

INTEGRATION OF CRITICAL CARE NURSES IN ANTIMICROBIAL STEWARDSHIP; OPPORTUNITIES AND BARRIERS AT A COUNTY REFERRAL HOSPITAL IN KENYA

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International Academic Journal of Health, Medicine and Nursing (IAJHMN) | ISSN 2523-5508

Received: 3rd August 2024

Published: 6th August 2024

Full Length Research

Available Online at: https://iajournals.org/articles/iajhm_n_v2_i1_486_504.pdf

Citation: Chege, J. W., Mbuthia, N., Gachuri, G. (2024). Integration of critical care nurses in antimicrobial stewardship; opportunities and barriers at a county referral hospital in Kenya. *International Academic Journal of Health, Medicine and Nursing*, 2(1), 486-504.

ABSTRACT

Antimicrobial stewardship optimizes appropriate use of antimicrobials through agent selection, route, dosing, and duration of therapy. It serves to optimize clinical outcomes of patients and limit adverse reactions of antimicrobials. Nurses are frontline implementers of antimicrobial stewardship. However, they face issues on inter-professional jurisdiction, hierarchical power relations within hospitals and limited training on antimicrobial stewardship. The main objective of this study is to explore the integration of nurses into antimicrobial stewardship activities in the critical care unit at Thika Level 5 Hospital, Kenya. The study used exploratory descriptive qualitative research design. Data collection was done through semi-structured interviews and NVIVO 14 software was used for thematic analysis of data. A total of 11 nurses working in the intensive care unit were interviewed. Patient advocacy, communication and collaboration, monitoring and documenting, and patient education and empowerment emerged as important roles that nurses play in

antimicrobial stewardship. Participants highlighted continuous medical education, inclusion of antimicrobial stewardship in formal nursing education, team work and organization support as major facilitators of nurses' roles in antimicrobial stewardship. The study findings revealed that stringent regulatory requirements, heavy workload, poorly regulated systems and limited knowledge on antimicrobial stewardship as the major barriers that limit nurses' role in antimicrobial stewardship. Nurses' inputs in decision making process on treatment plans and antimicrobial use is invaluable in promoting judicious use of antimicrobials. Future research should focus on redefining the nature, scope and influence of perceived nurses' role in antimicrobial stewardship.

Keywords: Antimicrobial stewardship, Antimicrobial Resistance, Intensive care unit

INTRODUCTION

Prompt and judicious use of appropriate antimicrobial agents reduce disease severity and mortality and improve patient health outcome in sepsis (Hussain et al., 2020). The use of antimicrobials in the critical care units is exponentially high, ranging between 67% to 97% due to postoperative prophylaxis, hospital acquired infections and community acquired sepsis (Haque et al., 2018). However, studies indicate that up to 50% of antimicrobial use is inappropriate (Hussain et al., 2020). This high use of antimicrobials is associated with problems such as antimicrobial resistance (AMR), drug interactions as well as drug toxicity (Lindsay et al., 2019). The World Health Assembly of May 2015 and the subsequent United Nations General Assembly of September 2017 recognized resistance to antimicrobial agents as a global public health threat (WHO, 2019). Herein, hospitals implement antimicrobial stewardship to maximize the use of antimicrobials in healthcare sector today. Antimicrobial stewardship is a tool for optimizing the use of antimicrobials by reducing their inappropriate use and maximize antimicrobial agent selection, route, dosing, and duration of therapy (WHO, 2019). It serves to optimize clinical outcomes of patients and limit adverse reactions of antimicrobials (Hussain et al., 2020).

The Joint Commission and CDC advocates for engagement of nurses in antimicrobial stewardship program (ASP) as a part of the multidisciplinary approach to the judicious use of antimicrobial agent to curb adverse effects of overuse and misuse of antimicrobials (The Joint Commission, 2016). Nurses consider themselves as antimicrobial stewards (Polisetty et al., 2022). In a multisite study in pediatric and general hospitals, nurses agree that they have roles in antimicrobial stewardship; to include patient advocacy and knowledge on antimicrobials use (Mostaghim et al., 2017). The widespread involvement of nurses in activities relating to the use of antimicrobials calls for their integration in antimicrobial stewardship (Olans et al., 2016). The involvement of nurses in ASP includes a myriad of activities such as antimicrobial de-escalation, effective assessment and timely culturing practices (Carter et al., 2018). As part of the antimicrobial stewardship team, nurses question the route of antimicrobial administration, reassess the antimicrobial therapy in 2-3 days, and reconcile antimicrobials during all transitions of patient care (Wright, 2019).

Furthermore, nurses have significant potential of minimizing antimicrobial use, errors and time-to-antimicrobial administration (Padigos et al., 2021). Nurses occupy a conscious and essential position in hospitals and they can act as brokers of doctors' antimicrobial prescription based on their capacity to challenge doctors' decisions (Broom et al., 2017). Virtual education significantly increased nurses' awareness on antimicrobial stewardship (Polisetty et al., 2022). Nurses consider in-service training every 6 months, manager and physician support as well as saving time for education as pathways to address knowledge

gaps in antimicrobial stewardship (Hendy et al., 2022). Educating nurses on antimicrobial stewardship is a critical milestone in empowering healthcare professionals to take part in the program (Kirby et al., 2020). Knowledge on microbiology and pharmacology in nursing education should be presented as an applied science whose application and relevance in clinical practice is regularly reinforced (ANA & CDC, 2017). Antimicrobial stewardship is a collective endeavor and a responsibility for all healthcare professionals involve directly in patient care in hospitals (Courtenay et al., 2018). Collaborative and consultative network is essential in acquiring knowledge and skills that foster long-term growth of antimicrobial stewardship (Moehring et al., 2021). Antimicrobial stewardship teams, infection control teams and pharmacists are sources of support for their involvement in stewardship programs (Mostaghim et al., 2017). Robust organizational structures, strong nursing leadership and utilization of technology were identified as enablers of nurses' participation in ASP (Padigos et al., 2020).

Limited knowledge on antimicrobial use, culture of deference to doctors and inter-professional dissonance are major barriers to nurses' involvement in ASP (Padigos et al., 2021). Majority of nurses feel they receive little in way of formal education on antimicrobial stewardship, and the glean information they have about the program is either reactive or incidental (Kirby et al., 2020). Therefore, nurses often feel insecure about their knowledge on microbiology and antimicrobial use, and thus perceive antimicrobial stewardship as not their function since they are not prescribers (ANA & CDC, 2017). Organizational factors such as lack of a safety culture is an obstacle to nurses integration into ASP activities (Monsees et al., 2020). Failure to include nurses in ASP rounds, disregard of nursing input in the rounds and interdisciplinary poor relations are major barriers towards their integration the program (Monsees et al., 2018). According to Charani et al. (2019), nurses' input in the decision making process was least influential compared to recommendations by senior doctors and pharmacists. Complicated inter-professional jurisdiction and authority of doctors around antimicrobial prescription makes nurses feel that they have less control on antimicrobial stewardship practices (Kirby et al., 2020). Lack of teamwork and empowerment in terms of inter-disciplinary roles discourage nurses' involvement in ASP (Abbas et al., 2019).

The purpose of this study is to explore the integration of nurses into antimicrobial stewardship activities in the critical care unit at Thika Level 5 Hospital. The study explores perceived roles, facilitators and barriers of nurses' involvement in antimicrobial stewardship.

Statement of problem

Even though the potential for nurses to inform and advance antimicrobial stewardship is undisputed, they encounter considerable challenges with many initiatives principally

focusing on doctors. Nurses face issues on inter-professional jurisdiction, hierarchical power relations within hospitals and limited training on antimicrobial stewardship (Monsees, Goldman & Popejoy, 2017). The failure to integrate antimicrobial stewardship in formal nursing education limits nurses' knowledge on AMR and their involvement in antimicrobial stewardship (Abbas et al., 2019). Significantly, 57% of nurses often describe their knowledge on antimicrobial stewardship as limited or minimal (Mostaghim et al., 2017). Their involvement in antimicrobial stewardship is sometimes viewed as interfering with doctors' prescription (Monsees et al., 2017). As a result, the authority of doctors around prescription impedes the willingness of bedside nurses to be engaged in the selection, use and monitoring consumption of antimicrobial (Kirby et al., 2020). CCUs have experienced an unprecedented spread of *pseudomonas aeruginosa* in the recent past. With up to 30% of inappropriate use of antimicrobials in critical care units (Saleem et al., 2019), 12% and 10% of *P. aeruginosa* isolates are resistant to meropenam and piperacillin/tazobactam respectively (Claeys et al., 2018). Herein, a formalized antimicrobial stewardship program with greater involvement of nurses is a valuable avenue to reduce unnecessary exposure to antimicrobials, decrease adverse drug reactions, decrease development of AMR and improve infection cure rates.

SUBJECTS AND METHODS

Study setting, design and population

This study was carried out at Thika Level 5 Hospital (in Kenya) whereby exploratory descriptive qualitative research design was used to collect data from 11 nurses working in the intensive care unit.

Sample selection and size

The study used purposive sampling technique to recruit participants, and data saturation and redundancy was achieved at 11.

Data collection

The researcher used semi-structured interview guide to assist in collection of qualitative data during the interviews. For rigor and trustworthiness, the researcher adopted the Lincoln and Guba model (1985).

Pre-test of the questionnaire

Pretesting was done at Machakos Level 5 Hospital (in Kenya) on five critical care nurses.

Data analysis and presentation

The researcher used NVIVO 14 software and thematic analysis in data analysis.

Ethical consideration

Ethical approval was obtained from Kenyatta University Ethics Review Board: *Ref: KU/ERC/APPROVAL/VOL.1*, National Commission for Science Technology and Innovation (NACOSTI): *Ref No: 759136*, Kiambu Research Board: *Ref. No: KIAMBU/HRDU/AUTHO/2023/09/13/Waithanji JC*, and Thika Level 5 Hospital Research and Ethics Committee: *Ref No. CGK/TL5H/09/09/2023*. The purpose and benefits of the study was explained to the participants and informed consent obtained.

RESULTS

Perceived nurses' role in antimicrobial stewardship

Patient advocacy

The first overreaching theme on the perceived nurses' roles in antimicrobial stewardship was advocacy. Advocacy leverages on speaking on behalf of the patient. Herein, nurses ensure that patient care is in line with the needs of the patient and works to minimize harm to the patients. They confirm collection of samples prior to initiation of antibiotics, they monitor prescriptions for dosage and dosage schedule for antimicrobials, and adherence to treatment guidelines.

C02: "I advocate for the patient to determine whether the antimicrobials are right for the patient, or maybe when we need to change the antimicrobial therapy."

C03: "I play a role in patient advocacy. For instance, when I find a drug has been used for so long, so I advise on the cessation of use."

Communication and Collaboration

Nurses are team players in antimicrobial stewardship in the ICU. They participate in decision making, collaborate with the doctors, pharmacists and the laboratory technicians. Furthermore, they participate in the collection of samples for culture and sensitivity studies, follow up the results in the laboratory and communicate the findings of the culture and sensitivity studies and discuss with both the physicians and pharmacists on the implications and potential adjustments of the treatment regimen.

C04: "In collaboration with the doctors, we participate in decisions involving the selection of antibiotics for our patient."

C10: "we emphasize on multidisciplinary approach in patient care, so that it does not become a one cadre role. Herein, I participate in the selection of antibiotic in the unit in consultation with the doctor. Also, I do suggest to the doctor the need for culture and sensitivity study."

C01: "we take samples for culture and sensitivity studies in the laboratory in the absence of the phlebotomist."

Monitoring and documenting

Nurses participate in monitoring and documenting patient outcomes and response to antimicrobial treatment. They do so by assessing the vital signs, review laboratory data, tracking symptom improvement and conduct follow-up assessment. They further conduct follow-up assessments to gauge the effectiveness of an antimicrobial agent and discuss with the doctor whether to continue or change the medication.

C02: “I participate in the monitoring the response of the patient clinically and also symptomatically.”

C05: “We monitor the duration of the use of the antibiotic. For instance, if is for five days, we ensure the patient get the antibiotic for the five days.”

C03: “In our treatment sheet, we have the days where it is well indicated how many days is the patient supposed to get the antibiotics. In our nurses’ sheet, there is a way we write today the patient is doing day 2 of the drug. In case we have reached day 7, We stop the antibiotic.

Patient education and empowerment

Nurses participate in patient education and empowerment. The content leverage on the benefits, risks and adverse effects of the antimicrobial agents. Nurses further empower patients on the importance of adhering to the antimicrobial agents to include dosage and timing of administration, and safety measures.

C06: Patient health education, upon discharge, we advise them on drug compliance and duration.

C08: Offering education to the patient on antimicrobial use.

Perceived facilitators of nurses’ roles in antimicrobial stewardship

Continuous medical education

Continuous medical education build capacity for nurses on antimicrobial stewardship. Capacity building is invaluable in increasing nurses’ knowledge on the program and promoting better practices in the use of antimicrobials in the unit. It offers ongoing support and updates on disease control and surveillance, emerging infections, antimicrobial resistance and allow nurses to adopt to evolving practices and guidelines in antimicrobial stewardship.

C02: “The institution here, the ICU specifically, we do participate in CMEs where we have different sections of antimicrobial stewardship lessons we get to acquire more knowledge on antimicrobials stewardship”.

C05: We normally have CMEs in the hospital especially on Wednesday. So we can learn from there.

C01: *one means of promoting is nurses' role in antimicrobial stewardship is through organizing these CMEs and allocating more time that is required for the CMEs.*

Inclusion of antimicrobial stewardship in formal nursing education

Inclusion of antimicrobial stewardship in formal nursing education is invaluable in preparing future nurses in responsible use of antimicrobials in the hospital.

C02: *"I suggest the inclusion of antimicrobial stewardship in the curriculum of all nursing programs. This is to begin with diploma level, diploma nurses, degree nurses, and also to ensure that antimicrobial stewardship is put in place in different units.*

C06: *"Learning institutions should include antimicrobial stewardship in the nursing education. Maybe, it can be incorporated in some units in school."*

Team work

Team work through proactive engagement with physicians and other healthcare professionals on issues pertaining to antimicrobial prescription and patient response to treatment facilitates nurses' role in antimicrobial stewardship. Efficient communication promotes continuous consultation between nurses and doctors on all aspects of patient care including assessment, diagnosis, planning, intervention and evaluation.

C05: *"Multidisciplinary collaboration between the nurses and the doctors is good. I can rate it at 70%. And with effective communication between the inter-professional workers, we exchange ideas and teach each other."*

C07: *"The communication here between the nurses and the doctors is good and promotes multidisciplinary collaboration between the different professionals."*

C02: *"The hospital can put in place measures to ensure multidisciplinary collaboration is ensured in the ICU because in the ICU we depend on different disciplines which come in to place and that one will ensure"*

Organizational support

Organization support through provision of continuous training, access to resources, clear guidelines on antimicrobial stewardship, and empowering nurses to make informed decisions pertaining the use of antimicrobial in the ICU. Recognizing the efforts of nurses in antimicrobial stewardship and granting them authority to advocate for responsible use of antimicrobial in the facility fosters their roles in the program.

C04: *"The organization also offer support in form of sponsorship for nurses to go for conferences on antibiotic."*

C06: *"The organization offers supports in terms of training and conferences outside the hospital where we get to learn a lot of things."*

Barriers of nurses' roles in antimicrobial stewardship

Stringent regulatory requirements

Stringent regulatory requirements leave nurses as implementers of doctors' prescription. Wherein it falls under the scope of medical doctors/physicians, nurses play an important role in antimicrobial selection, administration and monitoring patients' response to the treatment. Undefined organizational culture on drug prescription makes nurses feel excluded on decisions on antimicrobial use in the unit.

C10: *“Doctors have too much authority on drug prescription and thus the role of the nurse is left to implement what the doctor has prescribed.”*

C01: *“Regulatory requirements on drug prescription affect our role as nurses as some doctors feel superior than the nurse and they are supported by their board. So the role should be regulated where the nurse is given a chance whether to agree or disagree with the doctor since the nurse is a patients' advocate.”*

Heavy workload

Heavy workload overwhelms nurses with routine patient care activities, hindering their involvement in ward rounds where decisions on treatment plans and antimicrobial selection are made. The preoccupation with routine nursing care activities makes nurses forgo monitoring duration of antimicrobial use.

C06: *“The ratio between the patients and the nurses is imbalance. Patients are many and nurses are few, so there is heavy workload on us.”*

C03: *“Sometimes you are so busy... like you don't even have the time to check like what day are we doing of this antibiotic.”*

C10: *“Sometimes, time is limited because you have to divide time between attending the CMEs and attending to your patients in the unit here.”*

Poorly regulated systems affecting multidisciplinary collaboration and communication

Opportunities for nurses to give their inputs in treatment planning and antimicrobial agent selection is limited. Sometimes doctors overlook nurses' inputs on antimicrobials selection or adjustment in treatment regimens. This in turn demoralizes nurses' involvement in decisions in antimicrobials selection as they assume that even if they give their inputs, it may not be considered.

C10: *“Multidisciplinary collaboration here is faced with challenges. You realize that it is not as efficient as it should be. You find that, for instance, if it is a ward round, consultants and doctors will do the ward round with exception of the nurse. So the nurse' role is really limited”.*

C03: *“I would say sometimes a doctor may not take my input into consideration. That becomes a challenge. Sometimes when the doctor who is around is not communicating, I won’t even tell him or her that we are not supposed to use this drug... the days are overdue. We will just continue.”*

C06: *“The hospital should promote good communication between the nurses and the doctors and give the nurses more liberty where they can choose maybe treatment because we are also knowledgeable.”*

Limited knowledge on antimicrobial stewardship

Limited knowledge on antimicrobial stewardship hinders nurses’ participation in decision making processes of antimicrobial selection. Furthermore, limited knowledge on antimicrobial treatment indication, dosage and duration hinders nurses’ participation in decision making processes of antimicrobial selection.

C02: *“you sometimes find that we have limited knowledge due to the evolving technology and the evolving healthcare, you find that maybe we lack knowledge in antimicrobial stewardship.”*

C03: *“The knowledge is limited... even though you go for those CMEs, there are some things that you are not going to put everything into practice because of the heavy workload and everything else, not everything you are going to put in your mind.*

C04: *“For the knowledge, we still need seminars and more CMEs to insist on it.*

DISCUSSION

Nurses’ roles in antimicrobial stewardship

Antimicrobial stewardship is an extension of the role of nurses in patient advocacy (Carter et al., 2017). Nurses have a significant potential to minimize use and errors to promote judicious use of antimicrobial (Padigos et al., 2021). They monitor patients and serve as testimony of how a prescription affects them (Hamdy et al., 2019). According to Davey and Aveyard (2022), nurses have a duty to speak up and uphold patients’ safety in fulfilling their patient advocacy role. In communication and collaboration, nurses’ initiate discussions on evaluation of treatment plan after two days of the commencement of antimicrobials (Davey and Aveyard, 2022). In this context, nursing as a profession should be recognized as the operational and communication hub within antimicrobial stewardship (Rout et al., 2021). They question de-escalation of antimicrobials from broad spectrum to narrow spectrum, and switch of intravenous to oral antimicrobials (Hamdy et al., 2019). According to Broom et al. (2017), nurses occupy a conscious position in healthcare facilities which makes them act as brokers of doctors’ antimicrobial prescription based on their capacity to challenge doctor’s decisions.

According to the Australian Commission on Safety and Quality in Health Care (2018), nurses are primary drivers in data monitoring through provision of feedback on adverse drug reactions, antimicrobial resistance and the spread of *clostridium difficile* in the unit. They monitor patient's response to antimicrobial regimen through daily observation and documenting adverse effects of antimicrobials (Madran, 2022). In patient education and empowerment, nurses talk to their patients about how they should take antimicrobials appropriately to prevent misuse and antimicrobial resistance (Schaffart, 2020). They further explain to patients why antimicrobial therapy is unnecessary in viral infection and the potential consequence of overuse of antimicrobial agents (Hamdy et al., 2019).

Facilitators of nurses' role in antimicrobial stewardship

Continuous medical education (CME) is a major facilitator of nurses' role in antimicrobial stewardship. Nurses are enthusiastic about continuous medical education (Greendyke et al., 2016). Improved nurses' education is an important enabler of nurses' participation in antimicrobial stewardship (Gotterson et al., 2021). In-service training after every 6 months is a pathway in addressing limited knowledge on antimicrobial stewardship (Hendy et al., 2022). According to Davey and Aveyard (2022), introduction of formal training on antimicrobial stewardship and protected teaching time will address knowledge deficit among nurses. Educating nurses on antimicrobial stewardship is a crucial milestone in empowering nurses to take part in the program (Kirby et al., 2020). Strengthening nursing education is a major facilitator in promoting nurses' involvement in antimicrobial stewardship (Sakaguchi et al., 2022). Pharmacology and microbiology lessons in nursing education should be presented as applied sciences whose application and relevance in clinical practice should be regularly reinforced (ANA & CDC, 2017).

Antimicrobial stewardship is a collective endeavor and a responsibility for all healthcare professionals involved directly in the care of patients (Courtenay et al., 2018). Consultative and collaborative network is crucial in acquiring knowledge and skills that forms the basis for long-term growth of antimicrobial stewardship (Moehring et al., 2021). There is urgent need to strengthen team communication in antimicrobial stewardship by addressing physician-nurse hierarchy to promote open and effective communication (Bos et al., 2023). Prior to formulating effective partnership between physicians and nurses, there is need to address uncertainty about the scope of nurses in antimicrobial stewardship (Greendyke et al., 2019). Essentially, having a clear definition of roles of different members of the healthcare team will foster respect for the significant contribution of all those involved in antimicrobial stewardship and promote multidisciplinary collaboration (Bransby et al., 2023). Robust organizational support, technology and strong nursing leadership are enablers of nurses' involvement in antimicrobial stewardship (Padigos et al., 2020). Herein, organizations can encourage nurses to take part in journal clubs and become champions of antimicrobial stewardship (ANA & CDC, 2017).

Barriers of nurses' role in antimicrobial stewardship

Failure to involve nurses in antimicrobial stewardship rounds and disregard of the inputs acts as a barrier of nurses' role in antimicrobial stewardship (Monsees et al., 2018). Nurses' inputs in decision making processes are least influential compared to inputs from pharmacists and senior doctors and are exempted in majority of ward rounds where decision on antimicrobial use are done. (Charani et al., 2019). Nurses' input on decisions on antimicrobial use is inadequate due to limited knowledge on antimicrobial prescription (Davey & Aveyard, 2022). The traditional hierarchical structure of the wards reserves decisions on antimicrobial selection to physicians who are viewed to be more knowledgeable (Davey & Aveyard, 2022). As a consequence, nurses are reluctant to take an active role in antimicrobial stewardship (Best & Smith, 2019).

The scope of practice for nurses and clear distinction of physician's role in drug prescription and nurses' role in drug administration limit nurses' role in antimicrobial stewardship (Abbas et al., 2019). Moreover, heavy workload force nurses to unintentionally neglect their roles in antimicrobial stewardship since they have to prioritize routine patient care activities (Ladenheim, 2018). High workload for nurses limit their time to participate in antimicrobial stewardship (Hendy et al., 2022). Inappropriate communication methods hinder consideration of nurses input in decision making processes of antimicrobial selection and use (Madran, 2022). Lack of formal policies that articulate nurses' role in antimicrobial stewardship and traditional professional hierarchies hinder nurses' involvement in antimicrobial stewardship in hospitals (van Gulik et al., 2021).

CONCLUSION

Nurses play a cognizant role in antimicrobial stewardship. Their inputs in decision making process on treatment plans and antimicrobial use is essential since they are the frontline caregivers of the patient. They are actively involved in patient assessment, monitoring patients' response to antimicrobial as well as reporting adverse reactions of antimicrobial agents. Contribution of nurses in important decisions on antimicrobial use in the unit is limited due to inefficient communication between doctors and nurses and stringent regulatory requirement that reserve the prescription authority to doctors. If implemented successfully, continuous medical education and inclusion of antimicrobial stewardship in formal nursing education would build capacity among nurses in antimicrobial stewardship and consequently their involvement in the program. Further clarity on how critical care nurses should perform their roles in complex working environment in the intensive care units is essential. Future research should focus on redefining the nature, scope and influence of perceived nurses' role in antimicrobial stewardship.

RECOMMENDATIONS

- i. Continuous medical education on antimicrobial stewardship in the unit to increase nurses' knowledge on antimicrobial stewardship.
- ii. Inclusion of antimicrobial stewardship in formal nursing education to nature responsible future nurses in antimicrobial use.
- iii. Use of multidisciplinary approach in antimicrobial stewardship to involve bedside nurses.
- iv. Institute open communication culture within the hospital through the use of a structured communication tool such as SBAR.
- v. Make it a policy for nurses to join ward rounds to allow them give inputs on treatment plans of patients in the unit.

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