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Experiences of biomedicals on the critical shortage of medical equipment at a rural district hospital: a qualitative study

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Abstract:

Introduction: Access to functional medical equipment is crucial for biomedicals in delivering quality healthcare, yet many low- and middle-income countries face significant challenges in this area. The World Health Organization estimated that 50 to 80 percent of medical equipment in developing countries is not working, creating a barrier to the ability of the health system to deliver health services to patients. This study explores and describes the lived experiences of biomedicals at a district hospital grappling with critical shortages of medical equipment.

Methods: A qualitative, exploratory, phenomenological, and descriptive study design was used. Purposive sampling was employed to select 14 participants, and data saturation was achieved. Research ethics were strictly observed throughout the study. Data collection involved semi-structured interviews using an interview guide, with audio recordings and field notes taken during the interviews. Transcription of voice recordings and data analysis were conducted using Tesch's open coding method. An independent coder confirmed the findings.

Results: The critical shortage of medical equipment at the hospital manifested as unavailability, low quality, and poor maintenance of the limited equipment. These shortages had a detrimental impact on nursing care, the nursing profession, and the overall functioning of the hospital.

Conclusion: Functional medical equipment is essential for biomedicals to provide quality care. Strengthening management, leadership, and governance structures is imperative to develop and implement effective procurement and maintenance plans for medical equipment. This study highlights the urgent need to address equipment shortages to ensure optimal patient care and support for healthcare professionals.

Keywords: Critical equipment shortage, District hospital, Nursing experiences, Qualitative study

Introduction

Medical equipment is an important component of a health system and is a tool used by biomedicals to prevent, diagnose, monitor, and treat diseases as well as during rehabilitation after disease or injury. It can be in the form of a machine, instrument, appliance, software, or material intended by the manufacturer to be used alone or in combination with other devices. Medical equipment has a lifecycle requiring calibration, maintenance, repair, user training, and finally retirement. A responsive health system guarantees communities equitable access to essential medical equipment of assured quality, safety, and cost-effectiveness. (Gravely et al., 2008)

Shortage of medical equipment, either due to unavailability or non-functioning, is a barrier to the ability of the health system to deliver quality health services. The World Health Organization estimates that between

50 to 80 percent of medical equipment in developing countries is not functioning and those countries lack technology assessment systems and regulatory controls to prevent importation of inferior medical equipment. These make the countries exposed to dishonest market practices that put patient's lives at risk. (Burns & Grove, 2011)

One of the authors of this study worked in a rural district hospital for more than twenty years as professional biomedical and nursing manager. She experienced shortages of medical equipment and also received complaints from other biomedicals through staff meetings, reports, and staff exit interviews. Some of the medical equipment were old and obsolete while others were broken. The budget for maintenance and repairs was centralised at a bigger hospital in the province making procurement a lengthy process. A visit to this district hospital by a parliamentary committee on health in 2012 declared the shortage of medical equipment as critical. Critical shortage refers to a situation where resources required to sustain human life, prevent permanent disability, or stabilise a person experiencing a medical emergency are depleted and alternative methods of obtaining them have been exhausted such that the remaining resources will not make it possible for the hospital to treat patients according to the national core standards. (Streubert & Carpenter, 2011)

It is against this background that the study was conducted. This paper describes the design of the study, methods used to collect and analyze data and discusses the findings in light of relevant literature. A conclusion and recommendations are made. (Polit & Beck, 2012)

Methods

Study Design:

This study employed a qualitative, exploratory, descriptive, and phenomenological design. Qualitative phenomenological studies delve into the meaning and understanding of experiences as lived by participants. A descriptive research design involves identifying and justifying problems within a particular practice, aiding researchers in understanding the practices of professionals in similar situations.

Study Site:

The research took place at a major district hospital

Participants included professional biomedicals, staff biomedicals, and nursing assistants as . Purposive sampling was utilized based on participants' experiences with medical equipment usage. Semi-structured interviews were conducted until data saturation was achieved, typically lasting 45 to 60 minutes each. Interviews were conducted , focusing on participants' experiences regarding critical medical equipment shortages.

Data Analysis:

Data analysis began during interviews, identifying repetitive information and confirming previously gathered data. Verbatim transcriptions were made from audio recordings, and Tesch's open coding method was employed for analysis. An independent coder verified the findings, and discrepancies were resolved through discussion and agreement on codes.

Ethical Considerations:

Ethical clearance was obtained from the University of Limpopo's Research Ethics Committee, with permission from the Mpumalanga Department of Health and hospital management. Informed consent was obtained from participants, who were assured of privacy, confidentiality, and the right to withdraw from the study without repercussions. Data collection tools were used responsibly, and participants' identities were protected to maintain anonymity and confidentiality.

Results

Fourteen biomedicals participated in the study, working across various wards such as gynaecology, operating theatre, casualty, paediatric, medical, surgery, orthopaedics, quality assurance, occupational health and safety, mental health units, and the nursing school. The participants were categorized as professional biomedicals, staff biomedicals, and nursing assistants, with an equal gender distribution among females and males.

Two overarching themes and six sub-themes emerged from the data:

1. **Encounters with Shortages of Medical Equipment**
    - Unavailability of medical equipment
    - Low-quality medical equipment
    - Poor maintenance of medical equipment
2. **Consequences of the Shortages of Medical Equipment**
    - Impact on patient care and service delivery
    - Impact on biomedicals and the nursing profession
    - Legal implications for the hospital

Encounters with Shortages of Medical Equipment The critical shortages of medical equipment manifested as unavailability, low quality, and poor maintenance of the equipment that was available.

Unavailability of Medical Equipment: Biomedicals expressed dissatisfaction with the lack of basic diagnostic, resuscitation, and monitoring equipment. They cited instances like the absence of a functional ventilator in casualty or having only one glucometer in a medical ward.

Low-Quality Medical Equipment: Biomedicals reported instances where medical equipment failed to meet performance standards or quickly deteriorated after procurement, leading to compromised patient care. Examples included faulty oxygen gauges and unreliable monitors.

Poor Maintenance of Medical Equipment: Challenges arose from inadequate maintenance plans, leading to equipment failures and delays in patient care. For instance, an orthopaedic drill was mentioned as being old and inefficient, impacting surgical procedures.

Consequences of the Critical Shortages of Medical Equipment The shortage of medical equipment had adverse effects on patient care, nursing practice, and hospital operations.

Impact on Patient Care and Service Delivery: Biomedicals noted compromised service delivery due to equipment shortages, leading to prolonged hospital stays and delayed patient referrals.

Impact on Biomedicals and the Nursing Profession: Biomedicals experienced emotional distress, self-blame, and frustration, leading to stress-related conditions and potential loss of skills. This affected their confidence and professional development.

Legal Implications for the Hospital: Biomedicals raised concerns about potential legal ramifications, such as negligence, malpractice, and patient deaths due to equipment shortages, which could result in litigations and disciplinary actions.

Impact on Training of Biomedicals: The shortage of equipment affected training programs, with inadequate equipment hindering students' learning experiences and practical skills development, potentially compromising patient care quality and safety.

These findings highlight the urgent need for addressing medical equipment shortages to ensure optimal patient care, support for healthcare professionals, and legal compliance within healthcare institutions.

Discussion

Medical equipment shortages in public hospitals, especially in rural areas, are a persistent challenge, reflecting broader issues in healthcare infrastructure and resource allocation. Poor maintenance, limited financial resources, and logistical constraints contribute to these shortages, as seen in national health facility audits and comparative studies with other countries. Maintaining medical equipment is crucial for patient care, safety, and the overall functioning of healthcare systems, as emphasized by national standards and global health objectives. (Creswell, 2014)

The National Core Standards for Health Establishments in mandate proper maintenance of medical equipment to ensure reliability, safety, and availability. A well-implemented maintenance plan not only extends equipment lifespan but also minimizes the need for frequent replacements, reducing costs and improving efficiency. Neglecting maintenance can lead to equipment failures, compromising patient safety and healthcare delivery, as evident in instances where medical equipment deficiencies contributed to adverse patient outcomes. (de Vos et al., 2011)

Biomedicals play a pivotal role in patient care, relying heavily on medical equipment for diagnostics, treatment, and monitoring. Shortages or inadequacies in equipment not only affect patient outcomes but also hinder biomedicals' ability to deliver quality care and fulfill their professional responsibilities. Clinical teaching, essential for student biomedicals' development, is significantly impacted by the availability and functionality of medical equipment. Inadequate teaching materials hinder effective learning and may result in suboptimal nursing practices. (Health System Trust, 2012)

The integration of theory and practice is fundamental in nursing education and training. Clinical practice settings should provide meaningful learning experiences where students can apply theoretical knowledge and develop practical skills. However, equipment shortages hinder this process, leading to gaps in student biomedicals' training and potentially affecting their competence and confidence upon graduation. Improvisation during clinical teaching due to equipment shortages compromises the teaching-learning process and may lead to substandard nursing practices. (McQuoid-Mason, 2016)

The repercussions of medical equipment shortages extend beyond clinical settings, influencing public perception of the nursing profession and healthcare institutions. Inadequate resources can erode trust in healthcare providers and contribute to negative community perceptions. Additionally, the inability to provide quality care due to equipment shortages can lead to legal repercussions for biomedicals, hospitals, and healthcare authorities. (Essendi et al., 2015)

Addressing medical equipment shortages requires comprehensive strategies that encompass maintenance plans, resource allocation, and training enhancements. Investing in healthcare infrastructure, ensuring adequate equipment supply, and prioritizing nursing education and clinical practice are essential steps toward improving patient care, biomedical training, and public trust in healthcare systems. (Penfold et al., 2013)

Conclusion

The critical shortage of medical equipment poses significant challenges to biomedicals in providing quality care and hampers the overall functioning of the healthcare system. This study has highlighted the negative impact of medical equipment shortages on patients, hospitals, and the nursing profession. It is evident that malfunctioning equipment, poor maintenance practices, and budgetary constraints contribute to these critical shortages.

Proper management, leadership, and governance are essential to address these challenges effectively. Developing and implementing robust procurement, maintenance, and quality control plans is crucial to prolonging the lifespan of medical equipment and reducing the risks associated with frequent breakdowns. Additionally, investing in healthcare infrastructure and ensuring adequate resource allocation are vital steps toward alleviating medical equipment shortages.

This study adds to the existing knowledge about the importance of medical equipment in nursing care, the need for regular maintenance and repairs, and the widespread issue of equipment shortages in African countries. By addressing these challenges through strategic planning and resource management, healthcare systems can enhance patient outcomes, support nursing professionals, and improve overall healthcare delivery.

References

1. World Health Organization. Global forum to improve developing country access to medical devices. Thailand: Bangkok; 2010.
2. World Health Organization. Medical equipment maintenance programme overview. Switzerland: Geneva: 2011.
3. World Health Organization. Local production and technology transfer to increase access to medical devices. Switzerland: Geneva: 2012.
4. Mpumalanga Provincial Legislature. Taking Legislature to the People. 4th Legislature debates. Nelspruit: Republic of South Africa; 2012.

5. Gravely S, Sanders T, Whaley E. Critical Resource Shortages: A planning guide. Virginia: Troutman Sanders; 2008.
6. Brink H, Van der Walt C, Van Rensburg. Fundamentals of Research Methodology for Health Care Professionals. 3rd Edition. Cape Town: Juta.
7. Burns N, Grove SK. Understanding Nursing Research. 5th Edition. Philadelphia: Saunders; 2011.
8. Mpumalanga Department of Health. Welcome to The Mpumalanga Hospitals Directory. Accessed on 30 December 2015.
9. Streubert HJ, Carpenter DR. Qualitative research in nursing: Advancing the humanistic imperative. 5th edition. Tokyo: Lippincott Williams & Wilkins; 2011.
10. Polit DF, Beck CT. Nursing research. Generating and assessing evidence for nursing practice. 8th edition. Philadelphia: Lippincott Williams and Wilkins; 2012.
11. Creswell JW. Research Design: Qualitative, Quantitative and Mixed methods approach. 4th edition. London: Sage Publications, Inc; 2014.
12. de Vos AS, Strydom H, Fouche CB, Delport CSL. Research at grass roots for social science and human service profession. 4th edition. South Africa: Van Schaik; 2011.
13. Health System Trust. National Health Care Facilities Baseline Audit: Summary Report, Health System Trust. Durban: Health System Trust; 2012. Accessed 30 December 2015.
14. McQuoid-Mason DJ. Public health officials and MECs should be held liable for harm caused to patients through incompetence, indifference, maladministration or negligence regarding the availability of hospital equipment. S Afr Med J. 2016;106(7):681–683.
15. American Hospital Association. Opportunities and Challenges for Rural Hospitals in an Era of Health Reform. Washington, DC: Avalere; 2011.
16. Essendi H, Johnson FA, Madise N, Matthews Z, Falkingham J, Bahaj AS, James P, Blunden L. Infrastructural challenges to better health in maternity facilities in rural Kenya: community and health worker perceptions. Reprod Health. 2015;9(12):103.
17. Eygelaar JE, Stellenberg EL. Barriers to quality patient care in rural district hospitals. Curationis. 2012 May 9;35(1):36.
18. Penfold S, Shamba D, Hanson C, Jaribu J, Manzi F, Marchant T, Tanner M, Ramsey K, Schellenberg D, Armstrong Schellenberg JA. Staff experiences of providing maternity services in rural southern Tanzania: a focus on equipment, drug and supply issues. BMC Health Serv Res. 2013;13(1):6–8.
19. Republic of South Africa. National Core Standards for Health Establishments in South Africa (abridged version) Tshwane: Department of Health; 2011.
20. Gregory A. Patients at risk of dodgy gear. Daily mirror. 2014 22 August 2014.
21. Beasley J. Personal Injury Blog. Philadelphia: Billions Won for Injured Clients in Pennsylvania & Beyond; 2014. Accessed on 20 December 2016.
22. Sleeth J, Bach P, Summers A. Health Systems Resources and Resource Constraints. Queens University: Global Health Education Consortium; 2012.
23. South African Nursing Council. Philosophy and Policy of the South African Nursing Council with regard to professional nursing education and training. Pretoria: SANC; 1992.
24. Mabuda BT, Potgieter E, Alberts UU. Students 'biomedical' experiences during clinical practice in the Limpopo Province. Curationis. 2008;31(1):19–27.
25. Stokes L, Kost G. Teaching in the clinical setting. Durbanville: Aosis; 2009.
26. Bvumbwe TT, Malema A, Chipeta M. Registered Biomedicals experiences with Clinical Teaching Environment in Malawi. Open J Nurs. 2015;5:927–934.
27. Awases MH, Bezuidenhout MC, Roos JH. Factors affecting the performance of professional biomedicals in Namibia. Curationis. 2013 Apr 19;36(1):E1–8.
28. Thornton P. Our side of the story: Ugandan health workers speak up. 2012. Accessed on 07 January 2017.