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Predictors of Hospitals' Nonachievement of Baseline Nursing Standards for Pediatric Oncology

Background: The International Society of Pediatric Oncology established baseline standards for pediatric oncology nursing; limited evidence is available to predict hospitals' capacity to meet these standards internationally. **Objectives:** The aims of this study were to (1) determine the proportion of hospitals that met, partially met or did not meet baseline standards for pediatric oncology nursing and (2) identify predictors of hospitals' nonachievement of baseline standards for pediatric oncology nursing.

Methods/Analysis: A secondary analysis of International Society of Pediatric Oncology web-based survey data of baseline nursing standards was conducted. Predictor variables were derived from surveyed hospital characteristics and external data sources. Multivariable parsimonious logistic regression models identified predictors of hospitals' nonachievement of each standard. **Results:** Nurses from 101 hospitals across 54 countries completed the survey; 12% to 66% of hospitals reported meeting each of 6 baseline standards. Predictors of nonachievement of standards included low current health expenditure as percentage of gross domestic product, World Health Organization Region of Africa, United Nations "developing or transition" country classification, countries with fewer than 3 nurses/midwives per 1000 population, and hospitals without bone marrow transplant and/or intensive care units. **Conclusions:** Hospitals with characteristics predictive of inability to meet baseline standards will likely require greater

capacity-building support and advocacy to improve the quality of nursing care. **Implications for Practice:** Findings from this study highlight internal and external factors that challenge the delivery of high-quality pediatric oncology nursing care internationally.

Each year, more than 300 000 new cases of childhood and adolescent cancer are diagnosed globally.[1] Great progress has been made over the past several decades toward achieving cures for children and adolescents with cancer; today, more than 80% survive their disease in high-income countries. However, in low- and middle-income countries (LMIC), where 80% of children and adolescents with cancer in the world reside, only 5% to 60% survive.[2] As the battle against childhood cancer continues to become a global concern, capacity-building initiatives to improve survival and outcomes in resource-limited settings will be of increasing priority.

Nurses comprise the largest group of health workers globally[3] and are essential to the provision of care necessary for delivering curative therapy to children with cancer. In high-income countries, previous studies of the nurse workforce have shown an association between patient morbidity and mortality and nursing-related factors such as staffing, education, and the nursing practice environment.[4–7] However, there is currently limited evidence available to predict hospitals' ability to support quality pediatric oncology nursing practice internationally.

■ Background

In 2014, the International Society of Paediatric Oncology–Paediatric Oncology in Developing Countries Nursing Working Group published baseline standards for pediatric oncology nursing in low- and middle-income countries.[8,9] Six baseline standards represent the essential elements necessary for healthcare settings to promote quality nursing care and outcomes for children and adolescents with cancer. These standards, which are summarized below, address staffing to acuity, orientation, continuing education, teamwork, resources, and policies.

Standard 1: Acuity-based Staffing Plans

Nurses specialize and are dedicated to the unit where pediatric oncology patients receive care and do not rotate out of the specialty. Nurse staffing assignments are based on patient acuity. An average nurse-to-patient ratio of 1 nurse to 5 patients is recommended for pediatric oncology units in low- and middle-income countries, on all shifts. The recommended average nurse-to-patient ratio in bone marrow transplant (BMT) and intensive care units (ICUs) is 1 nurse to 2 patients, on all shifts.

Standard 2: Formalized Orientation Program

A formal nurse orientation program is recommended. These programs should include a minimum of 2 weeks of core pediatric oncology nursing theory and skills training, followed by 3 to 4 weeks or more working under the supervision of a trained pediatric oncology preceptor. Recommended topics for a comprehensive program include overview of pediatric cancers, chemotherapy administration and side effect management, peripheral and central venous access management, infection prevention and control, blood/blood product transfusions, and early detection and treatment of oncologic emergencies (including neutropenic sepsis). In addition, pain assessment and management, nutritional support, patient and family education, palliative and end-of-life care, and spiritual and psychological issues should be addressed. Learning objectives should guide orientation programs and include an evaluation of nurse competency before providing independent care to pediatric oncology patients.

Standard 3: Continuing Education

Pediatric oncology nurses should receive a minimum of 10 hours of continuing education each year.

Standard 4: Multidisciplinary Teamwork

Nurses should be recognized as core members of the interprofessional care team through active participation in patient rounds and treatment plan discussions with parents and caregivers.

Standard 5: Resources for Safe Care

Provision of minimal resources required to provide safe patient care is recommended, including consistent access to hand hygiene supplies, intravenous (IV) infusion pumps, and personal protective equipment for use in preparing and administering chemotherapy. Pharmacists should prepare chemotherapy; when this is not possible, and nurses are responsible for preparing chemotherapy, a biosafety cabinet level II (or higher) is recommended, and occupational health screening should be offered to monitor exposure to hazardous drugs.

Standard 6: Policies and Procedures

Evidence-based policies and procedures should guide pediatric oncology nursing practice. Funding for nursing research is essential to inform best practices and policy and procedure development in resource-constrained environments.

In 2016, the International Society of Pediatric Oncology Baseline Nursing Standards Taskforce was formed to evaluate the capacity of hospitals that provide pediatric oncology care in low-, middle-, and high-income countries to achieve the 6 Baseline Nursing Standards. High-income countries were included in this evaluation to better understand pediatric oncology nursing practice environments across varied-resource countries. The Taskforce conducted a survey of nurses affiliated with pediatric oncology care facilities across the 6 World Health Organization (WHO) regions to evaluate hospitals' reported achievement of components of the Baseline Nursing Standards for pediatric oncology (S.W. Day et al, unpublished data, 2019). This article describes the results

of a secondary analysis of this survey data that aimed to (1) describe the proportion of hospitals that met, partially met, or did not meet the Baseline Nursing Standards and (2) determine the predictors of hospitals' non-achievement of the standards.

■ Methods

Study Design

This study is a secondary analysis of data from a cross-sectional survey, conducted between August 2016 and February 2017, of nurses affiliated with institutions providing pediatric oncology services across the 6 WHO regions (Africa, the Americas, Eastern Mediterranean, European, South-East Asia, and Western Pacific).[10] Research questions guiding the current study included the following: (1) What proportion of hospitals met, partially met, or did not meet the Baseline Nursing Standards? And (2) what predictors are associated with hospitals' nonachievement of each Baseline Nursing Standard?

Data Source and Sample

Data were collected as part of the Baseline Nursing Standards Survey study. Participants included a sample of nurse supervisors/administrators, educators, and frontline nurses/midwives affiliated with pediatric oncology care facilities in the 6 regions, who were invited to participate in the email survey. The email invitation described study objectives and the researchers' intent to disseminate deidentified results of the survey. At Boston Children's Hospital, the parent study was deemed non–human subjects research. Institutional review board exemption for the current analysis reported here was obtained from the University of Alabama at Birmingham (IRB 300000942). One response per institution was accepted. If more than 1 response was received per institution, the first and most complete response was included.

Study Instrument

Baseline Nursing Standards Task Force members developed survey questions using an iterative consensus methodology (modified-Delphi), based on previously published pediatric oncology Baseline Nursing Standards.[8,9] Content validity for this instrument was established and reported elsewhere (S.W. Day et al, unpublished data, 2019).[10] Reliability will be established in future studies through onsite assessment. The survey consisted of 53 items that assessed individual components and subcomponents of the 6 Baseline Nursing Standards. Item response format included yes/no, multiple choice, select all that apply, and free text. The survey was administered electronically using REDCap software; depending on branch logic, participants were asked to complete between 32 and 53 items. Surveys were available in English, French, Spanish, and Mandarin Chinese. Certified translators (Spanish and French) and native nurse speakers (Mandarin Chinese) provided translation. A second native speaker, who was also a pediatric oncology nurse, independently reviewed each translation. Free-text responses were translated by certified translators.

Variables of Interest

BASELINE NURSING STANDARDS

Components and subcomponents of each standard were defined based on the original publications[8,9] (Table 1). Criteria for having met (100%), partially met (50% to 99.9%), and not met (<50%) the standards were determined by expert consensus of Taskforce members and applied to all standards except Standard 3 (Continuing Education) and Standard 4 (Multidisciplinary Teamwork). Standard 3 had only 1 component and was therefore evaluated as met (100%) or not met (<100%). Standard 4 was grouped into 3 components; therefore, partially met was defined as 33% or 66% and not met as 0%. Only criteria included in both original publications[8,9] were included in the evaluation of each standard.

INDEPENDENT PREDICTOR VARIABLES

Predictor variables were derived from hospital characteristics obtained from the survey data and from external data sources. Six predictor variables were derived from the survey data: hospital type (general vs cancer center/pediatric), hospital funding source (public vs private), years of education for registered nurse practice entry (<3 or ≥3 years), and whether the hospital had a dedicated pediatric oncology unit (yes/no), ICU (yes/no), and BMT unit (yes/no).

Seven predictor variables were derived from external data sources. World Health Organization data included WHO Region (Africa vs not Africa), density of nurses/midwives per 1000 population (<3 vs ≥3 nurses), under-5 mortality rate (probability of death by age 5 per 1000 live births) (continuous), and current health expenditure as percentage of gross domestic product (GDP) (continuous). United Nations (UN) variables included UN Region Classification (Africa vs not Africa) and UN Country Development Class (developing/transition vs developed). In addition, the Universal Health Care index of essential service coverage (continuous) was included.

Region variables consist of UN Region and WHO Region classification. World Health Organization Member States are grouped into the following 6 regions: Africa, the Americas, Eastern Mediterranean, European, Southeast Asia, and Western Pacific.[11] United Nations Member States are grouped into 5 regions: Africa, Asia-Pacific, Eastern European, Latin American and Caribbean, and Western European and Others group.[12] Density of nurses/midwives per 1000 population measures the proportion of nurses and midwives per 1000 population. More than 50% of the countries in WHO regions have fewer than 3 nurses/midwives per 1000 population.[13] Sustainable Development Goals target a minimum of 4.5 health workers per population to meet disease burden demands by 2030.[14] The WHO's under-5 mortality rate measures the proportion of childhood deaths under the age of 5 out of the number of live births each year (per 1000 live births), based on territory, country, or geographic location. In low-income countries, under-5 mortality was 73.1 deaths per 1000 live births in 2016, whereas in high-income countries, it was 5.3 deaths per 1000 live births. Sustainable Development Goals target 25 deaths per 1000 live births across countries by 2030.[15]

The current health expenditure as a percentage of GDP measures the proportion of a nation's financial allocation toward

✳ Table 1 • Baseline Nursing Standards Definition of Met, Partially Met and Not Met

Criterion	Met	Partially Met	Not Met
Standard 1: Staffing Plans	Respondents reported having met all (100%) applicable components (1.A + 1.B + 1.C; +1.D + 1.E as applicable.): 1.A. Acuity-based staffing plan; 1.B. Dedicated oncology unit nursing staff; 1.C. Nurse-to-patient ratio of 1:5 or lower in the pediatric oncology unit on all shifts; 1.D. If institution has ICU: Nurse-to-patient ratio of 1:2 or lower in ICU on all shifts; and 1.E. If institution has BMT unit: Nurse-to-patient ratio of 1:2 or lower on BMT unit on all shifts	Respondents reported having met 50%–99.9% of applicable components (ie, 2 of 3 if no BMT or ICU; 2–3 of 4 if BMT or ICU; 3–4 of 5 if BMT and ICU).	Respondents reported having met <50% of applicable components.
Standard 2: Formalized Orientation Program	Respondents reported having met all (100%) components (2.A + 2.A.1 + 2.A.2 + 2.A.3 + 2.A.4): 2.A. Having a formalized pediatric oncology nursing orientation; 2.A.1. ≥2 weeks of theory and clinical skills training in orientation; 2.A.2. Learning objectives included in the program; 2.A.3. Evidence of evaluation of knowledge and skills prior to caring for patients independently; and, 2.A.4. ≥3 weeks with an experienced clinical preceptor	Respondents reported having met 50%–99.9% of components (3–4 of 5 components).	Respondents reported having met <50% of components (<3 of 5 components).
Standard 3: Continuing Education	Respondents reported receiving ≥ 10 h/y of formal continuing education		Respondents reported receiving <10 h/y of formal continuing education.
Standard 4: Multidisciplinary Teamwork	Respondents reported having met all (100%) components (4.A + 4.B + 4.C) Nurses are included in: 4.A. Daily patient rounds; 4.B. Diagnosis/relapse discussions; and 4.C. Treatment/consent meetings	Respondents reported having met 33% of components (4.A or 4.B or 4.C) *or* 66% of components (4.A + [4.B *or* 4.C] or [4.B + 4.C]).	Respondents reported having met 0% of components.
Standard 5: Resources for Safe Care	Respondents reported having met all (100%) components (5.A + 5.B + 5.C + 5.D): 5.A. IV pumps; 5.B. Hand hygiene (soap/running water, paper towels and alcohol hand rub); 5.C. Chemo PPE (gloves [powder-free latex or nitrile], lint-free/fluid resistant gown, masks, eye protector/face shield); and, 5.D. Chemo preparation (pharmacist prepares chemo or if nurse prepares chemo, medical screening and level ≥2 biosafety cabinet available)	Respondents reported having met 50%–99.9% of components (2–3 of 4 components: 5.A, 5.B, 5.C, 5.D)	Respondents reported having met <50% of components (0–1 of 4 components: 5.A, 5.B, 5.C, 5.D).
Standard 6: Policies and Procedures	Respondents reported having met all (100%) components (if 6.A, then 6.A.1 + 6.A.2): 6.A. If hospital provides written policies and procedure; 6.A.1. Pediatric oncology nursing policies are available in inpatient settings; and 6.A.2. Outpatient settings	Respondents reported having met 50%–99.9% components (if 6.A, then 6.A.1 *or* 6.A.2).	Respondents reported having met <50% of components (not A; or if A, then not A.1. *and* not A.2.).

Abbreviations: BMT, bone marrow transplant; ICU, intensive care unit; IV, intravenous; PPE, personal protective equipment.

healthcare compared with its economic wealth derived from goods and services produced.[16,17] Universal Health Coverage index of essential service coverage is an indicator developed by the WHO and World Bank. The UN Country Development Classification groups nations by economic condition of developing, transitional, and developed economies. Classifications are based on a composite index of per capita gross national income, human asset index, and economic vulnerability index.[18,19] The Universal Health Care index evaluates the availability of essential health services by country and accounts for prohibitive healthcare costs, which drive individuals and families into poverty. The composite index is composed of indicators representing newborn and child health, reproductive, maternal, noncommunicable diseases, infectious diseases, and service capacity and access.[20]

■ Data Analyses

Data were analyzed using statistical software IBM SPSS Statistics Version 24.0 (Armonk, New York) and SAS Version 9.4 (Cary, North Carolina). Descriptive statistics (frequencies, percentages) were calculated for nurse demographics, hospital characteristics, and proportion of hospitals that met, partially met, or did not meet each standard. Multivariable logistic regression models were used to analyze the associations between nonachievement of nursing standards and predictor variables, from which parsimonious models were developed to identify the predictors of nonachievement of each of the 6 standards. Variables examined in all models and their respective variance inflation factors are presented in the Table, Supplemental Digital Content, http://links.lww.com/CN/A19.

■ Results

Institutional Characteristics

A total of 208 nurses were invited to participate in the survey; 129 responses were received, and 101 responses from 54 countries were included in the final analysis. Incomplete (n = 20), duplicate (n = 7), and noneligible (n = 1) site responses were excluded. By language, 72% of survey responses included were received in English, 19% in Spanish, 6% in Mandarin Chinese, and 3% in French.

Forty-two percent of institutions were general hospitals; most were publicly funded (71%) and had a separate unit for pediatric cancer patients (92%) and an ICU (69%). Less than half (44%) reported having a BMT unit. More than 90% of institutions were located in countries requiring 3 or more years of nursing education to enter practice (Table 2). Figure 1 describes the proportion of respondents by WHO region.

Characteristics of Survey Respondents

Survey respondents were nurse supervisors/administrators (42%), frontline nurses/midwives (35%), or nurse educators (13%), with 11% classified as other or not evaluable. Seventy-seven percent of respondents had attained a professional nursing degree from a

Table 2 • Institutional Characteristics (N = 101)

| Characteristic	n	%
Hospital type		
Cancer specialty hospital/National Cancer Institute	18	17.8
Pediatric hospital	41	40.6
General hospital	42	41.6
Hospital funding source		
Public	72	71.3
Private	18	17.8
Other/not evaluable	11	10.9
Separate unit for pediatric cancer patients		
Yes	93	92.1
No	8	7.9
Intensive care unit		
Yes	70	69.3
No	31	30.7
Bone marrow transplant unit		
Yes	44	43.6
No	57	56.4
Years of nursing education required for practice entry		
<3 y/not evaluable	9	8.9
≥3 y	92	91.1

university, and 64% of respondents had worked for more than 10 years in nursing (Table 3).

Standards Met, Partially Met and Not Met

The proportion of hospitals that met, partially met, or did not meet the standards is represented in Figure 2. For standard 1 (Staffing Plans), 11.9% met, 43.6% partially met, and 44.6% did not meet the standard; standard 2 (Orientation), 29.7% met, 46.5% partially met, and 23.8% did not meet the standard; standard 3 (Continuing Education), 49.5% met and 50.5% did not meet the standard (partially met was N/A); standard 4 (Multidisciplinary Teamwork), 62.4% met, 32.7% partially met, and 5.0% did not meet the standard; standard 5 (Resources for Safe Care), 37.6% met, 45.5% partially met, and 16.8% did not meet the standard; and standard 6 (Policies and Procedures), 66.3% met, 9.9% partially met, and 23.8% did not meet the standard. Overall, across all 6 standards, the ranges of institutions that met, partially met, or did not meet standards were 11.9% to 66.3%, 9.9% to 46.5%, and 5.0% to 50.5%, respectively.

Predictors of Not Meeting Baseline Nursing Standards

In the multivariable parsimonious models (Table 4), for each unit decrease in the WHO Current Health Expenditure as a percentage of GDP, the odds of not meeting standard 1 (Staffing Plans) were 26% higher (odds ratio [OR], 1.26; 95% confidence interval [CI], 1.1–1.5; P = .006). Compared with hospitals with BMT units, hospitals without BMT units were 2.5 to 4.6 times less likely to achieve standards 2 (Orientation), 3 (Continuing Education), and 6 (Policies and Procedures) (standard 2: OR, 3.82, 95% CI, 1.5-10.0, P = .006; standard 3: OR, 2.5, 95% CI, 1.1-5.9, P = .038;
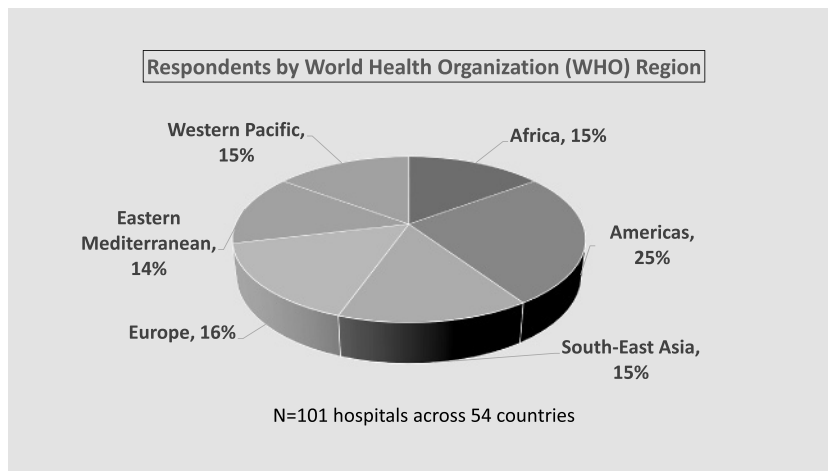
Figure 1. Respondents by World Health Organization (WHO) region.

and standard 6: OR, 4.6, 95% CI, 1.6-13.0, P = .004). Compared with hospitals in WHO Regions outside of Africa, hospitals in the WHO Region of Africa were 5.7 times less likely to meet standard 3 (Continuing Education; OR, 5.7; 95% CI, 1.2–28.0; P = .032). Compared with hospitals in countries with a UN Country Development Class of "developed", "developing/transition" countries were 3.3 times less likely to meet standard 4 (Multidisciplinary Team; OR, 3.3; 95% CI, 1.2–9.0; P = .023). Compared with hospitals in countries with 3 or more nurses/midwives per 1000 population, hospitals in countries with fewer than 3 nurses/midwives per 1000 population were 4.2 times less likely to meet standard 5 (Resources for Safe Care; OR, 4.2; 95% CI, 1.5–11.5; P = .006). Compared with hospitals with ICUs, hospitals without ICUs were 3.2 times less likely to meet standard 6 (Policies and Procedures; OR, 3.2; 95% CI, 1.2–8.4; P = .017).

■ Discussion

Proportion of Hospitals That Met, Partially Met, or Did Not Meet Standards

In this secondary analysis, we determined criteria for meeting, not meeting, and partially meeting the Baseline Standards. We found that there was wide variation in hospitals' reported-achievement of Standards. In addition, we found that more than 40% of institutions did not meet standard 1 (Staffing Plans) and standard 3 (Continuing Education), highlighting the gap in adequate staffing levels and acuity-based staffing plans, specialization (nonrotation), and continuing education/professional development. A concerted effort is needed to raise the standard of pediatric oncology nursing practice across low-, middle-, and high-income countries.

BMT Unit

In this analysis, we found that hospitals without a BMT unit were less likely to offer a structured pediatric oncology nursing orientation program (standard 2), have nurses who received 10 or more hours per year of continuing education (standard 3), and have inpatient and outpatient oncology-specific nursing policies to guide

practice (standard 6). Although in low- and middle-income countries, BMT is less commonly used because of high therapeutic intensity, supportive care requirements, and cost,[21,22] its benefits are now being recognized in developing countries.[22] In our survey, 44% of institutions across varied-resource settings reported having a BMT unit.

In low- and middle-income countries (LMIC), treatment-related mortality is most often attributed to bleeding and infection.[21] Because of barriers in access to essential medicines (including antimicrobials) and blood products, performing BMTs without adequate infrastructure, trained staff, and supportive resources may pose higher risk of harm than benefit to patients. Therefore, intensity of treatment in low-resource settings is often tailored to the level of available supportive infrastructure and resources to deliver safe and effective cancer-directed therapy. In settings where BMT is not offered for refractory disease, palliative care and hospice care are frequently the treatments of choice.[21,22]

A specialized oncology nursing workforce is essential to proficiently delivering cancer-directed therapy and achieving optimal outcomes. Nurses providing care to patients undergoing BMT must attain a comprehensive knowledge base and a complex skill

Table 3 ● Demographic Characteristics of Survey Respondents (N = 101)

Characteristic	n	%
Job Title		
Nurse/midwife	35	34.7
Nurse supervisor/administrator	42	41.5
Nurse educator	13	12.9
Other/not evaluable	11	10.9
Years working as a nurse		
≤5 y	15	14.9
6–10 y	21	20.8
>10 y	65	64.4
Nursing education/preparation		
Auxiliary/assistant	2	2.0
Technical	5	5.0
Professional (university degree)	78	77.2
Other	16	15.8
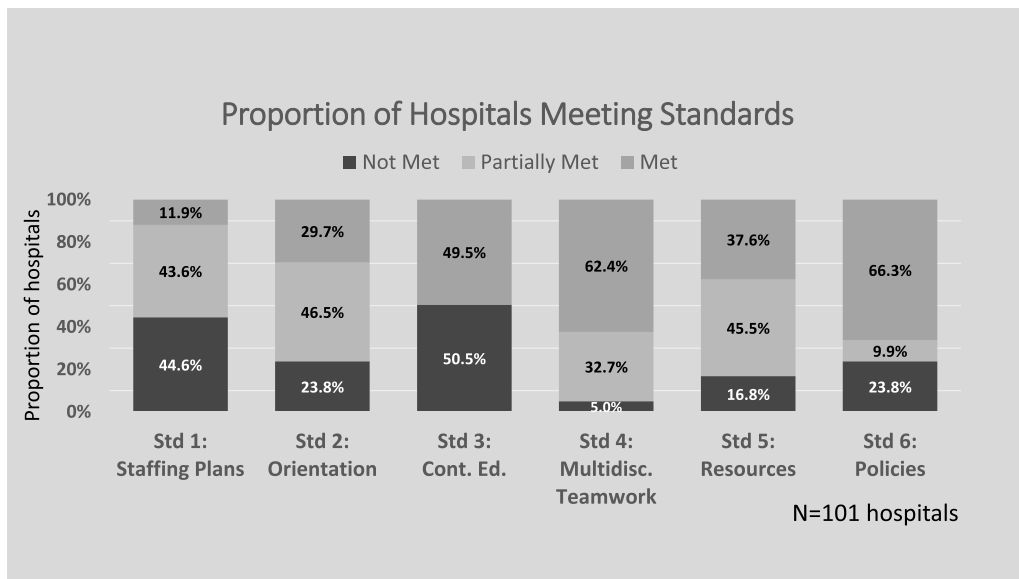
Figure 2. Proportion of hospitals meeting the Baseline Nursing Standards.

set to manage this high-risk population. Patients undergoing BMT require close monitoring and intervention for treatment-related complications related to infection, alloreactivity (eg, graft-versus-host disease and transplant engraftment failure), and toxicity.[23] Because of the high acuity of patients undergoing BMT, Foundation for the Accreditation of Cellular Therapy standards require that nursing staff is adequately trained to proficiently meet the care needs of high-acuity patients and that staffing plans and ratios are based on patient severity (up to >1 nurse per patient in times of increased acuity).[24] These recommendations are aimed toward well-resourced settings but enforce the principle of safe staffing standards outlined in the Baseline Nursing Standards recommending a 1:2 or less nurse-patient ratio in low- and middle-income countries.[8,9] Our findings that hospitals without BMT units were less likely to provide specialized nursing orientation, have nurses who received 10 hours or more of continuing education per year, and have oncology-specific policies, compared with those with BMT units, highlight the need for greater oncology service capacity-building support in institutions where BMT is absent. Furthermore, developing a BMT program could serve as a potential catalyst to strengthen oncology service capacity. However, careful consideration of the feasibility to procure and maintain adequate resources, including staffing, quality essential medicines, and supportive care resources needed for BMT, is necessary.

Intensive Care Units

In addition to 56% of hospitals in our survey lacking a BMT unit, 31% did not have an ICU. This supports well-documented reports of the lack of pediatric and adult ICUs in limited-resource countries.[25,26] In most hospitals in LMIC, a dedicated pediatric ICU, adequate nurse staffing and training in pediatric critical care, ancillary staff, and basic equipment and monitoring capabilities are limited.[25–27] Furthermore, standardized processes of care, guidelines, and context-appropriate checklists to guide care

in intensive care settings are lacking in LMIC.[28] Similarly, we found that hospitals without an ICU were less likely to have oncology nursing policies to guide evidence-based care (standard 6). Although of borderline significance in this analysis (P = .053),

Table 4 • Parsimonius Multivariate Logistic Regression Models: Predictors of Not Meeting Baseline Standards

Standard	P	Odds Ratio	95% CI Lower	95% CI Upper
Standard 1: Staffing Plans (N = 101)				
Current health expenditure as a percentage of GDP (per 1-unit decrease)	.006	1.26	1.07	1.49
Standard 2: Formalized Orientation Program (N = 101)				
BMT unit (no)	.006	3.82	1.46	10.02
Standard 3: Continuing Education (N = 101)				
BMT unit (no)	.038	2.48	1.05	5.87
WHO region (Africa)	.032	5.72	1.17	28.02
Standard 4: Multidisciplinary Teamwork (N = 101)				
UN development country classification (developing/transition)	.023	3.26	1.18	9.01
Standard 5: Resources for Safe Care (N = 101)				
WHO nurse/midwife density per 1000 population (<3 nurses/midwives per 1000 population)	.006	4.18	1.52	11.53
Standard 6: Policies and Procedures (N = 101)				
BMT unit (no)	.004	4.58	1.61	13.01
ICU (no)	.017	3.22	1.23	8.42

Abbreviations: BMT, bone marrow transplant; CI, confidence interval; GDP, gross domestic product; ICU, intensive care unit; UN, United Nations; WHO, World Health Organization.

hospitals without an ICU trended toward being less likely to have adequate resources for safe care, including hand hygiene supplies, personal protective equipment, biosafety cabinets and screening for hazardous drug exposure, and IV infusion pumps (standard 5). Patients with hematological malignancies are at increased risk of disease- and treatment-related oncologic emergencies and clinical deterioration, warranting early intervention and the need for intensive care management. Access to intensive care services with adequate equipment and procedures to guide care is essential for children and adolescents undergoing cancer-directed therapy.

Current Health Expenditure

Current health expenditure as a percentage of national GDP was a significant predictor of hospitals' nonachievement of standard 1 (Staffing Plans). Hospitals in countries with lower health expenditures were less likely to meet recommended staffing levels, have nonrotating/specialized nurse staff, and use acuity-based staffing plans. In general, national health expenditure is closely related to GDP (an indicator of a nation's wealth),[29] and the health workforce accounts for a substantial proportion of national health expenditures.[30] Furthermore, nurses and midwives comprise 50% of the health workforce in most countries.[31] Our findings support the association between a nation's health expenditure and health workforce; in countries with less funding allocated towards health, fewer health personnel (including nurses) will likely be available.[30,32,33]

Density of Nurses/Midwives per 1000 Population

A nation's health workforce is an essential pillar in health service delivery and the health of populations. The global nursing shortage has currently reached 9 million, although it is estimated to decrease to 7.6 million by 2030, and in Africa and Eastern Mediterranean regions, the nursing shortage is expected to worsen.[34] The migration of nurses from limited-resource to well-resourced countries for higher pay, professional advancement opportunities, and better working conditions exacerbates the workforce shortage in low-resource settings.[35] Maldistribution of health workers also highlights the disparity of health workers by region: Asia has 50% of the world's population and 30% of its health workers, Europe and America have 20% of the world's population and 50% to 60% of its health workers, whereas Africa has 11% of the world's population and 3% of the health workforce.[32]

Approximately 50% of WHO Member States have fewer than 3 nurses/midwives per 1000 population; 25% have fewer than 1 nurse/midwife per 1000 population.[31] In our study, hospitals in countries with fewer than 3 nurses/midwives per 1000 population were less likely to have adequate resources to safely facilitate patient care (standard 5). This highlights the intense workload of nurses in limited-human-resource settings and increased risk for occupational hazards, including unprotected chemotherapy exposure due to lack of biosafety cabinets and PPE, and greater risk of spreading infections because of lack of hand hygiene supplies. Furthermore, with decreased accessibility to smart IV pumps, there is an increased risk for medication infusion and blood transfusion errors. The lack of access to IV pumps, particularly for nurses caring for large numbers of patients, is a critical barrier in safe administration of IV chemotherapeutic agents, medications, and blood/blood products.

WHO Region of Africa

Nurses in the WHO Region of Africa were less likely to receive 10 hours of continuing education each year compared with nurses in other regions, likely because of the severe shortage of health workers. In Africa, there are ~2.3 health workers per 1000 population. This number of health workers is in stark contrast to other regions such as Europe and the Americas, with 18.8 and 24.8 health workers per 1000 population, respectively.[32] With severe health worker shortages, nurses are faced with inadequate staffing to meet patient care demands. Thus, continuing education within the hospital setting is likely a lower priority. In areas with limited human resources for health, educational workshops and online seminars are examples of methods used to effectively deliver continuing education. Continuing education and professional development ensure that health workers remain up-to-date on evidence-based practices and are delivering safe and high-quality care. Therefore, creative methods for delivering education in human-resource limited settings must be prioritized, especially in Africa and similar regions.

UN Development Country Classification

Interprofessional teamwork is integral to the delivery of high-quality care in pediatric oncology, where intensive treatment regimens rely heavily upon adequate supportive care measures. In well-resourced settings, interprofessional teams are composed of nurses, physicians (oncologists and other specialists), pharmacists, rehabilitation therapists, dieticians, social workers, child life specialists, psychologists, and others, whereas in limited-resource settings, the care team often lacks representation of multiple disciplines, specialties, and perspectives.

Hospitals in developing/transitioning nations (according to the UN Development Country Classification) are 3.3 times less likely to meet standard 4 (Multidisciplinary Teamwork) than hospitals in developed nations. This finding highlights a potential gap in effective communication and team-based care in developing countries, where nurses likely have less say in patient care decisions, which may occur as a result of exclusion of nurses from patient rounds and treatment planning discussions. Furthermore, these findings have implications for patient safety as teamwork has been documented to improve care decision making and health outcomes.[36] Our findings are similar to those identified in a cross-sectional study in the developing country of Ethiopia, where nurses reported low satisfaction with nurse-physician communication, perceived low levels of professional respect, and perceived low levels of open communication of patient information.[37] Hailu et al[37] note that hospitals in developing countries lack electronic systems to help facilitate the implementation of standardized communication protocols.

However, the implementation of certain standardized communication tools and processes can be implemented at low cost. The SBAR is a communication tool widely used between nurses and physicians to relay the patient situation (S), background (B),

assessment (A), and recommendation (R). Additional communication tools include the pediatric early warning score system, which was successfully implemented in the developing nation of Guatemala.[38] Use of communication tools, such as SBAR and the pediatric early warning score system, has been linked to better patient outcomes, including decreased mortality[39] and intensive care utilization,[38] respectively.

Communication among teams is essential to safe and efficient care delivery and the reduction of miscommunication errors.[40] Nurses provide most of patient care and therefore are highly attuned to the clinical status of patients and families and the need for intervention. The use of communication tools and inclusion of nurses in patient care rounds and treatment discussions will facilitate increased communication and awareness of patient information, thus improving care quality and patient safety.

■ Limitations

Because of the nature of a secondary analysis, findings were limited to existing formatted questions and responses of the survey data. Furthermore, criteria for having met, partially met, or not met the Standards were informed by the original publications, and therefore, elements of each standard were guided by this content. Currently, the Standards do not address nursing care delivery models and the availability of assistive personnel (skill mix). Reports on nurse staffing likely incorporate the total number of direct care nurse-to-patient ratios as opposed to professional nurse-to-patient or technical nurse-to-patient ratios. It is recommended that future studies evaluate the nursing care delivery model and skill mix. Furthermore, the survey was available in 4 languages, limiting responses to nurses fluent in those languages only. Survey responses were accepted by 1 representative per institution and therefore relied on his/her knowledge and accurate self-report of the site. Lastly, this study was a convenience sample of Taskforce members' contacts and represents 101 institutions across 54 countries and is therefore not generalizable. However, results from the parent study, as well as this study, provide evidence that was previously lacking regarding international pediatric oncology nurse work environments.

■ Implications

Predictors of nonachievement of the Baseline Nursing Standards provide insight into the barriers faced globally by pediatric oncology nurses. These predictors highlight internal and external factors that hinder the delivery of high-quality pediatric oncology nursing care. They also serve as indicators for increased capacity-building support and advocacy efforts related to each Baseline Nursing Standard. Our findings lay the foundation for future research on developing an onsite assessment tool to identify whether individual hospitals meet these Baseline Nursing Standards in pediatric oncology.

■ Conclusion

Pediatric oncology nursing practice environments vary widely worldwide, enforcing the need for Baseline Nursing Standards to improve the quality of nursing care and patient outcomes. We identified significant predictors of hospitals' nonachievement of Baseline Nursing Standards. These hospitals will likely require greater capacity building support through low-cost and creative solutions for staffing models, education, interprofessional communication, resources for safe care, and standardized policies and procedures. In settings with limited human and material resources, advocacy for safe practice environments and specialized education programs should be prioritized to improve patient and nurse outcomes. Results from this study highlight the need for future research to implement pediatric oncology nursing standards in hospitals across varied-resource settings and countries and to evaluate the impact on patient outcomes.

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