Workforce Readiness For Saudi Moc Chronic Pathways: Evidence From Hafar Al-Batin Health Cluster

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Abstract

Background: Saudi Arabia's Vision 2030 and Health Sector Transformation Program introduced the New Model of Care (MoC) to strengthen value based, integrated, and preventive healthcare delivery. The Chronic Care System is a core component of this transformation due to the rising burden of non-communicable diseases. Successful implementation of chronic care pathways depends on workforce readiness, yet evidence from health clusters remains limited.

Objective: To assess healthcare workers' knowledge, attitudes, perceived challenges, and opportunities related to Saudi MoC chronic care pathway implementation in the Hafar Al-Batin Health Cluster (HBHC), In addition to identifying factors associated with workforce readiness.

Methods: An analytical cross-sectional study was conducted between June and July 2025 among healthcare workers in primary, secondary, and tertiary facilities within HBHC. A validated bilingual self-administered questionnaire assessed sociodemographic characteristics, MoC-related knowledge, attitudes, implementation challenges, and enabling opportunities. Data were analyzed using descriptive statistics, non-parametric tests, Spearman correlation, and stepwise linear regression in R software, with significance set at $p < 0.05$.

Results: A total of 400 healthcare workers participated (mean age 38.1 ± 7.7 years; 72% female). Regarding knowledge, higher scores were observed among primary healthcare staff (80%), consultants/specialists, and those directly involved in chronic care pathways (62.5%). For attitudes, perceptions that are more positive were associated with MoC training attendance (46%) and higher digital health experience (64%). Concerning challenges, the most frequently reported barriers were inadequate training or awareness (50%), low patient health literacy (51.5%), workforce shortages (36%), and digital system limitations. In terms of opportunities, participants prioritized enhanced staff training, continuous professional education, improved multidisciplinary collaboration, and strengthened digital infrastructure. Regression analysis showed that knowledge level and digital health experience were the strongest independent predictors of positive attitudes, explaining approximately 24% of variance.
Conclusion: Strengthening workforce training, digital competencies, and organizational support is essential to enhance readiness for effective MoC chronic care pathway implementation in rural health cluster settings.
Keywords: Saudi Model of Care; Chronic Care; Workforce Readiness; Vision 2030; Digital Health

1. INTRODUCTION

Saudi Arabia has made substantial progress in advancing its healthcare system; however, growing population needs and the increasing burden of non-communicable diseases (NCDs) have highlighted the need for health system transformation to ensure sustainability and improved outcomes (Chowdhury et al., 2021). In response, the Kingdom launched its national Vision 2030 strategy, which emphasizes restructuring health services to enhance accessibility, efficiency, and population health (Alasiri, A. et al., 2022). As part of the Health Sector Transformation Program, the Saudi New Model of Care (MoC) was introduced to redirect the system toward proactive disease prevention; value based care, and improved care coordination (Chowdhury et al., 2021).

The MoC defines care delivery through six Systems of Care reflecting patient needs across their life course: Keeping Well, Planned Care, Women & Children, Urgent Care, Chronic Conditions, and Last Phase of Life (Memish et al., 2022; Chowdhury et al., 2021). Among these, the Chronic Care System is crucial due to the high prevalence of conditions such as diabetes, cardiovascular disease, and obesity, which strain healthcare capacity and contribute significantly to morbidity and mortality (Gosadi, 2025).

Implementation of MoC reforms has been operationalized through regional health clusters, which integrate primary and secondary healthcare providers under unified governance to support continuity of care and local accountability (Alasiri, A. et al, 2022). Despite these structural changes, successful MoC transformation depends heavily on workforce readiness, including adequate knowledge of MoC principles, positive attitudes toward system change, and empowerment to engage in role transformation (Gosadi, 2025).

Early evidence from studies in different regions of Saudi Arabia, including Riyadh and Jeddah, indicates knowledge gaps and variable acceptance of MoC among healthcare professionals, underscoring the importance of capacity building and communication efforts (Mugharbil et al., 2024; Alasiri, A. et al., 2022). These findings reflect the need to better understand frontline staff perspectives to accelerate effective implementation and attain Vision 2030 goals.

Hafar Al-Batin Health Cluster (HBHC) serves a growing and diverse population with unique geographic challenges. However, limited research has examined MoC implementation readiness within this cluster. This study adds new insights that have not

been adequately addressed in previous research on the Saudi Model of Care. While earlier studies primarily measured general knowledge or overall awareness of MoC at national or urban centers, our research uniquely focuses on healthcare workers' readiness to implement chronic care pathways within a rural and diverse health cluster context. Furthermore, the survey tool used in this study evaluates not only knowledge and attitudes but also perceived operational challenges and system level opportunities, allowing a more comprehensive assessment of workforce preparedness. These findings offer practical guidance for targeted MoC implementation support in Hafar Al-Batin and similar settings. Therefore, this study aims to assess the knowledge, attitudes, perceived challenges, and opportunities related to the implementation of the Saudi Model of Care (MoC) chronic care pathways among healthcare workers in Hafar Al-Batin Health Cluster, while examining the influence of Sociodemographic and professional characteristics, digital health experience, reflecting their MoC pathway implementation readiness for engagement.

2. METHODOLOGY

2.1. Study design and setting:

An analytical cross-sectional study was conducted across the Hafar Al-Batin Health Cluster (HBHC), Saudi Arabia, between June 1, 2025 and July 30, 2025. The study included healthcare workers in primary healthcare centers and secondary/tertiary hospitals to assess their knowledge, attitudes, challenges, and opportunities related to the implementation of the Saudi New Model of Care (MoC) and chronic care pathways.

2.2. Study population:

The study population comprised healthcare professionals working within the Hafar Al-Batin Health Cluster who were engaged, either directly or indirectly, in activities related to the implementation of chronic care pathways under the Saudi New Model of Care. Participants were eligible for inclusion if they were healthcare workers such as physicians, nurses, allied health professionals, or administrators employed in any facility affiliated with the cluster and actively supporting MoC-related functions. Only respondents who provided online informed consent were enrolled in the study.

Responses were excluded if they were incomplete, duplicated, submitted by individuals employed outside HBHC, or by personnel not involved in MoC implementation activities, to ensure data quality and relevance to the study objectives.

2.3. Sample size:

The sample size was determined using the Raosoft® online sample size calculator based on a single population proportion. As reported in the Healthcare Establishments and Workforce Statistics 2023 by the General Authority for Statistics in Saudi Arabia, the national healthcare workforce comprises approximately 542,878 professionals, including physicians, dentists, nurses, pharmacists, and allied health workers. [1] Using this population size, an expected response distribution of 50%, a confidence level of 95%, and a margin of error of 5%, the calculator indicated that a minimum of 384 participants would be required to achieve adequate statistical precision in estimating MoC-related knowledge and attitudes.

2.4. Data collection methods:

Data were collected using a structured, bilingual (Arabic and English) self-administered questionnaire designed specifically to assess the implementation of the Saudi New Model of Care (MoC) and chronic care pathways. The instrument was constructed by a panel of experts in epidemiology, healthcare administration, and projects management, ensuring that the content was aligned with national transformation priorities and operational requirements within the health sector.

The final questionnaire consisted of **32 items** organized into five main domains. The first section captured **sociodemographic and professional characteristics**, including age, gender, nationality, education level, profession, years of healthcare experience, type and location of facility, prior MoC training, direct involvement in chronic care pathways, and experience using digital health platforms. The second section focused on **knowledge related to chronic care pathways under the Saudi MoC**, covering core systems of care and recommended age groups for national screening programs such as breast cancer, colorectal cancer, and diabetes mellitus. Responses were scored dichotomously to generate an overall knowledge level.

The third section-evaluated **attitudes toward the chronic care model** through a five-point Likert scale (strongly disagree to strongly agree). Items assessed the perceived effectiveness, feasibility, and impact of chronic care initiatives on communication, coordination, and health service quality. The fourth section explored **implementation challenges** encountered in applying chronic care pathways within the MoC framework, addressing issues related to limited resources, patient engagement difficulties, digital infrastructure constraints, and barriers to interdisciplinary coordination. The fifth section investigated **opportunities and enablers** that could strengthen pathway implementation, such as enhancing multidisciplinary collaboration, improving provider training, optimizing electronic health systems, and increasing administrative and organizational support.

2.5. Validity and Reliability of the Instrument

The introductory page provided the study purpose, assurance of anonymity and confidentiality, a voluntary participation statement, and electronic informed consent. The expert committee examined the content validity of the questionnaire, and a pilot test was conducted among a small sample of healthcare workers to refine wording, improve clarity, and ensure feasibility prior to data collection. To assess psychometric performance, internal consistency reliability was measured using Cronbach's alpha. The overall scale demonstrated good reliability (α=0.87), with subscale reliability coefficients as follows: Knowledge scale: α =0.60, and Attitudes scale: α =0.93

2.6. Ethical Considerations

Ethical approval for this study was obtained from the Institutional Review Board (IRB) of the Damietta Faculty of Medicine, Al-Azhar University, (Approval No.: DFM-IRB000123467-25-04-056), on (17-4-2025). Participation in the study was voluntary, anonymous, and confidential. At the beginning of the online survey, participants were provided with clear information about the study objectives, and electronic informed consent was obtained prior to enrollment. No identifiable personal information was collected, and all procedures strictly adhered to the ethical principles of the Declaration of Helsinki for research involving human subjects.

2.7. Data Management and Statistical Analysis

Data were analyzed using R software (R Foundation for Statistical Computing, Vienna, Austria). Continuous variables were assessed for normality using the Shapiro-Wilk test and were summarized as mean ± standard deviation (SD) or median and interquartile range (IQR). Categorical variables were summarized as frequencies and percentages. The Mann–Whitney U test was applied for comparisons of continuous variables involving two groups, while the Kruskal–Wallis test was used for comparisons across three or more groups. Associations between continuous variables were examined using Spearman's rank correlation coefficient, and results were visualized using a correlation matrix. To identify independent predictors of knowledge and attitude scores, stepwise linear regression analyses were conducted. Standardized regression coefficients (β), 95% confidence intervals (CI), and p-values were reported. Model performance was assessed using R, R^2,

adjusted R^2, and changes in explained variance (ΔR^2). All statistical tests were two-tailed, and a p-value < 0.05 was considered statistically significant.

3. RESULTS

Table 1 shows the sociodemographic characteristics of the 400 study participants. The mean age was 38.1 ± 7.7 years, with a predominance of females (72%). Slightly more than half of the participants were non-Saudi (54%). Most respondents worked in primary health care centers (80%) and urban settings (75%). Nurses constituted the largest professional group (51%). Less than half of participants reported attending official MoC training (46%), while nearly two-thirds were involved in chronic care pathways (62.5%). Regarding digital health platforms, most participants reported intermediate to advanced experience (64%), whereas only 14% reported no experience.

Table 2 shows differences in knowledge and attitude scores across participant characteristics. Knowledge scores did not differ by gender, whereas males demonstrated significantly higher attitude scores than females ($p = 0.028$). Participants working in primary health care centers had significantly higher knowledge and attitude scores compared with those in secondary/tertiary hospitals (both $p < 0.001$). Higher educational attainment was strongly associated with increased knowledge and attitude scores, with doctorate/board holders achieving the highest medians (both $p < 0.001$). Consultants and specialists demonstrated significantly higher knowledge and attitude scores than nurses and allied health professionals (both $p < 0.001$). Non-Saudi participants had significantly higher knowledge and attitude scores than Saudis ($p < 0.01$). Attendance of MoC training was associated with higher attitude scores ($p = 0.013$), while involvement in chronic care pathways was associated with higher knowledge scores ($p = 0.002$). Increasing levels of digital health experience were significantly associated with higher knowledge and attitude scores ($p < 0.01$).

Figure 1 shows significant positive Spearman correlations between knowledge, attitude, and years of healthcare experience. **Table 3** shows the main challenges and barriers to implementing the new MOC and chronic care pathways. The most frequently reported challenge was lack of adequate training or awareness (50%), followed by limited staffing resources (36%). Low health literacy among patients (51.5%) and frequent missed appointments (45%) were the most common barriers to patient engagement. Technological challenges were dominated by insufficient staff training on digital platforms (47.5%) and lack of ongoing technical support (31%). Poor communication channels (40.5%) and insufficient follow-up mechanisms (45%) were the leading coordination challenges. Limited access to continuing professional education (36.5%) and lack of administrative support (32.5%) were the most commonly reported factors negatively affecting adherence to chronic care pathways.

Table 4 presents perceived opportunities to enhance the implementation of chronic care pathways. Increased staff training programs (38.5%) and improved inter-provider communication (27%) were the most frequently suggested workplace improvements. Continuous professional education was identified as the most critical factor for improving adherence to chronic care pathways (41.5%), followed by financial incentives (29.5%). Recruitment of additional staff was the preferred strategy to address workforce shortages (52%). Health education campaigns were viewed as the most effective measure to improve patient engagement (46%). Regular multidisciplinary meetings (32%) and unified electronic records (26.5%) were prioritized to strengthen interdisciplinary collaboration.

Table 5 shows predictors of knowledge scores from stepwise linear regression analysis. Older age and male gender were independently associated with higher knowledge scores

($p < 0.05$). Nurses and allied health professionals had significantly lower knowledge scores compared with general physicians ($p \leq 0.001$). Longer years of healthcare experience were modestly associated with lower knowledge scores ($p < 0.05$). Addition of MoC training, chronic care involvement, and digital health experience did not significantly improve the model, with minimal change in explained variance ($\Delta R^2 = 0.001$).

Table 6 illustrates predictors of attitude scores across three stepwise regression models. In the final model, higher digital health experience and higher knowledge scores emerged as significant independent predictors of more positive attitudes ($p < 0.05$). Holding a master's or post-bachelor qualification was also associated with higher attitude scores ($p = 0.042$). Other sociodemographic and professional variables were not significant predictors. The final model demonstrated improved explanatory power, accounting for approximately 24% of the variance in attitude scores, with knowledge score contributing the largest incremental increase ($\Delta R^2 = 0.104$).

Table 1. Sociodemographic Characteristics of the Study Participants

Variable	**N = 400**[1]
Age (years)	38.1 ± 7.7
Gender	
Male	112 (28%)
Female	288 (72%)
Nationality	
Saudi	183 (46%)
Non-Saudi	217 (54%)
Facility type	
Primary health care center	320 (80%)
Secondary / Tertiary hospital	80 (20%)
Highest education attained	
Diploma	124 (31%)
Bachelor's	148 (37%)
Master's / Diploma after Bachelor's	68 (17%)
Doctorate / Board	60 (15%)
Profession	
General Physician	64 (16%)
Specialist Physician	78 (20%)
Consultant Physician	14 (3.5%)
Nurse	204 (51%)
Allied health professional	30 (7.5%)
Administrator / Manager	10 (2.5%)
Years of healthcare experience	11.5 ± 6.8
Facility setting	
Urban	298 (75%)
Rural	102 (26%)
Attending any official MoC training	182 (46%)
Involving in any chronic care pathways	250(62.5%)
Level of experience with digital health platforms	
No experience	54 (14%)
Basic user	70 (18%)
Intermediate user	124 (31%)

Variable	N = 400[1]
Advanced user	130 (33%)
Expert user	22 (5.5%)
[1]Mean ± SD; n (%)	

Table 2. Comparison of Knowledge and Attitude Scores Across Participant Characteristics

Studied variables	Knowledge Median (IQR)	Attitude Median (IQR)
Gender		
Male	3.0 (2.0, 4.0)	22.0 (20.0, 25.0)
Female	3.0 (2.0, 4.0)	20.0 (20.0, 23.2)
p-value	**0.439**	**0.028***
Hospital type		
Primary health care center	3.0 (2.0, 4.0)	21.0 (20.0, 25.0)
Secondary / Tertiary hospital	2.0 (1.0, 3.0)	20.0 (19.0, 20.0)
p-value	**<0.001***	**<0.001***
Education level		
Diploma	2.0 (1.0, 3.0)	20.0 (20.0, 24.0)
Bachelor's	2.0 (1.0, 3.0)	20.0 (19.0, 23.0)
Master's / Post-Bachelor Diploma	4.0 (2.0, 4.0)	21.0 (20.0, 25.0)
Doctorate / Board	4.0 (4.0, 5.0)	24.0 (21.0, 25.0)
p-value	**<0.001***	**<0.001***
Profession		
General Physician	4.0 (3.0, 4.0)	21.5 (20.0, 25.0)
Specialist	4.0 (3.2, 5.0)	23.0 (20.0, 25.0)
Consultant	5.0 (4.0, 5.0)	24.0 (23.0, 24.8)
Nurse	2.0 (1.0, 3.0)	20.0 (20.0, 22.0)
Allied health professional	2.0 (2.0, 3.0)	20.0 (20.0, 22.5)
Administrator / Manager	2.0 (2.0, 3.0)	20.0 (20.0, 25.0)
p-value	**<0.001***	**<0.001***
Nationality		
Saudi	2.0 (1.0, 3.0)	20.0 (20.0, 23.0)
Non-Saudi	4.0 (2.0, 4.0)	21.0 (20.0, 25.0)
p-value	**<0.001***	**0.002***
Facility setting		
Urban	3.0 (2.0, 4.0)	20.0 (20.0, 24.0)
Rural	3.0 (2.0, 4.0)	21.0 (20.0, 24.0)
p-value	**0.112**	**0.365**
Attended training		
Yes	3.0 (1.0, 4.0)	21.0 (20.0, 25.0)
No	3.0 (2.0, 4.0)	20.0 (20.0, 24.0)
p-value	**0.865**	**0.013***
Chronic care involvement		
Yes	3.0 (2.0, 4.0)	20.5 (20.0, 24.0)
No	2.0 (1.2, 4.0)	20.0 (20.0, 24.0)
p-value	**0.002***	**0.466**

Experience level		
No experience	2.0 (1.0, 3.0)	20.0 (18.2, 21.0)
Basic user	2.0 (1.2, 4.0)	21.0 (19.2, 24.8)
Intermediate user	3.0 (2.0, 4.0)	20.0 (20.0, 23.0)
Advanced user	3.0 (2.0, 4.0)	22.0 (20.0, 25.0)
Expert user	3.0 (2.0, 4.0)	20.0 (20.0, 24.8)
p-value	**0.005***	**0.003***

***Significant; P-values were calculated using the Mann-Whitney U test for two-group comparisons and the Kruskal–Wallis test for comparisons involving three or more groups.**

Table 3. Reported Challenges and Barriers to the Implementation of The New Model of Care and Chronic Care Pathways

Challenges & Barriers Domains	**N = 400[1]**
Biggest challenges in applying chronic care pathways within the MoC	
Lack of adequate training/awareness	200 (50.0%)
Limited staffing resources	144 (36.0%)
Resistance to change among teams	96 (24.0%)
Lack of clear protocols/guidelines	76 (19.0%)
Main barriers to patient engagement in chronic care programs	
Frequent patient no-shows to scheduled appointments	180 (45.0%)
Cultural and language barriers that hinder understanding and trust	54 (13.5%)
Low health literacy and limited knowledge of disease management	206 (51.5%)
Limited access to digital tools and telehealth platforms	88 (22.0%)
Most frequent technological challenges when implementing MoC initiatives	
Inadequate IT infrastructure	94 (23.5%)
Poor integration of EHR	84 (21.0%)
Insufficient training for staff on digital platforms	190 (47.5%)
Lack of ongoing technical support	124 (31.0%)
Primary challenges in coordinating care across sectors	
Poor communication channels	162 (40.5%)
Lack of standardized referral systems	92 (23.0%)
Insufficient follow-up mechanisms	180 (45.0%)
Resistance to cross-specialty teamwork	98 (24.5%)
Barriers most affect adherence to MoC chronic care pathways	
Lack of updated clinical pathways and standardized guidelines	106 (26.5%)
Limited access to continuing professional education for providers	146 (36.5%)
Lack of administrative and organizational support	130 (32.5%)
Systems to track patient outcomes	112 (28.0%)
[1]n (%); MOC: Model of Care; EHR: Electronic Health Record	

Table 4. Reported Opportunities for the Implementation of the New Model of Care and Chronic Care Pathways

Opportunities domains	**N = 400[1]**
Improving chronic care pathway implementation in your workplace	
More staff training programs	154(38.5%)
Better communication between providers	108(27.0%)

Opportunities domains	N = 400[1]
Improving chronic care pathway implementation in your workplace	
Improved electronic health systems	86(21.5%)
Increased administrative support	40(10.0%)
Most critical factor for enhancing adherence to chronic care pathways	
Continuous professional education	166(41.5%)
Financial incentives for providers	118(29.5%)
Regular performance audits	2(0.5%)
Regular performance feedback	60(15.0%)
Best strategy to address workforce shortages for chronic care implementation	
Recruitment of additional staff	208(52.0%)
Redistribution of tasks	114(28.5%)
Increased use of telemedicine services	76(19.0%)
Measure that best supports patient engagement in chronic care pathways	
Health education campaigns	184(46.0%)
Involving families in care planning	76(19.0%)
Digital patient platform with reminders	72(18.0%)
Community outreach programs	62(15.5%)
Priority to strengthen interdisciplinary collaboration for chronic care	
Regular multidisciplinary meetings	128(32.0%)
Unified electronic record	106(26.5%)
Clear role definitions	68(17.0%)
Joint cross-specialty training	96(24.0%)
[1]**n (%)**	

Table 5. Stepwise Linear Regression Models Examining Predictors of Knowledge Score

	Model 1			Model 2		
Predictors	**Beta**	**95% CI**	**p-value**	**Beta**	**95% CI**	**p-value**
Age (years)	0.04	0.02, 0.07	<0.001*	0.04	0.02, 0.07	0.001*
Gender (Ref: Female)						
Male	0.32	0.02, 0.61	0.035*	0.32	0.02, 0.61	0.035*
Nationality (Ref: Non-Saudi)						
Saudi	0.10	-0.30, 0.51	0.600	0.10	-0.30, 0.51	0.600
Facility type (Ref: Primary health care center)						
Secondary / Tertiary hospital	0.04	-0.36, 0.43	0.900	0.02	-0.39, 0.42	0.900
Highest education attained (Ref: Diploma)						
Bachelor's	-0.17	-0.61, 0.26	0.400	-0.17	-0.61, 0.27	0.500
Master's / Diploma after Bachelor's	0.44	-0.05, 0.94	0.080	0.44	-0.07, 0.94	0.089
Doctorate / Board	0.58	-0.06, 1.2	0.078	0.57	-0.07, 1.2	0.082
Profession (Ref: General Physician)						
Specialist	0.11	-0.41, 0.63	0.700	0.13	-0.39, 0.65	0.600

	Model 1			Model 2		
Predictors	**Beta**	**95% CI**	**p-value**	**Beta**	**95% CI**	**p-value**
Consultant	0.51	-0.29, 1.3	0.200	0.52	-0.29, 1.3	0.200
Nurse	-0.98	-1.5, -0.49	<0.001*	-0.97	-1.5, -0.48	<0.001*
Allied health professional	-0.95	-1.5, -0.38	0.001*	-0.94	-1.5, -0.37	0.001*
Administrator / Manager	-0.52	-1.4, 0.33	0.200	-0.53	-1.4, 0.32	0.200
Years of healthcare experience	-0.03	-0.06, 0.00	0.039*	-0.03	-0.06, 0.00	0.038*
Facility setting (Ref: Rural)						
Urban	-0.16	-0.45, 0.12	0.300	-0.18	-0.47, 0.11	0.200
Attending any official MoC training				0.05	-0.20, 0.30	0.700
Involving in any chronic care pathways				0.02	-0.23, 0.27	0.900
Level of experience with digital health platforms				0.02	-0.09, 0.13	0.700

Model	**R**	**R^2**	**Adjusted R^2**	**ΔR^2**
Model 1	0.621	0.385	0.363	
Model 2	0.621	0.386	0.358	0.001

***Significant; CI: Confidence Interval**

Table 6. Stepwise Linear Regression Models Examining Predictors of Attitude Score

	Model 1			Model 2			Model 3		
Predictors	**Beta**	**95% CI**	**p-value**	**Beta**	**95% CI**	**p-value**	**Beta**	**95% CI**	**p-value**
Age (years)	0.10	0.02, 0.18	0.010*	0.09	0.01, 0.17	0.023*	0.04	-0.03, 0.12	0.200
Gender (Ref: Female)									
Male	-0.18	-1.0, 0.67	0.700	-0.17	-1.0, 0.68	0.700	-0.49	-1.3, 0.31	0.200
Nationality (Ref: Non-Saudi)									
Saudi	0.41	-0.77, 1.6	0.500	0.47	-0.70, 1.6	0.400	0.36	-0.73, 1.5	0.500
Facility type (Ref: Primary health care center)									
Secondary / Tertiary hospital	0.12	-1.0, 1.3	0.800	-0.11	-1.3, 1.1	0.900	-0.13	-1.2, 0.96	0.800
Highest education attained (Ref: Diploma)									
Bachelor's	-1.3	-2.5, 0.03	0.055	-1.2	-2.5, 0.05	0.060	-1.0	-2.2, 0.14	0.085
Master's / Diploma after Bachelor's	-0.82	-2.3, 0.63	0.300	-0.97	-2.4, 0.48	0.200	-1.4	-2.8, -0.05	0.042*

	Model 1			Model 2			Model 3		
Predictors	**Beta**	**95% CI**	**p-value**	**Beta**	**95% CI**	**p-value**	**Beta**	**95% CI**	**p-value**
Doctorate / Board	0.79	-1.1, 2.7	0.400	0.68	-1.2, 2.5	0.500	0.10	-1.6, 1.8	0.900
Profession (Ref: General Physician)									
Specialist	0.02	-1.5, 1.5	0.900	0.29	-1.2, 1.8	0.700	0.15	-1.3, 1.6	0.800
Consultant	0.13	-2.2, 2.5	1.000	0.40	-1.9, 2.7	0.700	-0.13	-2.3, 2.0	0.900
Nurse	-0.62	-2.1, 0.81	0.400	-0.57	-2.0, 0.84	0.400	0.41	-0.94, 1.8	0.600
Allied health professional	-0.67	-2.3, 0.99	0.400	-0.60	-2.2, 1.0	0.500	0.35	-1.2, 1.9	0.700
Administrator / Manager	0.09	-2.4, 2.6	1.000	-0.26	-2.7, 2.2	0.800	0.28	-2.0, 2.6	0.800
Years of healthcare experience	-0.03	-0.12, 0.05	0.400	-0.03	-0.12, 0.05	0.400	0.00	-0.08, 0.07	0.900
Facility setting (Ref: Rural)									
Urban	-0.25	-1.1, 0.59	0.600	-0.49	-1.3, 0.34	0.200	-0.31	-1.1, 0.47	0.400
Attending any official MoC training				0.70	-0.01, 1.4	0.055	0.65	-0.02, 1.3	0.057
Involving in any chronic care pathways				-0.42	-1.1, 0.28	0.200	-0.44	-1.1, 0.22	0.200
Level of experience with digital health platforms				0.40	0.07, 0.72	0.017*	0.38	0.07, 0.68	0.016*
Knowledge score							1.0	0.74, 1.3	<0.001*

Model	**R**	**R^2**	**Adjusted R^2**	**ΔR^2**
Model 1	0.371	0.138	0.106	
Model 2	0.406	0.165	0.128	0.027
Model 3	0.519	0.269	0.235	0.104

***Significant; CI: Confidence Interval**

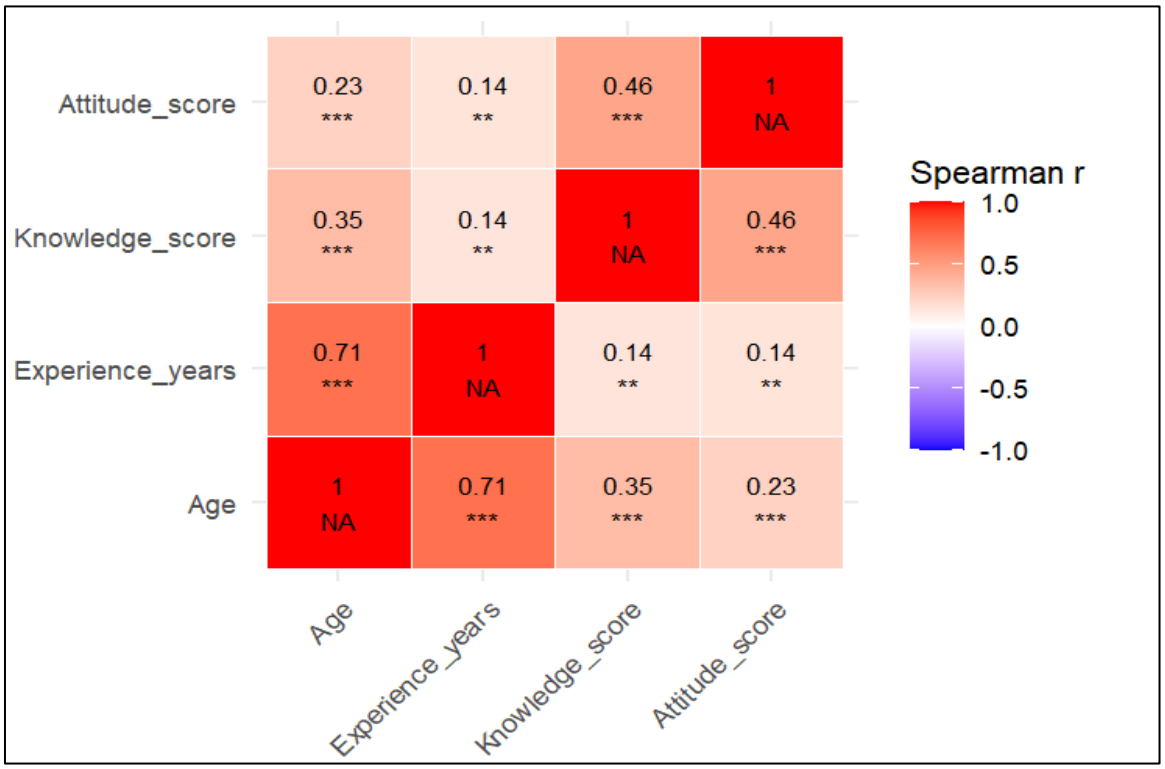

Figure 1. Spearman Correlation Matrix Between Key Study Variables

4. DISCUSSION

A Model of Care (MoC) provides a structured, evidence-based framework for delivering high quality, person-centered health services across populations. In alignment with Saudi Vision 2030, the Ministry of Health (MoH) launched the Saudi New Model of Care in 2018 to guide national healthcare transformation. The model is organized around six interconnected Systems of Care (SoC): Keep Well, Planned Care, Safe Birth, Urgent Care, Chronic Care, and Last Phase (Saudi Ministry of Health, 2023). Within this framework, chronic care pathways emphasize standardized protocols, multidisciplinary teamwork, digital integration, and continuity across primary, secondary, and tertiary levels of care. Evidence from international settings has demonstrated the effectiveness of chronic care models in improving outcomes for long-term conditions (Davy et al, 2015). This underscores the relevance of this approach within the Saudi context. Hence, this study examined healthcare workers' (HCWs) knowledge and attitudes toward the chronic care pathways of the Saudi MoC in the Hafar Al-Batin Health Cluster, and explored how sociodemographic, professional, experiential, and digital health factors shape readiness for implementation.

Knowledge and Attitudes Toward the Saudi Model of Care

The findings reveal a discrepancy between HCWs' knowledge of the overall MoC structure and their familiarity with specific components of chronic care delivery. Only one quarter of participants were able to correctly identify the six Systems of Care, indicating limited conceptual understanding of the MoC as an integrated national framework. In contrast, most participants demonstrated good knowledge of key features of chronic care pathways. Knowledge of recommended age groups for national screening programs was moderate, with higher awareness of breast cancer screening compared with colorectal cancer and diabetes mellitus. Similar patterns have been reported in other Saudi health clusters. Mugharbil et al. (2024) documented moderate overall MoC knowledge among HCWs in the Jeddah First Health Cluster. These results suggest that HCWs may engage more readily with operational aspects of the MoC than with its overarching design.

Despite these knowledge gaps, attitudes toward the chronic care model were generally positive. Most HCWs perceived the MoC as effective, feasible, and capable of improving communication, coordination, and quality of care. This favorable attitudinal profile aligns with findings from both Mugharbil et al. (2024) and Alrawaili et al. (2024), who reported high levels of acceptance of the MoC among HCWs in different Saudi regions. Positive attitudes are particularly important in large-scale system reforms, as they can foster engagement, teamwork, and openness to practice change, even in the presence of incomplete knowledge.

Factors Shaping Knowledge and Attitudes toward the MoC

Gender differences were not observed in overall knowledge levels; however, male participants demonstrated more positive attitudes toward the MoC. This suggests that while baseline knowledge of the MoC may be comparable across genders, perceptions and readiness to engage with system reform may be influenced by contextual or role-related experiences. After adjusting for other factors, male gender remained independently associated with higher knowledge, indicating a modest but consistent effect. Previous Saudi Arabian study had reported greater communicative confidence and advocacy among female HCWs (Alrawaili et al 2024). This discrepancy highlights the complex and context-dependent nature of this relationship.

Type of healthcare facility was a significant determinant of both knowledge and attitudes. HCWs working in primary healthcare centers showed higher knowledge and more favorable attitudes compared with those in secondary or tertiary hospitals. This finding reflects the central role of primary care in the Saudi MoH's transformation strategy, where MoC principles, particularly those related to prevention and chronic disease management, are more directly integrated into routine practice. Alomari et al. (2021) similarly reported higher MoC knowledge among primary care staff in the Riyadh First Health Cluster, especially within the Planned Care system. Although among Northern Border Health Cluster staff at the Ministry of Health, Saudi Arabia, Alrawaili et al 2024 have reported greater MoC familiarity among hospital-based staff, likely due to specialized services and resources, the present findings emphasize the importance of primary care as the operational backbone of the MoC.

Educational attainment and professional role demonstrated a clear gradient in shaping knowledge and attitudes. HCWs with higher academic qualifications and senior clinical positions, particularly consultants and physicians, consistently showed higher knowledge and attitudes that are more positive. These associations persisted after adjustment, indicating that professional role remains a strong independent determinant of MoC knowledge. This likely reflects greater involvement of physicians in clinical governance, planning, and decision-making processes where MoC concepts are discussed and applied. In contrast, nurses and allied health professionals demonstrated lower knowledge scores, highlighting persistent disparities in access to information and participation in reform initiatives. Similar professional differences have been documented by Alomari et al. (2021) and Alrawaili et al. (2024), underscoring the need for inclusive, multidisciplinary capacity-building strategies.

Experience with MoC-related systems was significantly associated with both knowledge and attitudes in the present study. Progressive exposure appears to strengthen understanding and support more favorable perceptions, in line with the Saudi MoH's phased implementation strategy and emphasis on continuous professional development. This finding is consistent with Alomari et al. (2021), who reported higher MoC knowledge among more experienced staff in the Riyadh First Health Cluster. Their results also indicated that less-experienced staff demonstrated greater motivation, readiness for change, and confidence in knowledge sharing, whereas more experienced staff showed

lower reactivity and confidence. This suggests that while experience enhances knowledge, openness to change may be greater among newer staff.

Challenges and opportunities in Saudi Model of Care:

In the present study, HCWs described a dynamic interplay between challenges and opportunities shaping the implementation of the Saudi MoC and chronic care pathways within the Ministry of Health. Workforce-related barriers, including inadequate training, limited awareness, staff shortages, and resistance to change, reflected suboptimal preparedness for large-scale system transformation. These constraints were compounded by patient-level challenges such as low health literacy, missed appointments, cultural and language differences, and limited access to digital tools, all of which undermined engagement and continuity of care. Technological limitations, particularly insufficient training on digital platforms, weak IT infrastructure, and poor electronic health record integration, further highlighted uneven progress in digital transformation. In addition, weak intersectoral coordination, non-standardized referral pathways, and limited interdisciplinary collaboration contributed to fragmented care delivery, threatening the sustainability and effectiveness of MoC implementation. These findings are consistent with previous evidence emphasizing the influence of organizational context, leadership support, provider readiness, and resource availability on successful chronic care implementation (Kadu & Stolee, 2015; Davy et al., 2015).

Moreover, HCWs also identified actionable opportunities that directly respond to these barriers. Expanding provider training and continuous professional development emerged as the most critical enablers, underscoring the central role of sustained capacity building in promoting confident and consistent MoC application. Strengthening multidisciplinary communication, optimizing electronic health systems, and enhancing administrative and organizational support were viewed as essential to improving care integration and long-term sustainability. To address workforce shortages, participants supported strategic recruitment, task redistribution, and greater use of telemedicine, reflecting openness to innovative staffing models aligned with national digital health priorities. Financial incentives were perceived as effective motivators for engagement, whereas performance audits were less emphasized, suggesting a preference for supportive, developmental approaches. At the patient level, health education initiatives, family involvement, and the use of digital patient platforms were highlighted as key strategies to enhance engagement and adherence. These findings indicate that while MoC implementation faces substantial systemic challenges, leveraging workforce development, digital innovation, and patient- and family-centered approaches offers a viable pathway toward more effective and sustainable chronic care delivery, consistent with evidence on culturally responsive and continuity-focused care models (Pinero de Plaza et al., 2023).

5. Limitations

This study has several limitations. Its cross-sectional design precludes causal inference. Data were based on self-reported responses, which may be influenced by recall or social desirability bias. In addition, the study was conducted within a single health cluster, which may limit the generalizability of the findings to other regions with different organizational contexts or implementation maturity. While the predominance of primary healthcare staff reflects their key role in MoC delivery, perspectives from other professional and leadership groups may not be fully captured. Despite these limitations, the study provides valuable real-world insights into workforce preparedness for chronic care pathway implementation in a rural health cluster setting.

6. Author Contributions

F.A.A.S. led study conceptualization and supervision. **A.F.A., K.M.A., and O.S.A.M.** contributed to study design and coordination. **A.Y.** conducted statistical analysis and drafted the manuscript. **H.A.A.S., H.M.A.E.E., and H.A.A.A.A.** supported interpretation of findings and manuscript revision. **A.K.A., I.S.A., S.O.A., A.S.A., F.D.N.A., and A.D.A.** contributed to data collection, data management, and results validation. **A.H.A.A.A.** provided healthcare delivery insights. All authors reviewed and approved the final manuscript and take responsibility for its content.

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Supplementary tables:

Table S1. Distribution of Correct Responses to Knowledge Items and Total Knowledge Score

Knowledge items	N = 400[1]
K1	104 (26.0%)
K2	296 (74.0%)
K3	282 (70.5%)
K4	222 (55.5%)
K5	200 (50.5%)
Total score	3.0 (2.0, 4.0)
[1]n (%); Median (Q1, Q3)	

Table S2. Distribution of Likert Responses to Attitude Items and Total Attitude Score

Attitude items	N = 400[1]
A1	
Strongly disagree	12 (3.0%)
Disagree	10 (2.5%)
Neutral	30 (7.5%)
Agree	202 (51%)
Strongly agree	146 (37%)
A2	
Strongly disagree	8 (2.0%)
Disagree	4 (1.0%)
Neutral	24 (6.0%)
Agree	184 (46%)
Strongly agree	180 (45%)
A3	
Strongly disagree	8 (2.0%)
Disagree	8 (2.0%)
Neutral	22 (5.5%)
Agree	204 (51%)
Strongly agree	158 (40%)
A4	
Strongly disagree	8 (2.0%)
Disagree	2 (0.5%)
Neutral	52 (13%)
Agree	230 (58%)
Strongly agree	108 (27%)
A5	
Strongly disagree	6 (1.5%)
Disagree	6 (1.5%)
Neutral	30 (7.5%)
Agree	214 (54%)
Strongly agree	144 (36%)

Attitude items	**N = 400**[1]
Total score	20.0 (20.0, 24.0)
[1]**n (%); Median (Q1, Q3)**	