Interprofessional	Biennial	http://www.uicc.org/

For a list of oncology conferences, see:

<http://www.conference-service.com/conferences/oncology.html>

Conclusion

The burden of cancer is increasing worldwide (Global Burden of Disease Cancer Collaboration 2015) and cancer is one of the non-communicable diseases prioritized by the agendas of WHO, the UN, and other international organizations. According to an American Cancer Society report on the global impact of cancer (American Cancer Society 2010), "Cancer causes the highest economic loss of all the 15 leading causes of death worldwide. The economic toll from cancer is nearly 20% higher than heart disease, the second leading cause of economic loss (\$895 billion and \$753 billion, respectively)". It is estimated that by 2025 approximately 20 million people will be diagnosed with cancer (Franceschi and Bray 2014) and by 2030, 12.6 million will die per year (World Health Organization 2014c). Unfortunately, the healthcare professionals who are necessary to provide care across the entire cancer continuum, from prevention and detection, to treatment, end-of-life care or survivorship are seriously lacking in LMICs. It is well known that there is a global shortage of healthcare workers including physicians and nurses, a burden disproportionate affecting LMICs. There have been initiatives to address cancer in LMICs using the limited healthcare staff available, however, until there is a serious commitment from governments and donors to fund and support the development of healthcare infrastructure including the human and material resources required, there is little hope that significant improvement can be made in the current devastating mortality statistics in these countries, where 72-75% of patients with cancer die (Farmer et al. 2010).

This paper is a call to action to governments, funders, and nursing associations around the world to address oncology-nursing education in the LMIC where 80% of the patients with cancer now live (Knaul, Frenk, and Shulman 2011). Nurses are a critical component of any country's cancer control plan since they are capable of delivering public health messages for cancer prevention, provide cancer screening (e.g., cervical and breast cancer screening), form the largest group of healthcare providers in any hospital or outpatient clinic setting, and are the backbone of many end-of-life or hospice programs around the world. In addition, nurses who have cared for patients with cancer are in a unique position to continue care after patients are diagnosed as they are often integral members of patient communities, particularly in rural areas. Therefore, in order to establish an effective cancer control program in any LMIC, it is necessary to address the oncology education needs of nurses, including but not limited to continuing education for professional oncology nurses. Additionally, it is pivotal to advocate for the maintenance or enhancement of nurses' role as part of the cancer care team.

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