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# Readiness of the health system to provide non-communicable disease services in Nepal: a comparison between the 2015 and 2021 comprehensive health facility surveys

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## Abstract

**Background** In Nepal, despite the escalating burden of non-communicable diseases (NCDs), there is a gap in the continuum of care for prevention, diagnosis, treatment, and care services for NCDs. The study aimed at assessing the changes in availability and readiness scores of health facilities between two consecutive health facility surveys.

**Methods** We compared NCD readiness scores between 2015 and 2021, using data from two nationally representative cross-sectional Nepal Health Facility Surveys (NHFS). Both consecutive surveys used globally validated standard tools of Demographic and Health Surveys (DHS)'s service provision assessment. Both surveys were undertaken using World Health Organization's (WHO) service availability and readiness assessment (SARA) tools. Data were collected using the Census and Survey Processing System on tablets, with validation performed through field check tables. Trained enumerators with a medical background collected data for the surveys, and we analyzed the information from a de-identified dataset downloaded from the DHS website upon request. Both the NHFS protocols were reviewed and approved by the Nepal Health Research Council and the institutional review board of ICF. We calculated the readiness scores based on WHO SARA indicators for diabetes, cardiovascular disease (CVD), and chronic respiratory disease (CRD) using an additive procedure. Multivariate linear regression analysis was undertaken to assess associated factors, with complex sampling design accounting for both surveys.

**Results** The overall availability of all three services has improved between 2015 and 2021 NHFS. Although the availability of diabetes-related services increased significantly between 2015 and 2021, this does not correspond to the increase in the readiness score. The readiness score increased by 10% points for CVDs related services and 9% points for CRDs. Compared to public hospitals, primary healthcare facilities experienced greater increase in readiness scores (11.5% versus 20.9%). Interestingly, those health facilities without quality assurance systems experienced a lower increase or even decrease in readiness scores than those with quality assurance systems. For the factors associated with readiness scores, health facilities charging additional or separate fees to the

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patients had a higher readiness score than those not charging any user fee for all three services. Compared to 2015, the readiness scores in 2021 improved for diabetes [ $\beta = 11.01$  (95% CI 9.02 to 12.96)], CVD [ $\beta = 10.70$  (95% CI 9.61 to 11.80)], and CRD [ $\beta = 8.41$  (95% CI 7.20 to 9.62)].

**Conclusion** The improvement in NCD service availability does not correspond to the proportional increase in readiness scores, which is crucial for delivering quality care. Regular staff meetings and feedback systems are crucial for improving all services including NCD-related service readiness and should be prioritized by local and provincial governments.

**Keywords** Service availability, Service readiness, Health system, Non-communicable diseases, Cardiovascular disease, Diabetes, Chronic respiratory disease

## Introduction

Globally, three out of four deaths is attributed to non-communicable diseases (NCDs) [1]. South Asian countries are experiencing a rapid surge of NCDs-related deaths due to demographic and socioeconomic transition. Every year, 1.78 million deaths in men and 1.27 million deaths in women among those aged 30 to 70 years in South Asia are attributed to four main NCDs, namely cardiovascular diseases (CVD), diabetes, chronic respiratory diseases (CRD), and cancer [2]. Despite the escalating burden, there are gaps in the care continuum for NCDs services, encompassing access to prevention, diagnosis, treatment, and care in low-and-middle-income countries (LMICs) [3]. In South Asia, approximately three quarters of the people with hypertension remain undiagnosed of their hypertension status and less than 20% of those with hypertension ever achieve their treatment target [2]. In countries such as Nepal, as low as 18% of individuals with hypertension were ever on medication [4]. Likewise, 47.3% were unaware of their raised blood glucose and only 36.7% of those on treatment ever achieved their blood glucose target [5].

There has been a consistent rise in the prevalence of NCDs in Nepal which can be attributed to the rising levels of behavioural (e.g., tobacco use, unhealthy diet, physical inactivity) and metabolic (e.g., raised blood pressure, cholesterol) risk factors [6]. According to the global burden of disease, NCDs claimed more than two-thirds (71%) of total estimated deaths in 2019 [6]. Deaths due to NCD is likely to increase to 79% by 2040, at current level of interventions [7]. The sharp rise in NCDs particularly due to CVDs and respiratory diseases are mainly attributable to the increasing prevalence of cardiovascular risk factors and increasing age. Approximately one in five individuals in Nepal are currently living with hypertension, and the prevalence of diabetes increased from 3.6% in 2013 to 5.8% in 2019 for adults aged 15 to 69 years old [8]. The age-standardized prevalence rate of chronic obstructive pulmonary disease (COPD) remained consistently high [6].

In countries such as Nepal, the progress in reducing the burden of NCDs is slow. With the current level

of interventions, the projected decline in mortality from the four main NCDs in South Asia by 2030 is just 6%; the lowest of all regions [9]. The Government of Nepal is likely to miss the sustainable development goal (SDG) 3.4 target, aimed at reducing premature mortality from NCDs by a third from 2015 to 2030 [9].

In such instances, it is critical for the health facilities to deliver affordable, appropriate, equitable NCD-related diagnosis and care. Service availability and readiness are core indicators for determining the system-level willingness and preparedness to provide high-quality service. Having appropriate healthcare facilities is critical to tackle the growing burden of NCDs [10]. Well-functioning health facilities is indispensable to enable access to diagnosis, treatment and long-term management of NCDs [11]. For effective delivery of NCD services, it is essential to understand the current capacity and gaps to direct resources towards developing locally-tailored cost-effective solutions to adequately prepare health facilities for the delivery of NCD care [12, 13].

Nepal experienced a significant change in health governance with the introduction of federalism in 2015 [14]. The Constitution of Nepal 2015 established basic health care services as a fundamental right of every citizen. In light of the country's transition to a federalized governance system, the state must ensure that all citizens have access to quality health services. As a result, local and provincial governments now share functional assignments with the federal government in delivering health services. The constitutional provisions are elaborated in the functional assessment and analysis [15] and the Local Government Operation Act 2017 [16].

The constitution assigns the management of basic health care services to the local level. Prevention, diagnosis and management of NCDs is one of the critical services under basic health care services. The structure of health institutions has undergone change following the federal structure. Basic health service centers and basic hospitals (<15 beds) are under local government; primary and secondary hospitals under provincial government; tertiary, super-specialized and academia/teaching hospitals are under the federal government. The public

health service regulation guides level of health facilities and type of health services to be provided by these facilities, including NCD services. The basic health care centers (BHCCs) that includes health posts (HPs), urban health centers (UHCs) should provide screening, diagnosis, initial management and referral for uncomplicated NCDs such as hypertension, diabetes mellitus, COPD, asthma, cervical cancer or breast cancer [17]. Confirmatory diagnosis, complicated case management, referral management and medication review for NCDs are undertaken through secondary or tertiary hospitals which are owned either through province or federal government [17]. However, service treatment protocols have been developed, only for the basic health services. Basic health services includes screening, provision of diagnosis, initial management and referral of major NCDs [17].

We aim to compare the readiness scores between 2015 and 2021 among the health facilities in Nepal and assess the factors associated with health facility readiness. This will enable a comparative analysis of service readiness over the years and up-to-date information on the current situation of service readiness in Nepal.

## Methods

### Data source and study design

We used de-identified datasets from the two consecutive nationally representative Nepal Health Facility Surveys (NHFS) undertaken in 2015 and 2021, downloaded from the DHS website upon request. Both surveys were undertaken using the globally validated standard tools such as Demographic and Health Surveys (DHS)'s service provision assessment and World Health Organization (WHO)'s service availability and readiness assessment (SARA). Such surveys are designed to provide information on the availability of basic and essential healthcare services and the readiness of health facilities to provide quality services to clients. This is an analytical repeated cross-sectional study for a comparative analysis of NCD-related service readiness.

### Data collection and quality control

The data on the availability and readiness of NCDs (i.e., diabetes, CVD and CRD) were collected through two types of questionnaires: (a) the facility inventory questionnaire: included comprehensive information on infrastructure, guidelines, equipment, medicines, diagnostics supplies, and services provided in health facilities; and (b) the health provider questionnaire enabled collection of information on qualifications, professional experience and trainings received by health workers. Computer-assisted personal interviews were undertaken to record responses through tablets. Data were collected using the census and survey processing system on tablets, with validation performed through field check tables. Following

data collection at each facility, the interviewers, with at least graduate degree in health sciences, reviewed the data before handing over to the field supervisors. The supervisors further reviewed the data for consistency and structural checks to identify any errors or missing information. After thoroughly scrutinizing the data, supervisors transferred them to the NHFS central office in Nepal using an internet-based file streaming system. To ensure data quality, on-site quality assurance officers (medical doctors) were deployed to conduct regular checks. Similarly, the core team from the central office also made regular field visits and utilized field check tables for monitoring, both in the field and at the office.

### Sample size and sampling procedures

Both surveys utilized a sampling frame provided by the Ministry of Health and Population (MoHP), which comprise of a comprehensive master list of all health facilities in Nepal. All health facilities except for specialized polyclinics or hospitals with stand-alone services such as cancer care or heart conditions, were eligible for the survey. After exclusion, a total of 4,719 health facilities in 2015 and 5,681 health facilities in 2021, served as the sampling frame. These facilities were further classified into different categories: hospitals (public or private), primary health care centers (PHCCs), BHCCs that included HPs and UHCs, community health units (CHUs), stand-alone HIV testing and counseling centers (HTCs).

In 2015, the survey covered a total of 1,000 facilities comprising all nonspecialized public hospitals and PHCCs and those private hospitals with 100 or more inpatient beds. The remaining health facilities comprised of selected BHCCs, private hospitals with at least 15 beds but fewer than 100 beds, stand-alone HTC sites. However, it was discovered that eight facilities were duplicates, thus, resulting sample size was 992 facilities, after removing the duplicates.

In 2021, the survey included 1,633 health facilities. All public hospitals were included in the sample due to their relatively small number and significant role in the healthcare system. Additionally, given their limited numbers, all private hospitals with at least one bed and those located in the Karnali or Sudurpashchim provinces were included with certainty. Among the non-government hospitals sampled, 54% were included with certainty, while 46% were selected randomly. Moreover, all PHCCs and stand-alone HTC sites were included in the sample. The remaining sample comprised of selected BHCCs (HPs, UHCs, CHUs) and private hospitals (except those already included with certainty). Seven facilities were identified as duplicates, resulting in a total sample size of 1,626 facilities. Since our study focused on the readiness of health facilities for diabetes, CVD, and CRD services, based on the WHO SARA manual, our eligibility criteria

included only those facilities expected to offer these services. Therefore, we removed stand-alone HTC sites. Therefore, the final sample size for this analysis, specifically focusing on health facilities offering services related to diabetes, CVD, and CRD, is presented in Table 1.

### Ethical considerations

Both the survey protocols were reviewed and approved by the Nepal Health Research Council (ERB Protocol Registration No. 733/2020P) and the institutional review board of ICF. We used publicly available de-identified dataset from the DHS website ([www.dhsprogram.com](http://www.dhsprogram.com)) for this analysis. Therefore, no separate ethical approval was required. In both surveys, the interviewers obtained written consent from the health facility in-charge or respondents. Privacy and confidentiality were ensured during interviews by trained interviewers. Interviewers from clinical backgrounds received intensive residential training to administer the questionnaires [18].

### Unit of analysis and study variables

The WHO SARA reference manual [10] was used to guide the selection of indicators for NCD services (diabetes, CVD and CRD). The service readiness is described by the tracer items of the following domains: staff and guidelines, equipment, diagnostic services and availability of essential medicines (details of the domains are presented in Supplementary Table 1).

Trained staff were defined as healthcare providers who had undergone structured in-service training on NCDs within 24 months preceding the survey. The availability of guidelines was assessed based on the presence of any relevant guidelines containing information on management of NCDs on the day of visit. Additionally, the facility needed to have functioning equipment and diagnostic services available on the day of the visit.

The indicator used for the analysis is the percent of facilities offering NCD services (diagnosis and/or management) with tracer items on the assessment day. Hence, our units of analysis are facilities that provide NCD services. In the health facility survey, offering NCD services is defined as providers in the facility having the capacity to diagnose, treat, and/or manage patients with diabetes, CVD or CRD. Health facilities offering services for these three specific NCDs were categorized into the readiness

index as our outcome variables. We have also analyzed the percentage of health facilities offering both diagnosis and treatment facilities. The covariates of the study include facility type, managing authority, location of the facility, ecological region, province, external supervision at the facility in the last four months preceding the survey (occurred/not occurred), system to determine client opinions (reviewed/not reviewed), user fee (Yes/No), staff management meeting(s) (occurred/not occurred), management meeting(s) among management committee members (occurred/not occurred), and quality assurance (performed/not performed). We used a free accessible global positioning system (GPS) for the location of health facilities for the survey conducted in 2015 [19], whereas in 2021, the distribution was available within the dataset.

### Statistical analysis

We presented the descriptive analysis of covariates and the outcome, i.e. the percentage of health facilities offering services for diabetes, CVD and CRD. To determine the readiness index of NCD services (diabetes, CVD and CRD), facilities offering any service is the outcome variable, and it is calculated from the tracer domains using the weighted additive procedure. This involves assigning equal weights to each domain and adjusting for the “variation in the number of indicators within each domain so that the weight of the indicator is inversely proportional to the number of indicators in the domain” [19–21]. For example, to assign a score ranging from 0 to 100%, each domain comprised 33.3% (100 divided by 3) of the score for CVD and CRD services. However, for diabetes services, each domain accounted for 25% (100 divided by 4) of the score. Therefore, percentage assigned to each indicator within the domain was calculated as 33.3% for CVD and CRD services and 25% for diabetes services. The percentage distribution of service and specific domain readiness scores was calculated for each NCD service. We have compared the readiness score between two consecutive surveys with percentages and a 95% confidence interval (CI).

To test the statistical significance of the change (point percentage) between the surveys, we calculated t-statistics at  $p$ -value  $\leq 0.05$  level. We used the both surveys data (using pooled data) to examine the association between covariates and readiness scores and identify the factors

**Table 1** Survey year and sample size of health facilities

NHFS year	Sampling frame	Sample size	HFs (removing duplicates)	HFs surveyed	Number of HFs HFs offering NCD services (final sample analysis) <sup>a</sup>
2021	5681	1633	1626	1576	$N = 1565$ Diabetes ( $n = 1149$ ), CVD ( $n = 1411$ ), and CRD ( $n = 1507$ )
2015	4719	1000	992	963	$N = 940$ Diabetes ( $n = 198$ ), CVD ( $n = 687$ ), and CRD ( $n = 885$ )

NHFS Nepal Health Facility Survey, HFs health facilities, NCDs Non-communicable diseases, CVD Cardiovascular disease, CRD Chronic respiratory disease; <sup>a</sup>Stand-alone HIV testing and counselling centers were excluded because they are not supposed to provide NCD services.

associated with the current readiness scores. We undertook multivariate linear regression analysis to identify the factors associated with readiness score and  $p$ -value  $\leq 0.05$ , and 95% CI was considered to determine whether the association was statistically significant. Before choosing the multivariate linear regression, we checked the normality of the data. Furthermore, we performed the Breusch-Pagan test statistic for heteroskedasticity before using linear regression models.

Furthermore, residual plots were used to validate the linear regression model and assess its assumptions. The linearity of the association between dependent and independent variables were also assessed. To enable these comparisons, we used statistical independence between residuals, the constant variance between errors, and graphical methods to ensure normality between error distributions. Univariate linear regression and the final multivariate linear regression models satisfied the assumptions. Since the health facility sample was stratified, sampling weights were calculated based on sampling probabilities separately for each stratum. We also conducted a multivariate linear regression analysis using pooled dataset. The survey year, along with other covariates [type of health facility, province, management meeting, staff meeting, quality assurance system, supervision, location of facility (rural vs. urban), geographical location and user fee], was adjusted to assess changes between the two surveys and to determine whether there were any changes over time. Before the analysis, we grouped our primary sampling unit (facility type) and strata for both surveys. A 'svyset' was then developed based on these groupings to account for the complex sampling design from the pooled dataset. The survey design and all analyses were performed using Stata 17.0 (StataCorp, College Station, TX, USA).

## Results

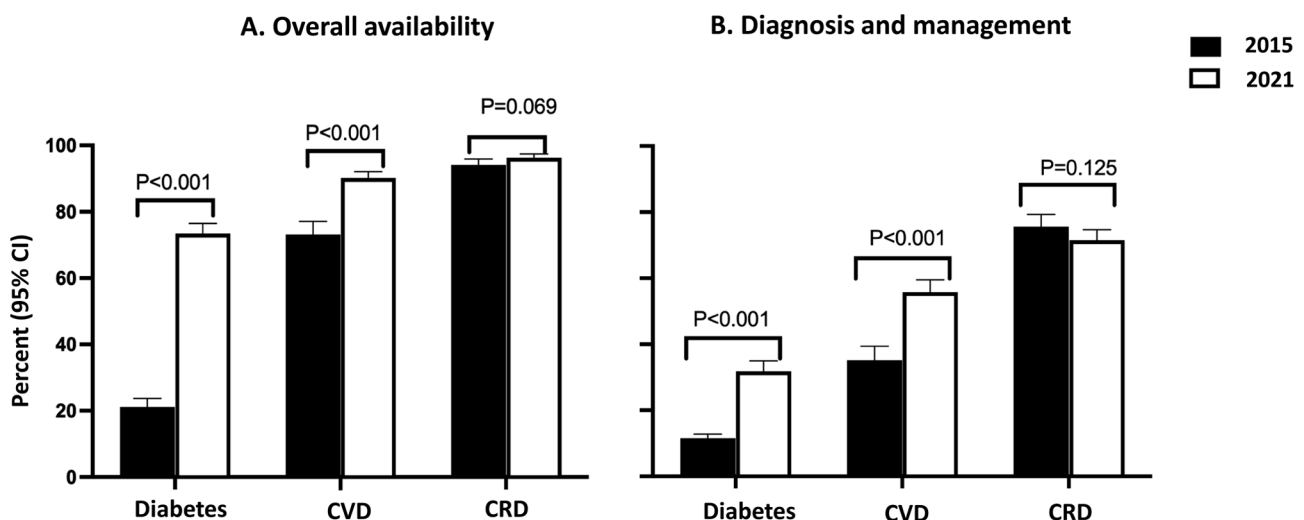
In both surveys, most health facilities were BHCCs mainly HPs located in hilly regions. Majority of the health facilities were from Bagmati province. Approximately half of the health facilities were from the rural municipalities. More than three-quarters of the health facilities did not have a quality assurance system and did not levy any user fee to their clients (Supplementary Table 2).

### Changes in the availability of health services

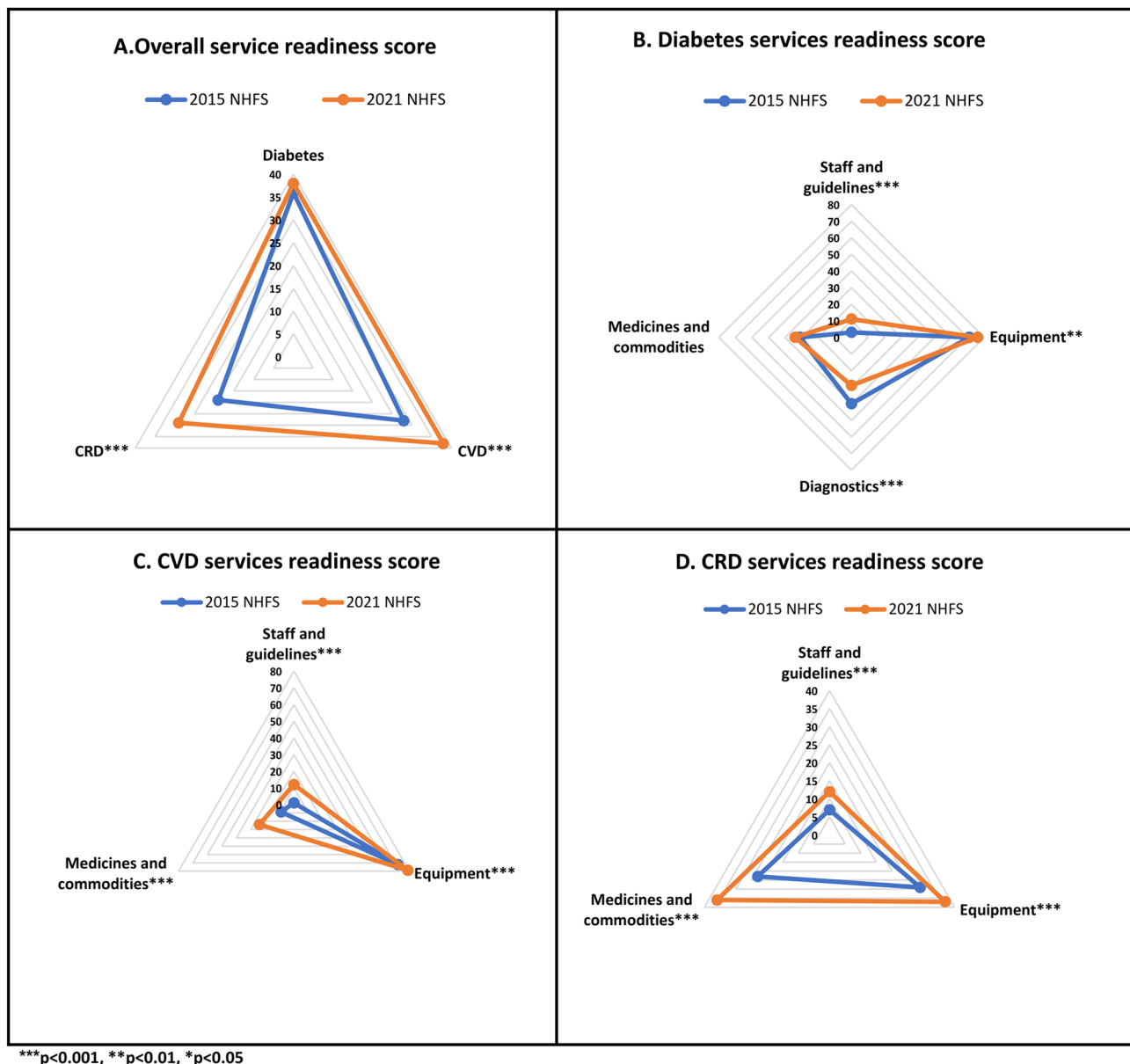
The overall availability of NCD services (diabetes, CVD and CRD) increased between 2015 and 2021 (Fig. 1A). Significant change was observed in the availability of diabetes services, which increased from 21% in 2015 to 73% in 2021 (increased by 52% points,  $p < 0.001$ ). There was a modest increase in the availability of CVD services (increased by 17% points,  $p < 0.001$ ). When the facilities were compared for providing both diagnosis and treatment, those facilities that deliver services for diabetes and CVD witnessed significant increases from 12 to 32% for diabetes ( $p < 0.001$ ) and 35 to 56% for CVD from 2015 to 2021 ( $p < 0.001$ ) (Fig. 1B). However, those facilities that deliver both CRD diagnosis and treatment declined by 4% points from 2015 to 2021, but this decline was not statistically significant.

### Changes in the readiness score from 2015 to 2021

Although the availability of diabetes-related services increased significantly between 2015 and 2021, this did not correspond to an increase in the readiness score (Fig. 2). There was a modest increase in the readiness score for diabetes-related services from 36 to 38% [by 2% points; with large confidence interval (Fig. 2)]. The readiness score increased by 10% points for CVD-related services ( $p < 0.001$ ) and 9% points for CRD ( $p < 0.001$ ).



**Fig. 1** Changes in availability of service provision from 2015 to 2021 (A) Any service availability (B) Both diagnosis and management CI, confidence interval; CVD, cardiovascular disease; CRD, chronic respiratory disease



**Fig. 2** Changes in readiness score according to different domains: (A) Overall service readiness score (B) Diabetes service readiness score (C) CVD service readiness score and (D) CRD services readiness score; CVD, cardiovascular disease; CRD, chronic respiratory disease; NHFS, Nepal Health Facility Survey

Staff training, along with the availability of NCD-specific guidelines and availability of medicines, increased modestly across all three services. Regarding diabetes-related services, although there was a modest increase in training and guidelines for diabetes, the availability of diagnostic services and essential medicines such as glibenclamide and insulin conversely declined in 2021 compared to 2015 (Fig. 2; Supplementary Table 3). There was persistent low availability of essential medicines for CVD and CRD, with readiness score of 38% for CVD and 36% for CRD in 2021. The availability of medicines for diabetes and CRD improved modestly over the years (31% to 34% for diabetes; 23% to 37% for CRD).

#### Changes in the readiness scores according to characteristics of facilities

A greater increase in readiness scores was observed for PHCCs compared to public or private hospitals. Public hospitals were found to have greater readiness scores for diabetes, CVD and CRD (increased by percentage points of 12, 15 and 17, respectively) than private health facilities (Table 2). Interestingly, facilities without a quality assurance system had significantly lower increase or even decline in readiness score compared to those facilities with regular quality assurance system (Table 2).

The increase in readiness score was also greater for rural health facilities than the municipal health facilities.

**Table 2** Changes in readiness score of diabetes, cardiovascular disease, and chronic respiratory disease from 2015 to 2021 by health facility characteristics

Variables	Diabetes			CVD			CRD		
	2015 NHFS	2021 NHFS	Diff	2015 NHFS	2021 NHFS	Diff	2015 NHFS	2021 NHFS	Diff
	% (95% CI)	% (95% CI)		% (95% CI)	% (95% CI)		% (95% CI)	% (95% CI)	
<b>Total</b>	<b>36.15</b> [33.75,38.55]	<b>38.35</b> [37.10,39.59]	<b>2.20</b>	<b>27.54</b> [26.83,28.24]	<b>38.47</b> [37.54,39.40]	<b>10.93</b>	<b>19.35</b> [18.53,20.17]	<b>28.61</b> [27.66,29.57]	<b>9.26</b>
<b>Facility types</b>									
Public hospitals	47.72 [45.64,49.80]	59.24 [55.15,63.34]	<b>11.52</b>	41.22 [38.95,43.49]	56.51 [53.47,59.55]	<b>15.29</b>	36.92 [34.04,39.81]	53.53 [50.40,56.67]	<b>16.61</b>
Private hospitals	49.13 [46.07,52.19]	53.18 [50.56,55.80]	<b>4.05</b>	44.8 [41.62,47.98]	50.84 [48.39,53.28]	<b>6.04</b>	39.15 [35.01,43.29]	47.76 [44.92,50.60]	<b>8.61</b>
PHCCs	35.86 [34.03,37.68]	56.81 [54.85,58.78]	<b>20.95</b>	30.11 [28.59,31.63]	51.52 [49.38,53.66]	<b>21.41</b>	23.64 [21.99,25.30]	47.92 [45.67,50.17]	<b>24.28</b>
BHCCs	22.20 [19.21,25.20]	34.57 [33.13,36.01]	<b>12.37</b>	24.80 [24.11,25.50]	36.10 [35.06,37.14]	<b>11.30</b>	16.88 [16.05,17.71]	25.33 [24.28,26.37]	<b>8.45</b>
<b>Managing authority</b>									
Public	29.62 [27.22,32.01]	36.73 [35.41,38.05]	<b>7.11</b>	25.70 [25.06,26.35]	37.41 [36.44,38.38]	<b>11.71</b>	17.75 [16.97,18.52]	27.07 [26.09,28.05]	<b>9.32</b>
Private	49.13 [46.07,52.19]	53.18 [50.56,55.80]	<b>4.05</b>	44.80 [41.62,47.98]	50.84 [48.39,53.28]	<b>6.04</b>	39.15 [35.01,43.29]	47.76 [44.92,50.60]	<b>8.61</b>
<b>Ecoregion</b>									
Mountain	31.65 [25.74,37.55]	38.35 [34.11,42.59]	<b>6.70</b>	26.94 [25.67,28.20]	35.15 [32.97,37.33]	<b>8.21</b>	17.54 [16.20,18.88]	27.16 [24.25,30.07]	<b>9.62</b>
Hill	37.79 [34.21,41.36]	39.58 [37.91,41.26]	1.79	28.02 [27.00,29.04]	40.40 [39.14,41.66]	<b>12.38</b>	18.70 [17.56,19.84]	30.15 [28.85,31.44]	<b>14.45</b>
Terai	35.46 [31.77,39.16]	36.6 [34.46,38.74]	1.14	27.04 [25.81,28.27]	36.63 [34.97,38.28]	<b>9.59</b>	20.94 [19.41,22.48]	26.78 [25.08,28.48]	<b>5.84</b>
<b>Province</b>									
Koshi	32.45 [26.62,38.27]	36.02 [32.82,39.23]	3.57	28.21 [26.24,30.17]	37.91 [35.62,40.20]	<b>9.70</b>	18.12 [16.44,19.79]	26.20 [23.65,28.76]	<b>8.08</b>
Madhesh	34.74 [25.96,43.51]	30.98 [28.17,33.80]	-3.76	23.88 [22.21,25.54]	33.10 [30.60,35.60]	<b>9.22</b>	18.12 [15.82,20.43]	23.88 [21.33,26.43]	<b>5.76</b>
Bagmati	42.21 [37.53,46.90]	41.94 [38.71,45.18]	-0.27	29.88 [28.08,31.69]	39.87 [37.90,41.85]	<b>9.99</b>	20.51 [18.48,22.55]	30.33 [28.20,32.46]	<b>9.82</b>
Gandaki	40.75 [33.12,48.38]	39.73 [36.67,42.78]	-1.02	28.95 [27.03,30.86]	41.78 [39.45,44.11]	<b>12.83</b>	19.32 [17.00,21.65]	31.30 [28.54,34.06]	<b>11.98</b>
Lumbini	34.92 [31.26,38.57]	39.46 [36.65,42.27]	<b>4.54</b>	29.12 [27.12,31.11]	41.19 [38.60,43.78]	<b>12.07</b>	21.81 [19.62,23.99]	31.32 [28.76,33.88]	<b>9.51</b>
Karnali	29.29 [23.89,34.69]	37.57 [33.65,41.48]	<b>8.28</b>	25.61 [24.24,26.98]	37.80 [34.62,40.99]	<b>12.19</b>	15.17 [12.88,17.46]	28.83 [26.00,31.66]	<b>13.66</b>
Sudurpashchim	33.58 [28.21,38.94]	43.48 [40.03,46.93]	<b>9.90</b>	26.11 [24.61,27.61]	37.35 [34.94,39.77]	<b>11.24</b>	20.68 [18.19,23.17]	28.60 [26.71,30.48]	<b>7.92</b>
<b>Location</b>									
Metro/sub metropolitan city	44.54 [40.18,48.89]	44.93 [40.56,49.31]	0.39	34.97 [31.69,38.25]	40.94 [37.70,44.18]	<b>5.97</b>	28.77 [24.78,32.77]	33.59 [29.84,37.33]	4.82
Municipality	37.95 [34.31,41.60]	38.42 [36.54,40.29]	0.50	28.51 [27.36,29.66]	38.48 [37.14,39.82]	<b>9.97</b>	20.6 [19.07,22.13]	28.14 [26.72,29.56]	<b>7.54</b>
Rural Municipality	26.01 [22.71,29.31]	36.75 [34.81,38.69]	<b>10.74</b>	25.28 [24.26,26.30]	37.93 [36.45,39.40]	<b>12.65</b>	16.72 [15.79,17.64]	28.05 [26.57,29.53]	<b>11.33</b>
<b>Quality assurance</b>									
Not Performed	35.66 [32.95,38.38]	37.10 [35.65,38.55]	1.44	27.60 [26.76,28.44]	37.66 [36.57,38.74]	<b>10.06</b>	19.35 [18.44,20.25]	27.66 [26.54,28.79]	<b>8.31</b>
Performed	38.40 [33.33,43.47]	42.05 [39.35,44.74]	3.65	27.29 [25.86,28.72]	41.03 [39.16,42.91]	<b>13.74</b>	19.34 [17.23,21.45]	31.61 [29.60,33.62]	<b>12.27</b>
<b>Staff management meeting</b>									
No	37.15 [33.81,40.48]	35.99 [36.53,39.10]	-1.16	27.09 [26.13,28.06]	36.79 [35.50,38.09]	<b>9.73</b>	18.64 [17.61,19.66]	26.55 [25.20,27.90]	<b>7.91</b>

**Table 2** (continued)

Variables	Diabetes			CVD			CRD		
	2015 NHFS % (95% CI)	2021 NHFS % (95% CI)	Diff	2015 NHFS % (95% CI)	2021 NHFS % (95% CI)	Diff	2015 NHFS % (95% CI)	2021 NHFS % (95% CI)	Diff
Yes	35.09 [31.40,38.77]	40.36 [42.83,55.54]	<b>5.27</b>	28.22 [27.00,29.43]	40.03 [38.64,41.42]	<b>11.81</b>	20.51 [18.96,22.06]	30.52 [29.08,31.95]	<b>10.01</b>
<b>Management meeting</b>									
No	38.34 [35.40,41.29]	37.67 [35.84,39.50]	-0.67	28.52 [27.51,29.53]	37.58 [36.28,38.88]	<b>9.06</b>	20.02 [18.89,21.15]	27.68 [26.27,29.09]	<b>7.66</b>
Yes	31.12 [26.96,35.27]	39.00 [37.16,40.84]	<b>7.88</b>	25.90 [24.89,26.91]	39.37 [37.98,40.75]	<b>13.77</b>	18.14 [16.93,19.36]	29.53 [28.15,30.92]	<b>11.39</b>
<b>System to determine client opinions</b>									
No	35.30 [32.84,37.77]	37.81 [36.53,39.10]	<b>2.51</b>	27.28 [26.56,28.00]	38.14 [37.19,39.08]	<b>10.86</b>	19.21 [18.37,20.05]	28.23 [27.26,29.20]	<b>9.02</b>
Yes	49.06 [42.49,55.63]	49.19 [42.83,55.54]	0.13	36.26 [30.27,42.25]	46.29 [40.65,51.93]	<b>10.03</b>	24.33 [17.58,31.08]	38.29 [31.92,44.66]	<b>13.96</b>
<b>External supervision in the last 4 months</b>									
Not Occurred	35.12 [30.36,39.87]	37.5 [35.21,39.79]	2.38	27.15 [25.79,28.51]	38.38 [36.80,39.96]	<b>11.23</b>	18.41 [16.87,19.94]	28.35 [26.68,30.02]	<b>9.94</b>
Occurred	36.66 [33.79,39.53]	38.71 [37.16,40.27]	2.05	27.76 [26.87,28.65]	38.51 [37.33,39.70]	<b>10.75</b>	19.89 [18.87,20.91]	28.75 [27.52,29.98]	<b>8.86</b>
<b>User Fee</b>									
None	21.23 [18.55,23.92]	32.29 [30.87,33.70]	<b>11.06</b>	24.95 [24.23,25.67]	35.53 [34.45,36.61]	<b>10.58</b>	16.65 [15.82,17.48]	24.62 [23.57,25.68]	<b>7.97</b>
Separate fee	45.08 [43.17,46.98]	51.95 [49.88,54.03]	<b>6.87</b>	37.03 [34.70,39.37]	47.04 [45.09,49.00]	<b>10.01</b>	31.92 [29.24,34.60]	40.73 [38.44,43.02]	<b>8.81</b>
Fixed for all services	31.92 [23.38,40.47]	48.19 [41.81,54.58]	16.27	28.09 [25.80,30.39]	42.33 [37.59,47.07]	<b>14.27</b>	20.71 [15.94,25.48]	35.49 [28.27,42.70]	<b>14.78</b>

CI Confidence interval, Diff Difference (percentage points), CVD Cardiovascular diseases, CRD Chronic respiratory diseases, NHFS Nepal health facility survey, BHCC Basic health care centers including health post, urban health clinic & community health unit, PHCCs, primary health care services, Bold indicates significance at  $p$ -value  $\leq 0.05$ .

Although readiness scores increased for health facilities with no user fees (increased by 11% for diabetes, 11% for CVD, and 8% for CRD), the readiness scores in 2021 were still lower for those facilities with no user fees compared to the facilities that levied some user fee.

#### Factors associated with the readiness scores

In a multivariate analysis of factors associated with readiness scores across both surveys (using pooled data), we found that those health facilities which charged patients additional or separate fees had a greater readiness score than those not charging any user fee for diabetes [ $\beta = -13.09$  (95% CI -17.55 to -8.65)] (Fig. 3). Similarly, the BHCCs had a lower readiness score than public or private hospitals for diabetes related services. Facilities with staff management meetings are likely to perform better than those without regular staff management meetings. Gandaki and Sudurpashchim province had better service readiness for diabetes than Koshi province.

For CVD related services, in addition to the user fee and type of health facility, those facilities in hilly region had better readiness scores than those in mountain region. Management practice such as staff management meetings was also found to be associated with a better readiness score [ $\beta = 1.88$  (95% CI 0.43 to 3.34)] (Fig. 3B).

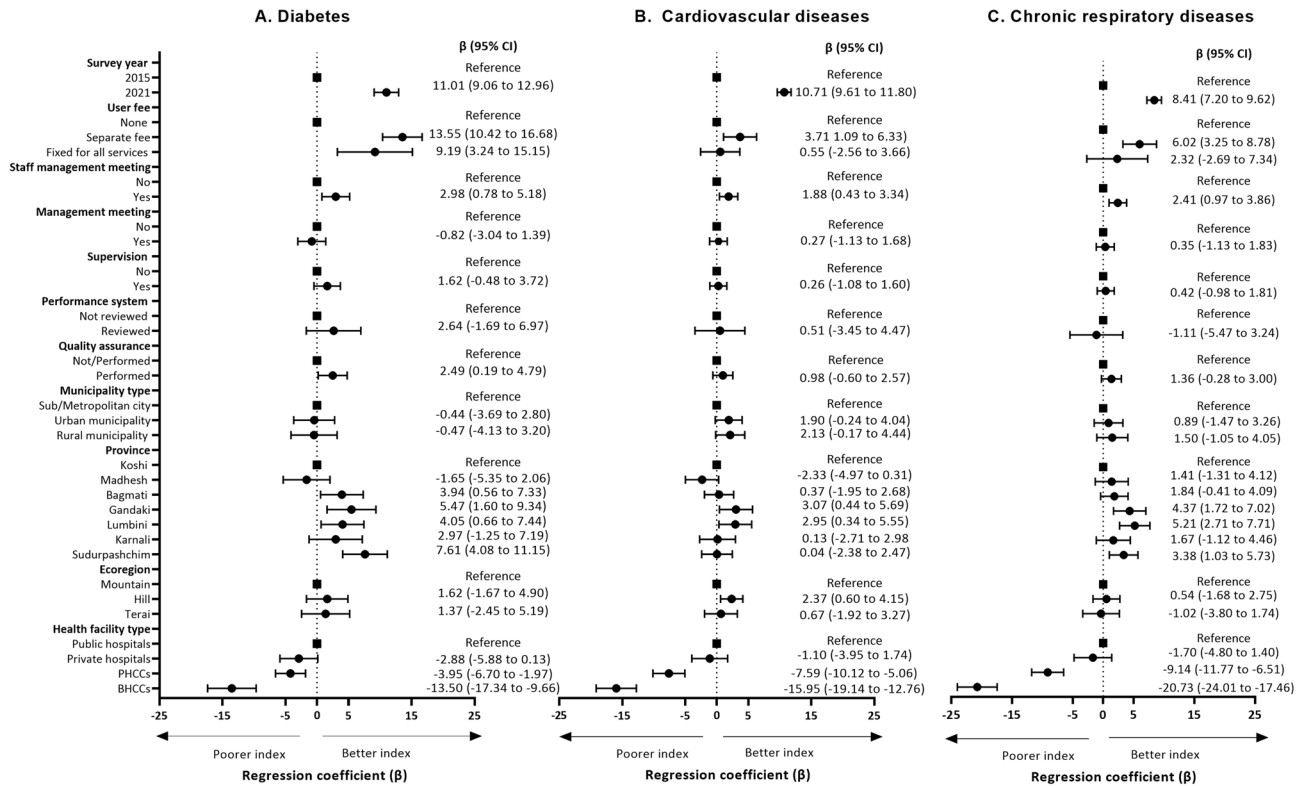
Gandaki and Lumbini provinces had better readiness scores for CVD compared to Koshi province. Peripheral health facilities such as PHCCs or BHCCs or HPs have lower CVD scores than the public hospitals. The overall service availability increased by 8.4% points for CRD from 2015 to 2021. Alongside user fees and type of health facilities, facilities with regular staff management meetings performed better with higher readiness score for CRD [ $\beta = 2.41$  (95% CI 0.97 to 3.86)] (Fig. 3C). Gandaki, Lumbini and Sudurpashchim province had better service readiness than Koshi province. The readiness scores were consistently poorer for BHCCs for all three services.

Compared to 2015, the readiness scores in 2021 improved for diabetes [ $\beta = 11.01$  (95% CI 9.02 to 12.96)], CVD [ $\beta = 10.70$  (95% CI 9.61 to 11.80)], and CRD [ $\beta = 8.41$  (95% CI 7.20 to 9.62)].

#### Discussion

To our knowledge, this is the first analysis that compared the service availability and readiness of major NCDs services between 2015 and 2021. The federal health system markedly increased the local government's role in delivering health services [14]. Thus, this analysis also accounts for the decentralization of the health system in Nepal. Overall, the availability of major NCD services





**Fig. 3** Factors associated with readiness scores of diabetes, CVD, and CRD services (pooled)

increased between 2015 and 2021, except for CRD. However, the increase in availability of services did not correspond to the quality of services measured using readiness scores. Significant improvements were observed in the staff training and availability of guidelines, and availability of medication compared to 2015. Despite these improvements, the readiness scores are still sub-optimal, especially for BHCCs and those facilities in municipal areas indicating the need to increase capacity building, procurement and supply of essential medications to ensure comprehensive services targeting these BHCCs and health care facilities at municipal areas.

The overall availability of NCD-related services increased significantly during the last five years. The Government of Nepal adopted a multisectoral action plan for 2015–2020, finalized a basic health care package in 2018, including the NCD services and expanded the Package of Essential Non-communicable Diseases (PEN) throughout the country during this period [18]. Diagnosis and management of major NCDs were also included in the basic health service package, developed in 2018. Inclusion in the basic health services package implies that the Government of Nepal is responsible for providing these services as constitutionally guaranteed citizens’ rights [17]. Further, PEN package included capacity building of health facilities to deliver NCD-related care. Local government facilitated the expansion and implementation of

the PEN Package at the community level. The PEN package might have attributed to the sharp increase in service availability in lower-level health facilities such as PHCCs and BHCCs [18]. The recent priority of NCDs through the inclusion in Nepal’s National Health Policy 2019 services coupled with the rapid expansion of PEN could explain the marked increase in service availability during this period [17, 22, 23].

There has been modest improvement in overall readiness scores for managing NCDs, but this improvement has been disproportionate across the health centers and differed according to the type of NCD. For example, the readiness score for diabetes-related services did not improve between two surveys. Yet, despite this, 73% of the health facilities were reported to offer diagnosis or treatment services in 2021, compared to 21% in 2015. This demonstrates the potential gaps in the comprehensive service through these newly expanded service sites. The rapid expansion of PEN may have enhanced the training aspect, but this was not well aligned with other components such as medication and diagnostics, resulting in consistently low readiness scores at these sites. Expanding the availability of NCD-related services should be aligned with improving readiness scores to ensure the quality of NCD care delivered through these facilities [20].

Interestingly, peripheral health facilities such as PHCCs or BHCCs witnessed a greater increase in readiness

scores compared to public or private hospitals. The readiness scores of BHCCs were strikingly low in 2015, and they experienced a significant positive increment in 2021. The readiness scores (36% for diabetes, 39% for CVD, and 29% for CRD) are lower than the family planning services (68%) or antenatal care (54%) [24]. A cut-off of 70% is considered as ready to manage NCDs [25]. However, the readiness scores for all three NCDs are much lower than the cut-off in 2021 (36% for diabetes, 39% for CVD and 29% for CRD). The service readiness for NCDs is even lower than the general health service readiness in Nepal [26]. Despite the marked increase, BHCCs are still the lowest-performing facility type, with the lowest readiness scores. Capacity of staff, availability of diagnostics and essential medicines has always been a challenge in the peripheral health facilities. Similarly, the change in readiness scores is also uneven across different provinces. In provinces such as Madhesh, there was a regressive change for diabetes and CVD services. It is uncertain why such a negative change has occurred. Insufficient diagnostic equipment could be a potential reason for such a decline. Investigators reported low priority of provincial and local government for procurement of equipment for diagnosis which might have subsequently resulted in lower readiness scores [27].

There was no positive change in the readiness scores for metropolitan, sub-metropolitan and municipality regions. Conversely, the prevalence of diabetes and hypertension is higher in municipalities and metropolitan cities. The BHCCs sites mainly UHCs in municipalities are not optimally prepared to deliver services for NCDs. The current structure of most UHCs does not provide the minimum services for NCDs despite the growing demand for health promotion, screening, diagnosis and management of NCDs in cities [8]. Without improved readiness for NCD services in city areas, the poor living in urban areas are the most affected, with limited access to quality care in these settings [28]. Facilities with separate user fees had a better readiness score than those without. Higher-level facilities, such as public or private hospitals, are likely to have separate user fees. The poor readiness in health facilities without user fee may exacerbate health inequity as it favors a system that prioritizes the ability to pay from users, thus widening the gap in accessibility to quality health services [29]. There is already evidence that NCDs are responsible for significant government and individual expenditures on health [27, 28]. In countries such as Nepal, out-of-pocket expenditure is already high [27]. The low readiness of peripheral health facilities, which do not charge user fee, might either push a large proportion to private health facilities, which are already expensive, or overburden already strained public hospitals.

It is important to note that the burden of NCDs and risk factors has increased substantially in Nepal over the years. The higher burden of diabetes, CVD and CRD in the country necessitate improved access to the diagnosis and treatment services for both primary and secondary prevention. However, our findings indicate that the increase in service readiness scores for the health facilities is modest. Although, a large proportion of health facilities have started providing some form of diabetes services, however, the service provided are not comprehensive and the quality of those services are not guaranteed as evidenced by the low service readiness scores. There is need for strengthening these service sites especially BHCCs through adequate capacity building and provision of guidelines, timely procurement and delivery of equipment and regular monitoring of the NCD related medicines to avoid stock-outs [27].

Importantly, we found that those health facilities with a system in place for regular staff meetings and feedback performed better on the readiness scores than those without, thus highlighting a potential avenue for improving health facilities readiness in Nepal. These quality improvement measures are critical for improving the effectiveness of an organization. Such measures have also been documented to improve the readiness of health facilities to deliver services for other chronic conditions such as HIV [19]. Such meetings and feedback systems inform the management committee of the shortcomings in an institution and enable continuous monitoring. With just half of the facilities instituting such quality improvement measures, the local government could strengthen these measures to improve the readiness and accountability for NCD-related services.

With an enhanced role of primary care for delivering NCD related care, there is need for strengthening capacity of health workers especially at peripheral levels [30]. Strengthening and expanding training through PEN package, task-sharing and regular supervision is essential for continuous skill-building. Moreover, access to medicines play a critical role in achieving universal health-care coverage, but ensuring year-round availability of essential medications is a challenge in countries such as Nepal [31, 32]. Procurement challenges including financial challenges such as inadequate funding and resource allocation, governance structure and poor logistic management are responsible for stock out of essential drugs for NCDs [27]. International coordination for pricing and quality of medication [33], domestic resource mobilization, strengthening procurements system at all levels of governments and proper logistic arrangements are required to better prepare these facilities to deliver quality care. Finally, enhancing the quality management system such as staff and management meetings, strengthening

feedback and quality assurance processes could be simpler, yet critical steps for improving readiness scores.

### Strength and limitations

We used nationally representative data from two consecutive cross-sectional surveys undertaken in 2015 and 2021. In this study, we have used comparable methodologies of the WHO SARA reference manual [10]. We have analyzed the datasets from the surveys and do not account for the experiences of NCD service users. Analyzing the data from two consecutive surveys enables us to estimate the readiness of health facilities across varying time points. Though we have not analyzed the direct effect of federalism, we believe our analysis can offer valuable insights for policymakers, examining the changes in Nepal from 2015 to 2021—both before and after the implementation of federalism. Since the surveys are cross-sectional, our study could not establish a temporal relationship between service readiness and covariates.

### Conclusion

The proportion of health facilities offering services for NCDs has increased significantly from 2015 to 2021. However, this improvement in service availability does not fully correspond to an increase in the readiness score, which raises concerns about the quality and comprehensiveness of services provided through these facilities. The improvement in readiness remained sub-optimal for urban municipalities and specifically for diabetes services, thus, requiring additional intervention through capacity building and improved supplies of diagnostics and essential medicines. Quality improvement initiatives, such as regular staff meetings and feedback systems, are critical in improving NCD-related service readiness. These initiatives could be facilitated through local and provincial governments and are essential in achieving universal health coverage and the SDGs target for reducing NCDs.

### Supplementary Information

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Supplementary Material 1.

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### Authors' contributions

Conceptualization, all the authors; methodology, all the authors; software, validation, and formal analysis, KA; writing—original draft preparation, RT, NB, KA and KB; writing—review and editing, all the authors; supervision, all the authors; This manuscript has been reviewed and approved by all authors.

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### Availability of data and materials

Data are available in a public, open-access repository. The datasets generated during the current study are available at <https://dhsprogram.com/data/available-datasets.cfm>.

### Declarations

#### Ethics approval and consent to participate

The Institutional Review Board of Nepal Health Research Council reviewed and approved the 2015 and 2021 NHFS in Nepal; data was publicly available without facility identification. Informed consent was obtained from the health workers present at the facility before interviews were conducted. Since we analyzed available datasets, ethics approval was not required.

#### Consent for publication

Not Applicable.

#### Competing interests

The authors declare no competing interests.

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