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Community Health Nursing in Oman: Competencies, Learning Needs, and Practice Challenges

Wafa Al Jabri

wafah@squ.edu.om

Sultan Qaboos University

Zainab Al Kindi

Sultan Qaboos University

Samia Al Harrasi

Sultan Qaboos University

Nasir Matani

Sultan Qaboos University

Naila Al Omairi

Ministry of Health

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Abstract

Background

Community health nurses (CHNs) play an important role in promoting health, preventing illness, and addressing community health needs. However, limited evidence is available on their current competencies, learning needs, and challenges in Oman. This study aimed to explore these areas among CHNs working in primary healthcare settings.

Methods

A descriptive cross-sectional study was conducted among CHNs in Oman. Data were collected through an online questionnaire based on the Canadian Community Health Nursing Standards of Practice (2019), covering eight competency domains. Nurses rated how frequently they performed each activity and their perceived need for training. An open-ended question was also included to identify challenges faced by CHNs. Data were analyzed using descriptive statistics, independent-samples *t*-tests, and Pearson's correlation.

Results

Seventy-four CHNs participated in the study. Nurses reported stronger practice in Evidence-Informed Practice, Professional Responsibility and Accountability, and Health Promotion, while Prevention and Health Protection and Health Equity were less consistently practiced. Professional Responsibility and Accountability had the greatest perceived training need. Participants also highlighted staffing shortages, workload, limited protected time, inadequate resources, and insufficient organizational support as important challenges.

Conclusion

CHNs in Oman have a good foundation for practice, but their ability to contribute fully to population health may be limited by both professional development needs and workplace conditions. Strengthening continuing education alongside supportive organizational environments, adequate resources, and clearer CHN roles can help nurses contribute more effectively to prevention, health equity, and primary healthcare, supporting the goals of Oman Vision 2040.

Introduction

Community health nursing (CHN) is a cornerstone of primary health care (PHC), bringing prevention, health promotion, and essential nursing services closer to individuals, families, and communities. In Oman, community health nurses (CHNs) play a vital role in strengthening PHC and developing a skilled

and responsive health workforce. Through their frontline role in communities, CHNs contribute to improving health outcomes, reducing healthcare costs, advancing universal health coverage, and supporting the health-related Sustainable Development Goals (1, 2). As an integral component of the health workforce, CHNs contribute significantly to health promotion, disease prevention, clinical care, care coordination, and community empowerment (1–4).

Oman's healthcare system has expanded significantly, emphasizing preventive care and broad access to services, supported by a widespread network of hospitals and clinics (5). Nurses make up over 40% of healthcare workers and about 60% of all health professionals in the country (6). The nursing workforce has gradually increased, from 5.6 nurses per 10,000 people in 1975 to 44.8 per 10,000 in 2016 (6). Additionally, Oman has invested in nursing education and specialization, offering undergraduate and postgraduate programs, including a dedicated Community Health Nursing Practice specialty at the Higher Institute of Health Specialties (7).

Community health nursing demands skills that extend beyond bedside care. According to literature, key areas include clinical practice, communication, professionalism, health promotion, teamwork, education, research, information technology, leadership, and case management (2, 8). In Oman, healthcare professionals generally feel confident in their overall competence, but research and evidence-based practice remain their weakest areas, indicating that technical skills alone may not lead to strong inquiry, evaluation, or implementation abilities (9).

Research conducted within primary care and community environments across the MENA region indicates a consistent trend: nurses often report moderate to good competence in direct care and educational responsibilities, yet exhibit lesser proficiency in community health management, research activities, and advanced public health functions (1, 10). Moreover, training plays a significant role. Nurses operating in primary care settings who have received pertinent training demonstrate higher competency scores, and community-based nurses commonly identify educational needs in areas such as health promotion, patient-centered care, and self-management of chronic diseases (1, 10).

Despite advancements in role scope and educational attainment, CHNs in numerous settings continue to face limitations imposed by organizational and structural obstacles. Reviews from low and middle income countries indicate that ambiguous responsibilities, insufficient support, inadequate training, ineffective teamwork, workload stress, and fragile infrastructure frequently hinder the contributions of community health nurses (4, 11). Qualitative research likewise highlights role ambiguity, role overlap with other professionals, and limited integration of community health nursing within primary care systems, which may hinder the effective delivery of community based services (12, 13).

Comparable studies further emphasize enduring deficiencies in community oriented education and ongoing professional development. Practical placements are frequently misaligned with the realities of community health, and curricula may remain predominantly hospital centric, resulting in graduates being inadequately prepared for roles in prevention, outreach, and population based care (12, 14). Continuous

training is extensively advocated; however, evidence suggests that its benefits depend on how well it is designed, supervised, and sustained (15, 16).

In Oman, community health nursing has evolved within the framework of the primary care system rather than as an independent service, with services integrated into existing primary healthcare centers to enhance continuity of care and workforce adaptability (17). Prior national efforts indicated that CHN was incorporated into fundamental curricula and subsequently reinforced through a 16-week practical training program; however, these initial courses were inadequate in preparing specialized community health nurses (17).

Simultaneously, numerous challenges persist in the Sultanate of Oman. Historically, community health nursing has received comparatively less policy focus, research, and workforce investment than hospital based nursing. Furthermore, resources allocated for community service provision have been constrained in terms of staffing, transportation, equipment, and program budgets (17). This is particularly significant because the development of workforce capacity in primary care depends not solely on numerical adequacy but also on leadership, support systems, community engagement, ongoing education, and role clarity (11).

Although CHN in Oman has expanded considerably in recent years, research examining the actual practices, learning needs, and workplace challenges of CHNs remains limited. Understanding these areas is essential for workforce planning, educational development, and service improvement, particularly as Oman continues to strengthen primary healthcare and population focused services. This is closely aligned with the Oman Vision 2040 priorities for a sustainable, high quality healthcare system, strengthened human capital, and improved health and wellbeing across the population (18).

Therefore, this study aimed to examine the current practice competencies, perceived learning needs, and challenges experienced by community health nurses working in primary healthcare settings in Oman. By identifying strengths, gaps, and barriers in community health nursing practice, the findings may inform workforce development, continuing professional education, and policy and service initiatives that strengthen community health nurses' contribution to prevention, health promotion, health equity, and population wellbeing. Strengthening these areas can support the development of a more capable, responsive, and sustainable primary healthcare workforce, while contributing to the broader health and wellbeing goals of Oman Vision 2040 (18).

This study is guided by the Canadian Community Health Nursing Professional Practice Model and Standards of Practice (2019) (19). The framework recognizes CHNs as essential contributors to population health and emphasizes practice grounded in health promotion, disease prevention, health maintenance, partnership and collaboration, community capacity building, health equity, professional responsibility, and evidence informed practice. In this study, the framework guided the assessment of CHN roles and competencies and provided a standardized basis for examining current community health nursing practice in Oman and identifying areas requiring further training and professional development (Fig. 1).

Method

Study Design

A descriptive cross-sectional study design was used to examine the practices, learning needs, and challenges faced by CHNs working in Oman.

Study Population and Sample

The target population consisted of community health nurses employed at primary healthcare centres in Oman. Eligibility criteria included current employment at a primary healthcare centre and a minimum of one year of clinical experience as a community health nurse.

According to the Ministry of Health (MOH) Annual Report (2021), Oman hosted a total of 267 primary healthcare centres (PHCCs). Presuming an allocation of approximately one community health nurse per PHCC, the estimated target population was 267 CHNs. Utilizing Slovin's formula for a finite population with a 5% margin of error, the requisite sample size was calculated to be approximately 160 CHNs (20).

The questionnaire was distributed electronically to the targeted nurses through the community health nursing representative at the Ministry of Health. Of the 160 nurses invited to participate, 72 completed the questionnaire, yielding a response rate of 46%. All completed questionnaires were included in the final analysis.

Recruitment Procedure

Participants were recruited in collaboration with the Ministry of Health via the community health nursing representative responsible for liaising with community health nurses across Oman. Qualified nurses received an electronic invitation outlining the study's objectives, eligibility requirements, voluntary nature, confidentiality assurances, and the right to withdraw at any time without penalty. Those who met the inclusion criteria and consented to participate were directed to complete the online questionnaire.

Measurement Instrument

Data were collected utilizing a structured questionnaire grounded in the Canadian Community Health Nursing Standards of Practice (2019) (19)**.** The questionnaire assessed CHNs' practices and perceived learning needs across eight competency domains: **Health Promotion; Prevention and Health Protection; Health Maintenance, Restoration and Palliation; Professional Relationships; Capacity Building; Health Equity; Evidence-Informed Practice; and Professional Responsibility and Accountability.** Items addressed competencies such as identifying community health needs, providing health education, using culturally appropriate communication, developing partnerships, and advocating for resource allocation. For each item, participants rated the frequency of performing the activity from 1 (Never) to 5 (Daily) and their perceived training need from 1 (No need) to 5 (Significant need).

The instrument had been previously adapted and validated among community health nurses in Saudi Arabia and exhibited high internal consistency, with Cronbach's alpha coefficients of 0.95 for competency performance items and 0.97 for learning-need items (21). The instrument was deemed suitable for application in the Omani context, owing to the similarities in regional and primary healthcare environments. Demographic and professional information, including age, gender, educational level, workplace location, and years of nursing experience was also collected. An open-ended question was included at the end of the questionnaire to allow participants to describe the main challenges they experienced in their community health nursing practice.

Data Analysis

The data were analyzed utilizing both descriptive and inferential statistical methods. Frequencies, percentages, means, and standard deviations were employed to summarize participant characteristics and competency scores. Independent-samples t-tests were conducted to assess differences in practice and training-need scores across relevant demographic and professional variables, while Pearson's correlation coefficients were calculated to explore associations between years of nursing experience and competency in practice and training-need scores. Responses to the open-ended question regarding challenges experienced by nurses in CHN practice were reviewed and summarized descriptively to identify commonly reported issues. Statistical significance was established at $p < 0.05$.

Ethical Considerations

Ethical approval was obtained from **Ministry of Health in Oman(Reference No. 199/2025),** and the**College of Nursing (Reference No. 05/2025).** Participants received information about the study purpose, procedures, voluntary nature of participation, confidentiality, and their right to withdraw at any time without penalty. Electronic informed consent was obtained before completion of the questionnaire. No directly identifying information was collected, and all data were treated confidentially and securely stored. The study was conducted in accordance with the **Declaration of Helsinki.**

Results

Participants' Characteristics

A total of 72 community health nurses participated in the study. The mean age was 38.22 years (SD = 4.72; range: 28–55), and the mean duration of nursing experience was 15.03 years (SD = 6.33; range: 2–32). Most participants were female (94.4%, *n* = 68), and 51.4% (*n* = 37) held a bachelor's degree in nursing, while 48.6% (*n* = 35) held a nursing diploma. The majority were Omani (79.2%, *n* = 57), with non-Omani nurses comprising 20.8% (*n* = 15) of the sample (Table 1).

Table 1. Characteristics of Community Health Nurses (N = 72)

Characteristic	Mean ± SD
Age (years)	38.22 ± 4.72
Years of nursing experience	15.03 ± 6.33
Gender	
Male	4 (5.6)
Female	68 (94.4)
Education	
Diploma in Nursing	35 (48.6)
Bachelor's degree in Nursing	37 (51.4)
Nationality	
Omani	57 (79.2)
Non-Omani	15 (20.8)
Note. SD = standard deviation	

Community Health Nursing Competencies and Training Needs

The overall domain level findings demonstrated variation between nurses' reported community health nursing practice and their perceived training needs (Table 2). **Evidence-Informed Practice had the highest reported practice score**(M = 3.16, SD = 1.14), followed by Professional Responsibility and Accountability (M = 2.96, SD = 1.16) and Health Promotion (M = 2.73, SD = 1.03). The lowest practice scores were observed for Prevention and Health Protection (M = 2.40, SD = 1.11) and Health Equity (M = 2.41, SD = 1.05).

Training need scores were relatively consistent across domains, ranging from 2.34 to 2.67. **Professional Responsibility and Accountability had the highest perceived training need** (M = 2.67, SD = 1.19), followed by Professional Relationships (M = 2.57, SD = 1.16) and Evidence-Informed Practice (M = 2.56, SD = 1.14). Health Promotion had the lowest training-need score (M = 2.34, SD = 1.00).

At the item level, nurses reported particularly frequent practice in **evaluating individual, family, and community outcomes in collaboration with healthcare team members** (M = 3.29, SD = 1.44), **using professional websites and resources to assess community health nursing interventions** (M = 3.22, SD = 1.42), and **identifying community health needs** (M = 3.06, SD = 1.38). In contrast, lower practice scores were observed for **developing mutually agreed healthcare plans with individuals and families (M = 2.06, SD = 1.15), using health education theories and strategies (M = 2.21, SD = 1.21), networking and partnership to address community health issues (M = 2.21, SD = 1.27), and advocating for resource allocation to facilitate healthcare access (M = 2.22, SD = 1.13).**

Table 2. Community Health Nursing Competency Practice and Perceived Training Needs by Domain (*N = 72*)

Competency domain	***Practice, M (SD)***	***Training need, M (SD)***
Evidence-Informed Practice	**3.16 (1.14)**	2.56 (1.14)
Professional Responsibility and Accountability	**2.96 (1.16)**	**2.67 (1.19)**
Health Promotion	2.73 (1.03)	**2.34 (1.00)**
Capacity Building	2.68 (1.11)	2.50 (1.10)
Health Maintenance, Restoration and Palliation	2.59 (1.02)	2.42 (1.00)
Professional Relationships	2.53 (1.14)	2.57 (1.16)
Health Equity	2.41 (1.05)	2.48 (1.16)
Prevention and Health Protection	**2.40 (1.11)**	2.49 (0.99)
Note. M = mean; SD = standard deviation.		

Differences in Practice and Training Needs Across Participant Groups

Independent-samples *t*-tests showed significant differences between diploma- and bachelor's-prepared nurses in two practice domains. Diploma-prepared nurses reported significantly higher practice in Prevention and Health Protection (M = 2.67 vs. 2.14; t(70) = 2.03, p = .046) and Health Equity (M = 2.70 vs. 2.14; $t(70) = 2.33$, $p = .023$). No significant differences were observed in the remaining competency domains or training needs.

Interestingly, no significant differences were identified between Omani and non-Omani nurses across the competency domains, with one exception. Non-Omani nurses reported significantly higher Professional Responsibility and Accountability training needs than Omani nurses (M = 3.22 vs. 2.52; $t(70) = −2.08$, $p = .042$). Although non-Omani nurses had numerically higher practice scores in several domains, these differences were not statistically significant.

No statistically significant differences were found between male and female nurses in either reported practice or training needs across any competency domain ($p > .05$). Although some differences in mean scores were observed, interpretation is limited by the small number of male participants ($n = 4$).

Moreover, Pearson's correlation analysis showed that years of nursing experience was negatively associated with practice in Health Promotion ($r = −.275$, $p = .019$), Evidence-Informed Practice ($r = −.361$, $p = .002$), and Health Maintenance, Restoration and Palliation ($r = −.249$, $p = .035$). No significant associations were found between years of experience and perceived training needs.

Challenges Faced by Community Health Nurses

The open-ended responses identified several interconnected challenges affecting community health nursing practice. The most prominent concern was inadequate staffing combined with increasing patient volume and workload. A second recurring issue was insufficient protected time for community health nursing activities. Several nurses reported that they were not fully released from routine health center responsibilities, limiting their ability to undertake home visits and broader community health activities. Participants also highlighted the need for a multidisciplinary team support and collaboration to facilitate comprehensive community health care.

Participants also highlighted organizational and managerial challenges, including limited administrative support, inadequate recognition of community health nursing as a distinct specialty, insufficient incentives, and the absence of clear policies addressing the specific roles and responsibilities of community health nurses. Several participants also expressed disappointment regarding the recent change in designation from community health nursing to home care, perceiving that it diminishes the broader preventive, health promotion, and community-oriented scope of the specialty.

Moreover, some participants reported dissatisfaction with the lack of risk allowances or financial incentives despite the nature of community-based work, which frequently requires travel to unfamiliar environments and may involve exposure to safety risks during field visits.

Transportation, geographical, and environmental barriers were frequently reported. These included limited availability of dedicated vehicles, long travel distances, difficult or mountainous roads, delays in transportation, and extreme weather conditions. Some participants linked these factors directly to reduced time for patient visits and concerns about personal safety.

Another important point was limited resources and technological infrastructure. Nurses reported shortages of equipment and supplies and emphasized the absence of dedicated mobile technology for accessing patient information, documenting care during visits, and communicating with patients and caregivers.

Participants additionally described safety and home environment challenges, including unpredictable situations during home visits, unsuitable home environments, exposure to potentially unsafe situations sometimes, and occasional refusal by families to receive nursing services.

Finally, communication and community-level barriers included language differences, particularly among expatriate nurses, limited health literacy among patients and caregivers, stigma, changing patient accommodation, and reluctance among some community members to use health center or home based services.

Discussion

This study provides important insight into the competencies and learning needs of CHNs in Oman. Overall, CHNs demonstrated a moderate but varied competency profile, with stronger practice in

Evidence-Informed Practice, Professional Responsibility and Accountability, and Health Promotion, and lower practice in Prevention and Health Protection and Health Equity. This pattern is consistent with primary healthcare literature showing that community health nurses tend to be more confident in direct care, health education, and established professional roles than in broader population-health activities such as advocacy, partnership-building, and addressing health inequities (8, 10).

Evidence-Informed Practice was identified as the most robust domain. In comparison with AlJohani's study conducted in Saudi Arabia (2024), which indicated that this area still requires further development, CHNs in the current study reported a high level of engagement with evidence-informed practice (22). This observation may reflect ongoing initiatives in Oman aimed at enhancing nursing education, research capacity, and evidence-based practice, as emphasized in several scholarly works (5, 9). However, the relatively high training need in this domain suggests that nurses view evidence informed practice as an ongoing professional responsibility rather than a competency that can be considered fully achieved.

Professional responsibility and accountability were also relatively strong but exhibited the highest perceived training need. Rather than indicating inadequate competence, this observation may reflect nurses' awareness of increasing professional expectations related to leadership, quality improvement, research utilization, mentoring, and lifelong learning. Similar observations were reported by Aljohani (2024), where nurses demonstrated well-established professional practices while simultaneously identifying learning needs in areas such as health informatics, outcome evaluation, and research participation (20). Therefore, the perceived need for training may represent a commitment to maintaining and enhancing competence, rather than a shortcoming in current practice.

Health Promotion was another area of strength. Nurses most frequently reported identifying community health needs, providing health education, and evaluating outcomes collaboratively, consistent with the traditional role of CHNs in health promotion and prevention. Similar findings have been reported by AlJohani (2024), where health education and preventive interventions were among the most frequently performed community nursing activities in Saudi Arabia, and by Enebeli et al. (2024) who identified health education as core component of nurses' daily practice in rural primary healthcare settings in Nigeria (3, 22). However, lower scores for using formal health education theories and strategies suggest that nurses may routinely provide education without consistently applying structured frameworks to plan and evaluate educational interventions. This represents an important opportunity for professional development, as theory-based approaches can strengthen the planning, implementation, and evaluation of health promotion activities and improve the effectiveness of educational interventions (23).

In contrast, Prevention and Health Protection and Health Equity were the lowest-scoring domains. At the item level, lower practice was reported for developing mutually agreed healthcare plans, using networking and partnership strategies, advocating for resource allocation, and applying epidemiological approaches such as screening and surveillance. These activities represent the broader population-health role of CHNs and require collaboration, advocacy, community engagement, and attention to social

determinants of health. Similar challenges have been reported internationally, where competing clinical demands, limited resources, organizational constraints, and unclear roles can restrict nurses' involvement in population-level activities (1, 4). Sharifikia et al. (2026) likewise highlighted leadership, advocacy, policy engagement, and community collaboration as important components of community health nursing competence, while Hosseinnejad et al. (2022) emphasized the importance of supportive organizational structures and clear role expectations (13, 14).

The finding that diploma-prepared nurses reported higher practice in Prevention and Health Protection and Health Equity than bachelor-prepared nurses should be interpreted cautiously. This difference may reflect differences in practical exposure, role allocation, or length and type of community-based experience rather than educational preparation alone (1). Moreover, Years of nursing experience showed modest negative associations with practice in Health Promotion, Evidence-Informed Practice, and Health Maintenance, Restoration and Palliation, while no significant associations were observed with perceived training needs. These findings suggest that experience alone may not guarantee continued competency development and highlight the importance of ongoing education, skills renewal, supportive supervision, and opportunities to practice the full scope of CHN roles remain important throughout nurses' careers (11, 15, 16).

Nationality exhibited minimal influence on competency outcomes, with no significant differences observed across most domains. This suggests that workplace structures and professional expectations exert a greater impact on practice than nationality alone. The increased training need in Professional Responsibility and Accountability among non-Omani nurses may indicate disparities in familiarity with local policies and professional standards; however, this observation should be approached with caution due to the small sample size of the subgroup. Likewise, the lack of significant gender differences should be interpreted cautiously, considering that only four male nurses participated in the study.

The challenges in CHN practice reported by participants provide important context for these findings. Staff shortages, increasing workloads, limited protected time, transportation difficulties, inadequate equipment and technology, safety concerns, and insufficient managerial and multidisciplinary support may limit nurses' ability to perform broader community health functions (11). These challenges are consistent with previous research from Oman and other settings, where community health nursing has faced limited organizational support and less recognition compared with hospital-based care (14, 17). Limited protected time is particularly important because activities such as home visits, outreach, surveillance, community assessment, partnership development, and advocacy require time beyond routine clinic based care. When clinical workload dominates, these broader population health activities may receive less attention (3, 4). Taken together, these findings suggest that strengthening CHN competency requires more than individual training; it also requires an enabling practice environment that provides nurses with the time, resources, support, and autonomy needed to translate their competencies into meaningful community-level action.

Study Limitations

The findings should be interpreted in light of several limitations. The cross-sectional design provides a snapshot of CHN practice and does not allow causal relationships to be established. The use of self-reported data may also have introduced recall or social desirability bias. Although 160 nurses were targeted, only 72 participated, potentially limiting the statistical power. Moreover, the small and unequal subgroup sizes, particularly the number of male participants, further limited subgroup comparisons. Nevertheless, the study provides useful baseline evidence to inform future research, education, and workforce development for community health nursing in Oman.

Implications

The findings highlight the need to strengthen CHN practice through competency-based continuing education, particularly in prevention, health protection, health equity, advocacy, epidemiology, evidence-informed practice, and health education strategies. However, education alone may not be sufficient. Organizational support, including adequate staffing, protected time for community activities, transportation, technology, managerial support, clearer CHN roles, and stronger integration within multidisciplinary teams, is essential to enable nurses to apply these competencies effectively. Efforts to strengthen the professional recognition of community health nursing should also be considered, including reinstating the designation of “community health nursing” in place of “home care” to better reflect the specialty’s broader roles in health promotion, disease prevention, community engagement, and population health. In addition, appropriate incentives and risk allowances may help acknowledge the unique demands, responsibilities, and potential safety risks associated with community health practice.

At the policy level, strengthening community health nursing can support Oman Vision 2040 by contributing to a skilled and sustainable primary healthcare workforce and promoting equitable population health. Policy efforts should prioritize clearly defined CHN roles and scopes of practice, standardized competency frameworks, structured continuing professional development, and regular competency assessment to ensure that CHNs are equipped to address evolving community health needs. Future research should use larger, more representative samples and longitudinal or intervention based designs to evaluate strategies for improving CHN competency and community health outcomes.

Conclusion

Community health nurses in Oman appear well positioned to contribute to health promotion, evidence-informed care, and community based services; however, their contribution to prevention, health equity, advocacy, partnership-building, and other population focused functions may remain constrained by the way services are currently organized.

Moving community health nursing forward will therefore require a shift from viewing competency development as primarily an individual educational responsibility toward a more comprehensive approach that also addresses organizational and system level conditions. Providing CHNs with adequate staffing, protected community practice time, resources, clear role expectations, multidisciplinary support, and greater professional recognition can create the conditions needed for nurses to engage more fully in

population health. Strengthening both the capability of CHNs and the systems in which they practice will be critical to realizing the full potential of community health nursing and advancing equitable, sustainable health outcomes in Oman, in alignment with Oman Vision 2040.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Ministry of Health in Oman (Reference No. 199/2025), and the College of Nursing (Reference No. 05/2025). Participation was voluntary, and informed consent was obtained from all participants prior to data collection.

Consent for publication

Not applicable. This study does not contain any individual person's identifiable data.

Competing interests

The authors declare that they have no competing interests.

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Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Author contributions

Wafa Al Jabri conceived and supervised the study. Zainab Al Kindi and Wafa Al Jabri contributed to study design, data collection, analysis, and manuscript drafting. Samia Al Harrasi assisted with data collection and interpretation. Nasir Matani contributed to data analysis and manuscript review. Naila Al Omairi contributed to data collection and manuscript revision. All authors reviewed and approved the final manuscript.

Author details

1College of Nursing, Sultan Qaboos University, Muscat, Sultanate of Oman

2Community and Mental Health Nursing Department, College of Nursing, Sultan Qaboos University, Muscat, Sultanate of Oman

3Ministry of Health, Muscat, Sultanate of Oman

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Figures

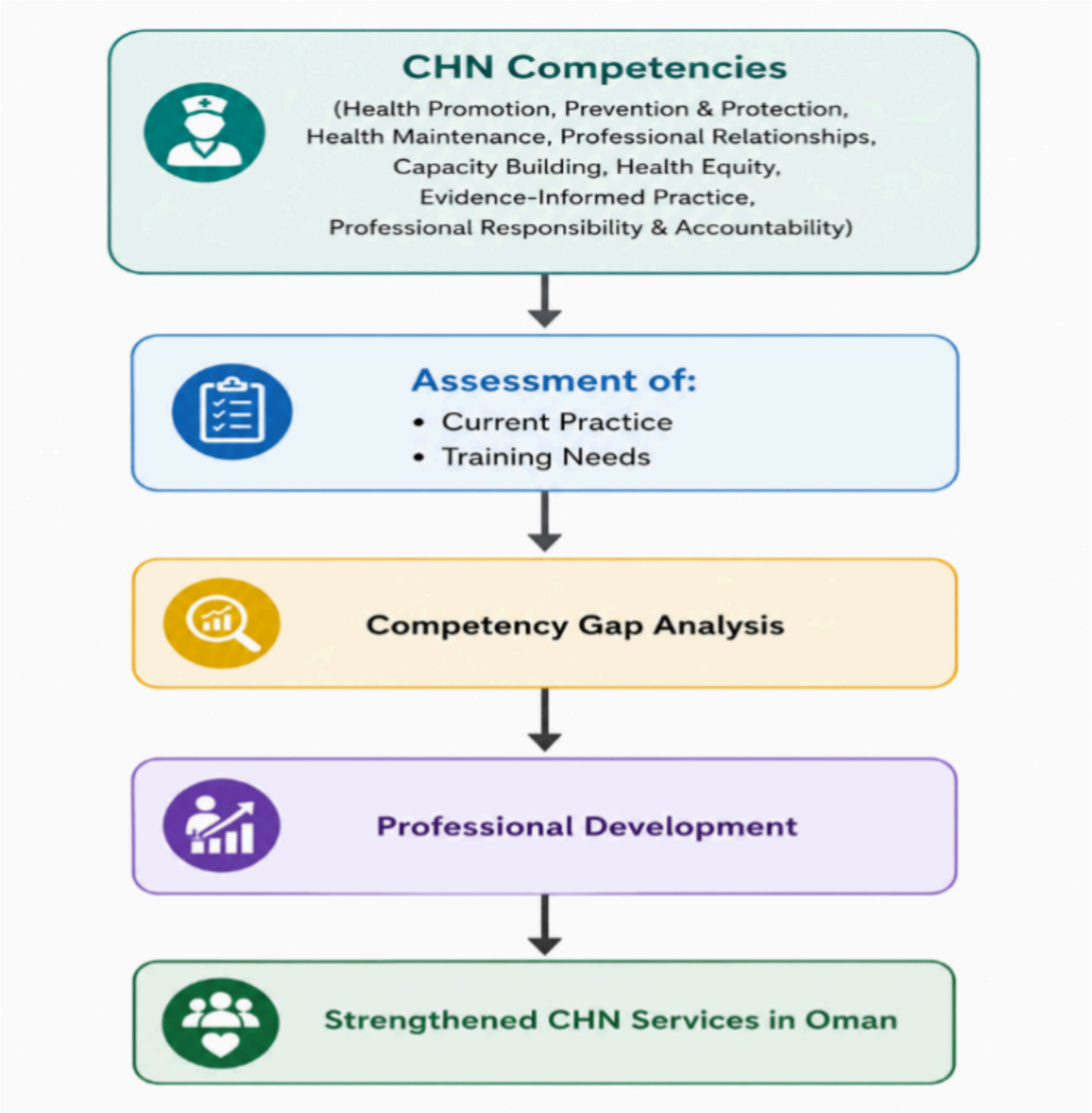


Figure 1

Study Conceptual Model