



OPEN Application of the workload indicators of staffing need (WISN) to assess dietetic workforce needs in South African central and tertiary public hospitals

Vertharani Nolene Naicker^{1,2}✉, Jane W. Muchiri², Keshan Naidoo³ & Modiehi Heather Legodi⁴

South Africa faces both under- and over-nutrition, highlighting the need for prioritizing nutrition services. Registered dietitians are crucial for delivering appropriate and quality nutrition services. Consequently, this case study employs the World Health Organization evidence-based Workload Indicators of Staffing Need to ascertain the requisite dietetic workforce needed at central and tertiary public hospitals in South Africa. Head dietitians from 21 of 22 central and tertiary public hospitals participated in an online survey to provide data and consensus on workload components and activity standards via Delphi technique. Data were analyzed using the World Health Organisation Workload Indicators of Staffing Need software. Dietetic staffing needs were determined based on the difference between existing and required numbers of dietitians. WISN ratio was used as a metric to gauge dietitians' workload pressure. Majority (95%) of hospitals experienced dietetic staff shortages and few (14%) had requisite staff to cover basic health services. Majority (76%) exhibited a WISN ratio below 0.5, indicating fulfilment of less than 50% of staff requirements. Based on the Workload Indicators of Staffing Need, dietitians in South African central and tertiary public hospitals experience high workload pressures due to extreme understaffing. The results can guide future profession workforce planning to facilitate enhanced nutrition outcomes in South Africa.

Keywords Dietitian, Hospital, Staffing needs, South Africa, WISN, Workload indicators of staffing need

Abbreviations

HPCSA	Health Professions Council of South Africa
HRH	Human Resources for Health
SA	South Africa
WISN	Workload Indicators for Staffing Need

To align with global health agendas, South Africans should have access to competent and motivated health workers, distributed equitably to deliver quality services that meet the socio-cultural needs of the population¹. The 2030 Human Resources for Health (HRH) Strategy in South Africa (SA), titled “Investing in the Health Workforce for Universal Health Coverage,” recognizes existing disparities in professional skill mixes that impede healthcare delivery^{2,3}. While attention frequently centers on staffing needs of doctors (8.6%) and nurses (56%), other important health professionals are often overlooked^{2,4,5}. Recent international studies focusing on these professionals emphasize the necessity of an appropriate skill mix to ensure high quality patient care⁴⁻⁶.

SA, characterized by its diverse population, mirrors this diversity in registered health care professionals governed by entities such as the Health Professions Council of South Africa (HPCSA), South African Nursing Council, and South African Pharmacy Council^{7,8}. The SA HRH strategy prioritizes 22 key disciplines including

¹National Department of Health, South Africa, Dr AB Xuma Building, 112 Voortrekker Road, Pretoria Townlands 351-JR, Pretoria 0187, South Africa. ²Department of Human Nutrition, Faculty of Health Sciences, University of Pretoria, Pretoria, South Africa. ³Right to Care, 1006 Lenchen Avenue North, Centurion, South Africa. ⁴Department of Human Nutrition and Dietetics, School of Health Care Sciences, Sefako Makgatho Health Sciences University, Pretoria, South Africa. ✉email: nolene.naicker1@gmail.com

nurses and pharmacists but does not include all professional categories registered under the HPCSA². Dietetics professionals are registered under one of the 12 professional boards within the HPCSA but have not been included in the HRH strategy. Compounded by the sluggish progress in achieving the 2025 global nutrition targets, the call for nutrition interventions grows stronger⁹. Additionally, SA's dual burden of malnutrition highlights the need to prioritize dietitians as part of an appropriate skill mix^{10–12}. Consequently, determining the current number and density of dietitians is a key first step in evidence based workforce planning at all levels of care^{2,13}.

The World Health Organization's (WHO's) Workload Indicators of Staffing Need (WISN), an evidence based planning tool, calculates the required number of specific health workers to match the workload demands of a given facility^{14,15}. This tool uses facility data to anticipate staffing needs, factoring in health service packages, care complexities, and inter-facility differences^{13–16}. The tool has proven valuable in analyzing staffing workloads, calculating staffing needs, and anticipating staffing requirements in hospitals around the world^{4,14,17–21}. Here, we apply the WHO WISN software in this case study to determine the dietetic workforce requirements in central and tertiary public hospitals in SA. Findings may be useful for developing a context specific staffing norm framework for dietitians in SA.

Methods

Ethics approval was obtained from the Research Ethics Committee, Faculty of Health Science at the University of Pretoria (Ethics reference 97/2021). The study was registered and approved for data collection via the National Health Research Database. All methods were performed according to the relevant guidelines and regulations. The WISN methodology informed the calculation of required dietetic staffing needs. The WISN combines workload components (WC), activity standards (AS), hospital characteristics such as available working time (AWT) and health service statistics, to calculate staffing needs¹⁵. The three categories of WISN WC were taken into consideration^{15,22}. These included: (1) Health service activities defined as the core activities performed by all members of the cadre for which health service statistics are collected; (2) Support service activities which are important tasks performed by all members of the cadre but do not have statistics and lastly; (3) Additional/Individual service activities only performed by certain members of the cadre which also do not have statistics^{15,22}. The AS were defined as the time taken by the cadre to perform each activity by professional standards in the local context^{15,22}. Data were collected in two phases with two sets of study participants following informed consent from participants, detailed elsewhere²². In phase 1, the study participants included all ($n=9$) provincial nutrition managers representing SA's nine provincial health departments. These provincial nutrition managers provided the job descriptions of dietitians working at central and tertiary level hospitals in their respective provinces. These job descriptions were analysed as per the three WISN WC providing the initial list for the Delphi exercise in phase 2. Phase 2 participants were 21 out of 22 head dietitians at SA central and tertiary hospitals. One hospital did not provide approval for data collection. SA currently has five categories of hospitals, namely: district; regional; tertiary; central and specialised²³. Only central and tertiary hospitals were purposely selected for this study because each hospital at these two levels of care had dietetic representation (at least one permanently employed dietitian) in comparison to the district, regional and specialised hospitals. Both of these categories of hospitals provide specialist services. The details of the Delphi process (phase 2) is reported elsewhere²². Briefly, three rounds of the online Delphi process obtained consensus on the WC together with their corresponding AS from the participants. Participants were presented with the initial list of 50 WC (12 health service, 16 support services, 22 additional service) and were required to do the following: (i) rate their agreement of the WC on a Likert scale, (ii) and any new activities on any of the WC if deemed necessary, and (iii) for each WC (initial and new) provide an AS. An agreement threshold of $\geq 70\%$ was used to determine consensus on WC while the median was used for the aligned AS²². There was 100% participation in all three rounds of the Delphi. Phase 2 culminated in 92% agreement on the initial and newly added WC's, resulting in a total of 45 WC, 15 per category (health services, support services, additional service activities) with their aligned AS²². These agreed upon WC and AS (Annexure 1) were utilised in the current study together with health service statistics data also collected during Phase 2. The AWT per staff was determined by calculating all the working days in a year (excluding the 12 public holidays, average of 26 annual leave, and 10 days on special leave days, and professional training development) as per South Africa labour guidelines²⁴.

The WISN software was used to generate the results of the inputted data¹⁵. The difference between current and required staffing levels, and the WISN ratio outputs from the analysis revealed workload pressures of dietitians¹⁵. The WISN software calculates WISN ratios by dividing the current number of dietitians with the required number of dietitians. A WISN ratio equal to one indicates sufficient dietitians. A ratio of more than one indicates overstaffing. A WISN ratio of less than one indicates understaffing and high workload pressure¹⁵.

We illustrated the generated WISN outputs in two sets: Set (1) WISN calculated number of dietitians required to perform ONLY health service activities; Set (2) Total WISN calculated number of dietitians required to perform health service, support service and additional service activities. The illustration of Set 1 provides insights on the number of hospitals currently struggling to meet basic health service activities, whilst Set 2, illustrates the ideal WISN calculated number of dietitians that are required at hospitals to meet the total dietetic workload.

Results

Participant characteristics

All current ranks of dietitians in the South African public sector were represented (production, chief, assistant director and deputy director). Most participants ($n=11$) had at least 11–20 years of experience, followed by

those with 21–30 years ($n=4$) and 6–10 years ($n=2$) experience. Four participants had more than 30 years experience. All participants were older than 30 years (30–39: $n=7$, 40–49: $n=9$, 50–59: $n=5$).

Health service statistics

Health service statistics were obtained from all 21 hospitals for the period January 2021 to December 2021, but only 8 of the 21 hospitals provided complete lists. Reasons for incomplete statistics related to poor data recording or no data being collected for certain health service activities. As a result, all health service activities without supporting statistics were omitted from final workload calculations for respective hospitals; resulting in underestimated staffing requirements^{15,17}. The AWT for a permanently employed dietitian at central and tertiary public hospitals was calculated as 1528 h per year.

Dietetic staffing requirements

When considering Set 1 results, only three (14%) hospitals had sufficient numbers of dietitians to cover basic health service activities (Table 1). Staff deficits ranged from 2 to 23. About half of hospitals ($n=10$) had WISN ratios of less than 0.5 indicating that they met less than 50% of staff requirements and thus experienced a high workload pressure. Two tertiary hospitals had the highest workload pressures in trying to meet basic health service activities indicated by very low WISN ratios of 0.23 and 0.24.

When considering Set 2 results (Table 2), only one hospital served by six dietitians met the WISN calculated requirement for dietitians. Staff deficits ranged from 2 to 38 dietitians with the latter observed in a tertiary hospital. About three quarters of the hospitals ($n=16$, 76%) had WISN ratios of less than 0.5 indicating that they met less than 50% of staff requirements and thus experienced a high workload pressure. Three hospitals (two central and one tertiary) experienced very high workload pressures because they met less than 25% of staff requirements (WISN ratio of <0.25). Workload pressures increased relative to the required staffing needs (Tables 1 and 2).

Discussion

This study revealed the extent of understaffing within dietetic units at central and tertiary public hospitals in SA¹⁶. The calculated WISN requirements have highlighted substantial shortcomings: 86% of hospitals fail to meet basic health service activity staffing needs (Set 1 results), while 95% struggle to fulfill the ideal WISN calculated staffing requirements as shown in Set 2 results. These levels of understaffing correspondingly align with a consistent trend in workload pressures for central and tertiary hospitals. The application of WISN in the South African Primary Health Care context and in other countries has also shown WISN to be useful in highlighting staffing deficiencies across various healthcare settings^{16,21,25–29}. A case study by Dimiri et al., in 2022 which focused on both clinical (medical, nursing, health extension officers; pharmacist and radiology staff) and non-clinical staff showed that the use of WISN as an approved national tool provided evidence for staffing decisions in the country¹⁹.

Hospital	Permanently employed dietitians (February to April 2022)	WISN calculated requirement of dietitians for ONLY health service activities	Difference	WISN ratio
A001-TH	17	26	-9	0.67
A002-TH	10	15	-5	0.65
A003-TH	5	10	-5	0.49
A004-TH	4	9	-5	0.44
A005-TH	11	10	-1	1.11
A006-TH	8	23	-15	0.35
A007-TH	9	11	-2	0.79
A008-TH	11	23	-12	0.47
A009-TH	6	4	2	1.63
A010-TH	5	21	-16	0.24
A011-TH	7	30	-23	0.23
A012-TH	7	19	-12	0.37
A013-TH	7	16	-9	0.42
A014-TH	8	6	2	1.23
A015-TH	6	8	-2	0.75
A001-CH	4	11	-7	0.37
A002-CH	13	24	-11	0.53
A003-CH	6	14	-8	0.44
A004-CH	9	26	-17	0.35
A005-CH	9	26	-17	0.34
A006-CH	11	12	-1	0.95

Table 1. Set 1 results: WISN calculated staffing differences and workload pressures based only on health service activities.

Hospital	Permanently employed dietitians (February to April 2022)	Ideal WISN calculated requirement for dietitians	Difference	WISN ratio
A001-TH	17	38	-21	0.45
A002-TH	10	23	-13	0.44
A003-TH	5	15	-5	0.34
A004-TH	4	14	-10	0.29
A005-TH	11	16	-5	0.69
A006-TH	8	34	-26	0.24
A007-TH	9	19	-10	0.47
A008-TH	11	35	-24	0.32
A009-TH	6	6	0	1.03
A010-TH	5	31	-26	0.16
A011-TH	7	45	-38	0.16
A012-TH	7	27	-20	0.18
A013-TH	7	24	-17	0.29
A014-TH	8	10	-2	0.78
A015-TH	6	12	-6	0.50
A001-CH	4	16	-12	0.25
A002-CH	13	37	-24	0.36
A003-CH	6	21	-15	0.29
A004-CH	9	38	-29	0.24
A005-CH	9	39	-30	0.23
A006-CH	11	19	-8	0.59

Table 2. Set 2 results: Ideal WISN calculated staffing differences and workload pressures.

It is a recommendation that hospitals strive to at least meet the basic health service activity requirements as depicted in Set 1 results as an initial step towards improving nutrition services. This goal should be to fulfill the WISN requirements depicted in Set 2 results as the ideal.

We noted an important disparity between the actual health service activities performed by dietitians and related record keeping. The WISN tool factors in differences in services and care complexities between hospitals, even when they fall under the same category¹⁵. Consequently, there is a pressing need for hospital-specific service statistics to support a standardised list of health service activities. As existing data are needed to assess and determine workloads¹⁵, the accuracy of the WISN method depends on the accuracy of data¹⁵. Previously, we developed a standardized list of WC that can be used to collect annual health service data²², which may improve the accuracy of future dietitian staffing and workload assessments^{3,15}. It is important to acknowledge that calculated WISN requirements in our study might underestimate actual figures for certain hospitals due to incomplete statistics. Nevertheless, these calculations represent an initial stride towards meeting the dietetic needs of all hospitals.

If the dietetic staffing needs of hospitals remain unmet, dietitians will have to compensate for staff shortages by working overtime, which will further increase workload pressures. The calculated WISN ratios provide policy makers and managers with a clear view of which hospitals are grappling with the highest workload pressures, enabling them to prioritize facilities accordingly¹⁴.

Facilities are encouraged to periodically revisit the WISN exercise due to possible changes in service demands [14]. Regular reviews, aligned with health and human resource plans, can facilitate accurate staff forecasting^{5,14,18,19,21}.

Conclusion

South Africa's central and tertiary public hospitals are grappling with a shortage of dietitians which impacts on the delivery of dietetic services. In SA, this WISN study reveals severe understaffing of dietitians who are exposed to extreme work pressures linked to high workloads. The findings of the study can inform future profession planning and facilitate enhanced nutrition outcomes in the South African central and tertiary public hospital context.

Data availability

The datasets generated and/or analyzed during the current study are not publicly available due to these being the property of the South African Department of Health but are available from VNN on reasonable request and with permission and approval from the South African Department of Health and its corresponding research committees at provincial and hospital level.

Annexure 1: Workload components and activity standards for dietitians at South African central and tertiary hospitals based on a Delphi consensus exercise by Naicker et al, 2024²²

Health service activities and related activity standards²²

Health service activities	Activity standard (minutes per patient)
Ward rounds (individual and Multidisciplinary)	10
Patient screening	5
In patient consultation and treatment (new)	30
In patient nutritional assessment (ABCDE) & diagnosis (new)	15
In patient calculation of nutritional requirements & development of nutrition intervention plans (new)	15
In patient nutrition support and dietary counselling (new)	30
In patient consultation and treatment (FU)	15
In patient referral, communication with the multidisciplinary team and related activities	10
Outpatient consultation and treatment (new)	45
Outpatient nutritional assessment (ABCDE) & diagnosis (new)	15
Outpatient nutritional plan and intervention including dietary counselling (new)	30
Outpatient consultation and treatment (FU)	30
Outpatient specialist clinics	45
Report writing and patient notes	15
Referral process between health facilities	10

Support service activities and related activity standards²².

Support activities	Activity standard (Hours per year)
Food service management (developing and updating of cycle menus, therapeutic diets & related diet sheets)	24
Development and review of policies, protocols, and guidelines (including related IEC materials)	36
Dietetics departmental meetings	38
Hospital committee/ internal stakeholder meetings	44
Meetings with industry representatives and other external stakeholders	18
Own performance development and management system (PMDS) reporting	8
Continued professional development (CPD) activities	24
Participation in journal reviews and working groups	38
In-service training to the multidisciplinary team (nurses, doctors etc.)	12
In-service training to the food service team	8
Student mentoring, evaluation & reporting (including meeting with universities and accreditation of facilities)	90
Attend training (generic)	18
Recordkeeping, statistics & report writing	48
Peer reviews and clinical audits	24
Outpatient health awareness events/campaigns/open days (planning and participation)	20

Additional service activities and related activity standards²².

Additional activities	Activity standard (Hours per year)
Managerial duties (risk management, financial management (budgeting and procurement), asset management, planning of duty rosters)	24
Audits (stock take and stock take audits, diet sheet audits, equipment audits etc.)	24
Develop and review departmental plans (Strategic, business and operational)	16
Evaluate and monitor the implementation of policies/strategies/guidelines/protocols and norms and standards	24
Report writing, validations and presentations	36
Human resource management (recruitment, selection of new staff, grievances and disciplinary processes, HPCSA registration & compliance, attendance and leave register)	48
Orientation of new staff, training, support and supervision of lower-level staff and community service dietitians	191
Performance development and management system (PMDS)	20
Participation in research activities	24

Additional activities	Activity standard (Hours per year)
National core standards/quality improvement programs (QIP)-develop plans, evaluation, and reports	19
Planning and coordination of departmental meetings	36
District, provincial integrated nutrition program (INP) and allied meetings	24
Mother baby friendly initiative (MBFI) mentor/committee participation and activities	24
Education, training and supervision of foodservice/diet kitchen staff/milk kitchen/tube feed personnel	53

Received: 18 March 2024; Accepted: 6 January 2025

Published online: 11 January 2025

References

- World Health Organization. *Global Strategy on Human Resources for Health: Workforce 2030* (WHO Press, World Health Organization, 2016). WHO.
- South & Africa Department of Health. *Human resources for health strategy: investing in the health workforce for universal health coverage* Edited by Department of Health. Pretoria: Government Printers; (2020).
- Aytona, M. G., Politico, M. R., McManus, L., Ronquillo, K. & Okech, M. Determining staffing standards for primary care services using workload indicators of staffing needs in the Philippines. *Hum. Resour. Health.* **19** (1). <https://doi.org/10.1186/s12960-021-00670-4> (2022). ;Suppl 1:129.
- Silva, A. P. D. & Dal Poz, M. R. An experience with the use of WISN tool to calculate staffing in a palliative care hospital in Brazil. *Hum. Resour. Health.* **19** (1). <https://doi.org/10.1186/s12960-021-00680-2> (2022). ;Suppl 1:135.
- Stankovic, S. & Santric Milicevic, M. Use of the WISN method to assess the health workforce requirements for the high-volume clinical biochemical laboratories. *Hum. Resour. Health.* **19** (1). <https://doi.org/10.1186/s12960-021-00686-w> (2022). ;Suppl 1:143.
- Kunjumen, T. et al. Multi-country case studies on planning RMNCH services using WISN methodology: Bangladesh, Ghana, Kenya, Sultanate of Oman and Papua New Guinea. *Hum. Resour. Health.* **19** (1). <https://doi.org/10.1186/s12960-021-00671-3> (2022).
- van Rensburg, H. C. J. South Africa's protracted struggle for equal distribution and equitable access – still not there. *Hum. Resour. Health.* **12** (1), 26. <https://doi.org/10.1186/1478-4491-12-26> (2014).
- South Africa. *Health Professions act 56 of 1974* (Regulations Defining the Profession of Dietetics, 1991).
- Global Nutrition Report: The State of Global Nutrition. Bristol, UK: Development Initiatives. (2021).
- Modjadji, P. & Madiba, S. The double burden of malnutrition in a rural health and demographic surveillance system site in South Africa: a study of primary schoolchildren and their mothers. *BMC Public Health.* **19** (1), 1087. <https://doi.org/10.1186/s12889-019-7412-y> (2019).
- Tydemans-Edwards, R., Van Rooyen, F. C. & Walsh, C. M. Obesity, undernutrition and the double burden of malnutrition in the urban and rural southern Free State, South Africa. *Heliyon* **4** (12), e00983. <https://doi.org/10.1016/j.heliyon.2018.e00983> (2018).
- Govender, L., Pillay, K., Siwela, M., Modi, A. T. & Mabhaudhi, T. Assessment of the nutritional status of four selected rural communities in KwaZulu-Natal, South Africa. *Nutrients* **13** (9), 2920. <https://doi.org/10.3390/nu13092920> (2021).
- Kunjumen, T. et al. Global experiences in health workforce policy, planning and management using the workload indicators of staffing need (WISN) method, and way forward. *Hum. Resour. Health.* **19** (1). <https://doi.org/10.1186/s12960-021-00695-9> (2022). ;Suppl 1:152.
- World Health Organization. *Workload Indicators of Staffing need (WISN): Selected Country Implementation Experiences* (World Health Organization, 2016).
- World Health Organization. *Workload Indicators of Staffing Needs (WISN): User's Manual* (WHO, 2010).
- Okoroafor, S. C. et al. Assessing the staffing needs for primary health care centers in Cross River State, Nigeria: a workload indicators of staffing needs study. *Hum. Resour. Health.* **19** (1). <https://doi.org/10.1186/s12960-021-00648-2> (2022).
- Nguyen, T. T. H., Phung, H. T. & Bui, A. T. M. Applying the workload indicators of staffing needs method in nursing health workforce planning: evidences from four hospitals in Vietnam. *Hum. Resour. Health.* **19** (1). <https://doi.org/10.1186/s12960-021-00668-y> (2022). ;Suppl 1:124.
- Machado, C. R., Brasil, D. & Dal Poz, M. R. Application of workload indicators to assess the allocation of orthopedists in a national referral hospital in Brazil. *Hum. Resour. Health.* **19** (1). <https://doi.org/10.1186/s12960-021-00666-0> (2022). ;Suppl 1:123.
- Dimiri, D. et al. Estimating staffing requirements using workload indicators of staffing need at Braun District Hospital in Morobe Province, Papua New Guinea. *Hum. Resour. Health.* **19** (1). <https://doi.org/10.1186/s12960-021-00677-x> (2022).
- Haroon, M. Z. & Thaver, I. H. An assessment of existing surge capacity of tertiary healthcare system of Khyber Pakhtunkhwa Province of Pakistan using workload indicators for staffing need method. *Hum. Resour. Health.* **19** (1). <https://doi.org/10.1186/s12960-021-00663-3> (2022). ;Suppl 1:120.
- Namaganda, G., Oketcho, V., Maniple, E. & Viadro, C. Making the transition to workload-based staffing: using the workload indicators of staffing need method in Uganda. *Hum. Resour. Health.* **13** (1), 89. <https://doi.org/10.1186/s12960-015-0066-7> (2015).
- Naicker, V. N. et al. A Delphi consensus study to determine the workload components and activity standards of dietitians in South Africa's central and tertiary public hospitals. *Hum. Resour. Health.* **22**, 4. <https://doi.org/10.1186/s12960-023-00883-9> (2024).
- National Department of Health. National Health Act. Regulations Relating to Categories of Hospitals; 2012 March 2: 3–28. (2003).
- Basic conditions of Employment Act. 1 997. Department of Labour. (Act No 75 of 1 997).Government Gazette. Pretoria: Government Printer.
- McQuide, P. A., Kolehmainen-Aitken, R. L. & Forster, N. Applying the workload indicators of staffing need (WISN) method in Namibia: challenges and implications for human resources for health policy. *Hum. Resour. Health.* **11** (1), 64. <https://doi.org/10.1186/1478-4491-11-64> (2013).
- Ogoe, H. A., Asamani, J. A., Hochheiser, H. & Douglas, G. P. Assessing Ghana's ehealth workforce: implications for planning and training. *Hum. Resour. Health.* **16** (1), 65. <https://doi.org/10.1186/s12960-018-0330-8> (2018).
- Bonfim, D., Mafra, A. C. C. N., da Costa Palacio, D. & Rewa, T. Assessment of staffing needs for registered nurses and licensed practical nurses at primary care units in Brazil using workload indicators of staffing need (WISN) method. *Hum. Resour. Health.* **19** (1). <https://doi.org/10.1186/s12960-021-00674-0> (2022). ;Suppl 1:130.
- RavhenganiNM Implementing workload indicators of staffing need (WISN) tool to determine human resources in primary health care settings in South Africa: a concept analysis. *IOSR JNHS (IOSR-JNHS)*. **6** (6), 65–73 (2017).

29. Al-Dabbagh, S. A., Sulaiman, H. M. & Abdulkarim, N. A. Workload assessment of medical doctors at primary health care centers in the Duhok governorate. *Hum. Resour. Health.* **19** (1). <https://doi.org/10.1186/s12960-021-00664-2> (2022). ;Suppl 1:117.

Acknowledgements

Participants are acknowledged for their contributions in making this study a possibility. Further acknowledgement is extended to the South African Department of Health for the opportunity to share the findings of this study. Dr. Cheryl Tosh (University of Pretoria) for editing.

Author contributions

VNN, MHL and JWM were responsible for the conceptualization and design of the study. MHL and JWM supervised data collection and analyses. VNN, MHL and JWM contributed to the drafting, writing, and editing of this paper. KN was responsible for the critical review of the draft manuscript. All authors read, reviewed, and approved the article.

Funding

No external funding was obtained to conduct this study. This study was conducted through means of the author's (VNN) personal budget.

Declarations

Competing interests

The authors declare no competing interests.

Ethics approval and consent to participate

Ethics approval was obtained through the Research Ethics Committee, Faculty of Health Sciences at the University of Pretoria (Ethics Number: 97/2021). The study was registered and approved for data collection via the National Health Research Database. All participants provided written informed consent prior to commencement of the study. Consent to participate was completely voluntary.

Consent for publication

Consent for publication was obtained through the South African National Health Research Database, corresponding provincial research committees and hospital research committees where applicable.

Additional information

Correspondence and requests for materials should be addressed to V.N.N.

Reprints and permissions information is available at www.nature.com/reprints.

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Open Access This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/>.

© The Author(s) 2025