

Quality Improvement and NCD Control: A Three-Year Primary Care Sustainability Assessment

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ABSTRACT

Objectives: This study aimed to evaluate the three-year sustainability of a quality improvement (QI) initiative designed to improve health records of individuals with hypertension and diabetes at a primary health facility in Delhi, India. Additionally, we used data from the records to calculate outcome indicators.

Methods: This mixed methods study assessed sustainability using the National Health Service Sustainability Model and Guide. The World Health Organization's cohort monitoring approach was used to calculate annual control rates, loss-to-follow-up rates and missed visits.

Findings: The overall score for the sustainability assessment was 96.2%. Factors contributing to sustainability included the transition to digital health records, stakeholder engagement, process adaptation, improved clinical decision making, and strong senior leadership support.

In all, 953 individuals living with hypertension and/or diabetes registered at the centre. Annual blood pressure and glycaemic control rates fluctuated from baseline to 2024. Records showed high loss-to-follow-up rates, and a large proportion of missed visits and missing data.

Conclusion: The QI initiative of improved record keeping achieved a high sustainability score after three years. While digital records enabled calculating outcome indicators, these fell short of desired levels because of external factors, patients' behaviour and poor availability of drugs and diagnostics.

Keywords: Blood Pressure Control, Glycaemic Control, Non-Communicable Disease, Quality Improvement, Sustainability, Primary Care

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INTRODUCTION

Non-communicable diseases (NCDs) are the leading cause of mortality in the world, with ischaemic heart disease contributing the highest burden.¹ Hypertension (HTN) has been found to be a major contributor to cardiovascular diseases, accounting for the largest number of disability adjusted life years in 2022.² In India, diabetes mellitus (DM) and HTN are mostly managed at the primary care level, making it essential for primary health centres (PHCs) to be equipped with all necessary drugs and technologies.

The World Health Organization (WHO) HEARTS technical package for cardiovascular disease management in primary healthcare, which was published to ensure standardised, high quality care for individuals with NCDs, recommends developing an information system for cohort monitoring of NCD patients at all PHCs.³ Such a system has been found to be the most important facility level measure for effective HTN management.⁴ It allows PHCs to monitor their patient load and in turn, forecast their drug requirements, calculate NCD control rates, identify patients who require follow-up reminder calls and bring them back into the system, and improve the continuity of care and coordinated care.^{4,5}

To set up an information system and monitor the NCD status of individuals seeking care at an urban primary health centre (UHC) in Delhi, our team performed a quality improvement (QI) initiative in 2021.⁶ Through the initiative, the availability of patient health records increased from 0% to 100% in a span of three weeks. The processes established during the QI initiative were integrated into routine care with the expectation that systematic record keeping would be sustained over time.

Sustainability, recognised as one of the domains of quality, refers to the capacity of the health system to continue to deliver the service over time, while maintaining its quality.⁷ However, due to the increasing demand on healthcare services, limited resources, and competing priorities, sustaining good practices is not always possible.⁸ Assessing the sustainability of a QI initiative post-implementation is essential to determine whether its benefits are maintained over time. Moreover, identifying the factors that contributed to sustainability can inform the replication of best practices in similar settings. Therefore, this present study was conducted to assess the sustainability of the processes implemented during the QI initiative undertaken to improve the availability of NCD records in a UHC in Delhi in 2021, three years post-implementation, using the National Health Service (NHS) Sustainability Model. Additionally, data from these NCD health records were used to calculate clinical outcome indicators, like annual blood pressure (BP) and glycaemic control rates, loss-to-follow-up rates and missed visits for individuals living with hypertension and DM seeking care at the facility, from baseline to 2024, using the WHO recommended co-

hort monitoring approach. This was done to identify shortcomings in healthcare delivery, for which future QI initiatives could be undertaken.

METHODOLOGY

The study setting was a UHC in Delhi, India, which is run by the Community Medicine Department of a government medical college situated 8 kilometres away. The UHC is located in a resettlement colony and caters to a population of around 38,000 individuals belonging to lower and middle socio-economic statuses. A large proportion of the population includes people native to other states who migrated there for employment opportunities. In the resettlement colony, apart from the UHC, there are a number of other government-run primary care dispensaries, a secondary level government hospital, and two major tertiary care government hospitals located within a ten-kilometre radius. Additionally, there are clinics belonging to private practitioners, traditional and alternative medicine practitioners, and informal care providers. Residents of this colony seek care from all these facilities.⁹

At the UHC, care is provided for all common conditions 5 days a week, from 10am to 12 pm. Around 5 to 6 resident doctors treat approximately 60 to 100 outpatients a day. These doctors are assisted by 6 to 7 support staff who run the registration counter, pharmacy, laboratory and counselling room. Resident doctors follow standard operating procedures (SOPs) while providing NCD care, which are printed on charts and stuck on the walls for quick referencing. These SOPs were adapted from the standard WHO guidelines and Indian national program guidelines, and were validated by specialists in endocrinology and community medicine. BP is measured for all patients using the standardised procedure recommended by WHO.¹⁰ Point of care tests are performed in the UHC's laboratory, including capillary glucose testing. For HbA1c testing, patients were referred to state government dispensaries (mohalla clinics), where blood tests were outsourced to National Accreditation Board for Testing and Calibration Laboratories (NABL) accredited private labs.¹¹ Drugs for the UHC are procured from the government medical college, subject to availability, and drug shortages occasionally occur.

In 2021, the unavailability of patients' NCD health records in the UHC was identified as a significant shortcoming, leading to irrational medication indenting and challenges in patient monitoring. To establish such a system, a quality improvement initiative was undertaken with the aim of increasing the availability of patient health records from 0% to 100% among patients with HTN and/or diabetes seeking care at the UHC within six weeks. The QI team consisted of a senior resident doctor (for training, implementing and supervising), a medical social service officer (for supportive supervision), a public health nurse and a

registration counter clerk (for implementing the intervention). Faculty members from the Community Medicine department in the medical college led the QI team, and were responsible for overseeing, supporting and guiding the other members.

The root causes of the problem were identified by mapping the existing processes, and constructing a fishbone diagram, following which the QI team developed a change and tested it using plan-do-study-act cycles. A *dhirg-aayu card (NCD passbook)* was developed for individuals living with NCDs, as well as a paper-based record keeping system for the UHC (NCD record file).¹² A run chart was used to monitor the availability of health records by the medical officer and medical social service officer for a period of six weeks. The availability of NCD records increased from 0% to 100% in 3 weeks. Thereafter, the data present in the NCD record files would be entered into Epicollect5 quarterly to digitalize the records. Details of the quality improvement initiative have been published previously.⁶

Over the course of three years, the QI team applied various methods to ensure sustained NCD record keeping, including routine workflow observations, discussions with UHC staff, and record reviews. In 2023, we found that the paper-based records kept at the UHC were occupying excess space since the number of files had increased over the years, and their maintenance and data entry were proving to be difficult. The QI team took feedback from the outpatient department (OPD) staff, reviewed the workflow, had meetings, and under faculty members' guidance, decided to adapt the process. Recognizing that real-time digitalisation would overcome these problems as well as enhance sustainability, the practice of maintaining NCD files along with quarterly Epicollect5 data entry was replaced with record entry into a Google Sheet on a daily basis. For this, one of the junior trainee doctors posted at the UHC was appointed to sit in the pharmacy daily and enter data from the NCD passbooks into a Google Sheet. After data entry, the pharmacist would dispense the medications and return the passbook to the individuals living with NCDs. It was ensured that doctors who were assigned the new responsibility of data entry were appropriately trained before-hand. Senior faculty members in the medical college were involved in the discussions, and changes were undertaken under their guidance. Follow-up discussions were conducted with all the staff to assess how favourable the new processes were.

This present study employed a mixed-methods approach, incorporating process analysis, record reviews, discussions with UHC staff, and team meetings to assess the sustainability of the QI initiative three years after its implementation. Additionally, the cohort monitoring approach recommended by WHO was used to calculate the annual BP and glycaemic control rates, as well as the loss-to-follow-up rates and missed visits of patients seeking care at the UHC.^{13,14}

We evaluated sustainability using the NHS Sustainability Model.¹⁵ The NHS Sustainability Model is a validated, free to use diagnostic tool which helps identify strengths and weaknesses in an implementation plan and potential areas of improvement. It measures sustainability of a particular improvement initiative out of a score of 100, based on 10 factors from three domains: process, staff and organization. To score each factor in the model, discussions were held among the QI team until a consensus was reached. The score assigned has been presented in the form of a radar chart.

We utilized data available in the NCD health records to calculate clinical outcome indicators using the procedure recommended in the Noncommunicable Disease Facility-Based Monitoring Guidance document released by WHO.^{13,14}

Control rates for HTN and diabetes were calculated at baseline in 2021, and for the calendar years (January to December) 2022, 2023 and 2024. Universal sampling was conducted, where all patients seeking care for HTN or DM at the UHC were included. The annual BP control rate was calculated as the number of individuals with HTN who's last systolic BP reading for the year was < 140mmHg and who's last diastolic BP reading was < 90mmHg, as a proportion of the total number of individuals with HTN who had reported to the UHC for treatment in that year, excluding those who registered in the last quarter of the year (October to December). The annual glycaemic control rate was calculated as the number of individuals diagnosed with DM who's last HbA1c reading was < 7% in that year, as a proportion of the total number of individuals with DM who had reported to the UHC for treatment in that year, excluding those registered in the last quarter of the year. An HbA1c cut off of 7% was chosen based on the standard treatment workflow recommended in India.¹⁶ If one's HbA1c value was unavailable, then a fasting blood sugar (FBS) value of less than 126 mg/dl was considered controlled. For sensitivity analysis, glycaemic control rates were also calculated using an HbA1c cut off of 8%, based on WHO recommendations.¹³ In case an individual's BP or HbA1c/ FBS value was missing from the database, they were excluded from the analysis. Those who registered in the last quarter of the year (October to December) were excluded because it is assumed that three months are required for BP or glycaemia to get controlled, following the initiation of treatment. If an individual had registered during a previous year but did not visit the UHC in the year of analysis, they were considered lost to follow up and were excluded. If only a single BP or HbA1c/FBS reading was available from the year of analysis, that has been included in the calculation, as long as the patient was not newly diagnosed in the last quarter of the year.

To calculate the control rate at baseline, the BP and HbA1c or fasting sugar readings recorded in the registration visit of all individuals diagnosed with HTN and DM at least 3 months prior, who registered in the

UHC in the last quarter of 2021 (when data collection began) was considered. Data was sourced from the digital patient health records available at the UHC.

The BP and glycaemic control rates have been reported cumulatively, for all individuals living with the conditions, as well as separately, for individuals with only HTN, only diabetes, and both diabetes and HTN.

Individuals seeking care for NCDs were advised to visit the UHC monthly for medication refills and follow-up consultations. The number of visits missed in the year for each individual was calculated and has been reported as a percentage of the total number of visits expected to be made. Proxy visits included visits not made by the individual but by someone else to replenish a previous prescription and were considered as missed visits.

Statistical analysis: Descriptive data analysis was performed using the STATA 18 software. Categorical variables have been reported as proportions or percentages and continuous variables as means with standard deviation if normally distributed, or medians with interquartile range (IQR) if not normally distributed.

We evaluated factors associated with BP and glycaemic control (2022-2024) using mixed-effects logistic regression. The unit of analysis was individuals for whom the latest BP, or blood sugar recording was available for any year, respectively. The outcome was BP control (yes/no), and glycaemic control (yes/no) as defined previously. Fixed effects included calendar year, age, sex, comorbidity status, missed visit proportion, and year of registration. A random intercept for unique ID of the patient was included to account for repeated observations of individuals in the model and to model between-patient heterogeneity in baseline odds of BP control. Results have been presented as adjusted odds ratios (ORs) with 95% confidence intervals (CIs). p-value <0.05 was considered statistically significant.

Ethical Approval: Ethical approval was obtained from the Institute Ethics Committee of All India Institute of Medical Sciences, New Delhi (Ref. No. IEC-34/14.01.2022) before conducting this study. This study was performed in line with the principles of the Declaration of Helsinki. Written informed consent was taken from the participants of the original quality improvement study, who registered in 2021. For this follow-up study, written informed consent from the participants was waived since the analysis was conducted using patient data available at the health centre which had been collected routinely for patient care purposes and only aggregated results were reported.

RESULTS

From the initiation of data collection and longitudinal tracking in the last quarter of 2021 (October to

December) till the end of 2024, digital NCD data was available for a total of 953 individuals living with DM and/or HTN who had registered for care in the UHC. The mean age of these individuals was 56.6 years (SD: 11.4) and 66.67% of them were females. The prevalence of DM, HTN and baseline risk factors among the individuals registered have been included in Table 1.

NHS Sustainability Model score: The total score for sustainability of the QI initiative as per the NHS Sustainability Model was 96.2 out of 100. The score for process was 27.3, staff was 52.4, and organisation was 16.5. Scores for each factor have been depicted in Figure 1. The factor 'benefit beyond helping patients' scored lower because the benefits of the QI were primarily related to patientcare and the ease in indenting medications. It didn't have wide range of benefits, such as reducing waste or making the staff's job easier.

The doctors at the UHC gave positive feedback of the QI initiative since it ensured continuity of NCD care for all individuals, regardless of the physician they were assigned to, since previous BP, sugar levels, blood test results and prescriptions were accessible at each visit. As a result, personalised care could be delivered by adjusting medication doses and providing lifestyle counselling based on past treatment history. This was a stark improvement to the practices taking place prior to the QI initiative when, if individuals with NCDs did not bring their previous stack of OPD cards, no records were available to track their treatment history or trends in BP or sugar levels, so doctors were sometimes clueless on how to proceed in treating the individual's NCD.

Table 1: Prevalence of diabetes mellitus, hypertension and baseline risk factors among individuals living with non-communicable diseases registered in an urban primary health centre in Dakshinpuri, Delhi (N=953)

Variables	Participants (%)
NCDs	
Hypertension only	367 (38.5)
Diabetes mellitus only	248 (26)
Hypertension and Diabetes	338 (35.5)
Risk factors	
Consumption of smoked tobacco	
Yes	121 (12.7)
No	832 (87.3)
Consumption of smokeless tobacco	
Yes	77 (8.1)
No	876 (91.9)
Alcohol consumption	
Yes	86 (9)
No	867 (91)
Body mass index (in kg/m²)	
Mean ± standard deviation	26.4 ± 5.08
<18.5	39 (4.1)
18.5 to 22.9	202 (21.2)
23 to 24.9	165 (17.3)
≥25	547 (57.4)

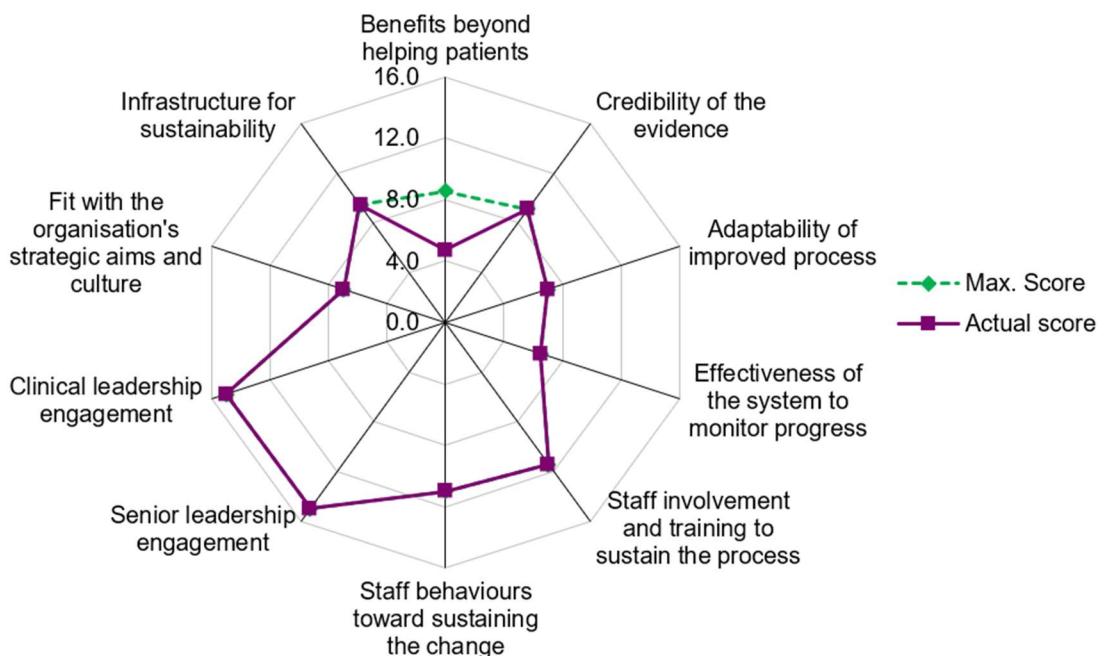


Figure 1: A radar chart based on the NHS Sustainability Model, showing the scores received by the QI initiative conducted at an Urban Health Centre in Dakshinpuri, Delhi

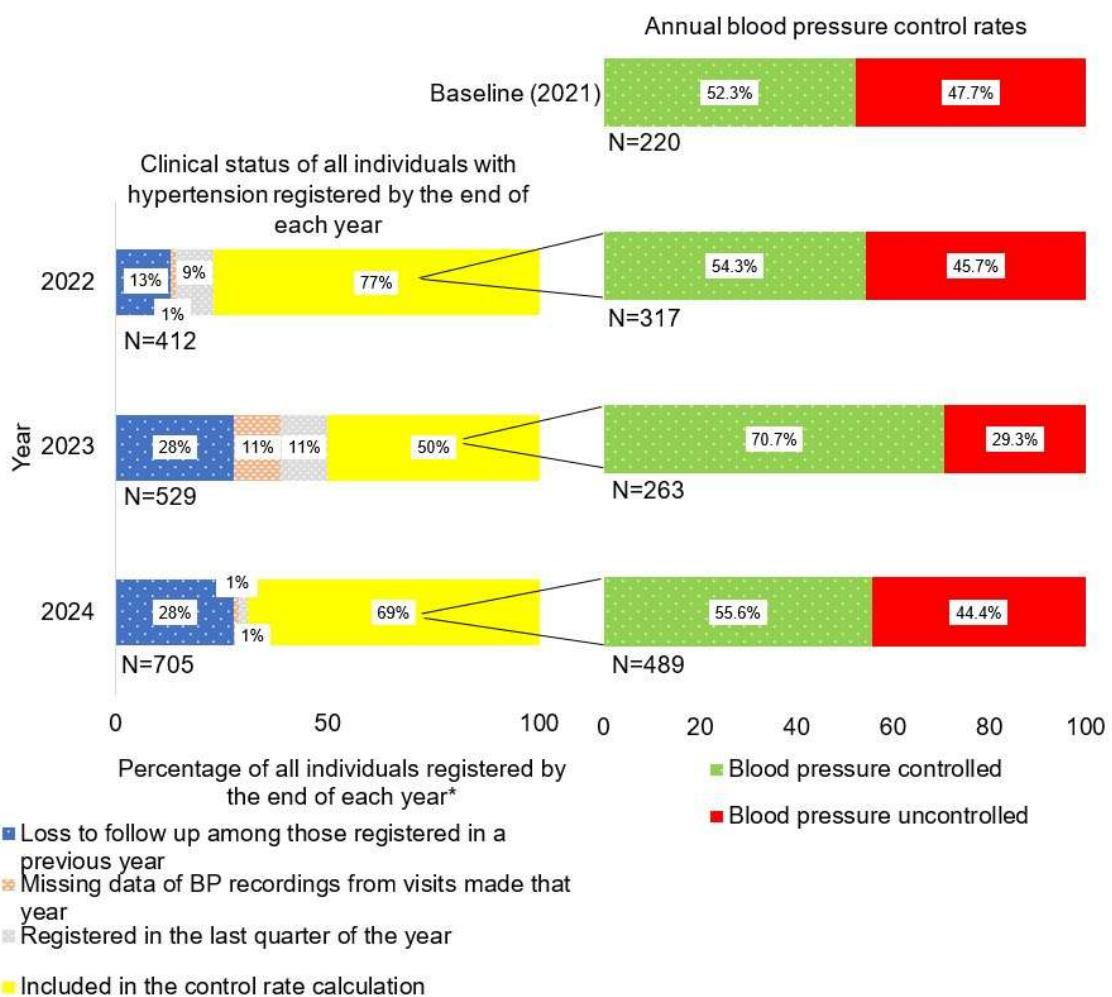


Figure 2: Year-wise clinical status of all individuals with hypertension registered for care in the urban health centre in Dakshinpuri, from October 2021 to December 2024

Table 2: Factors associated with blood pressure control between 2022 and 2024 among individuals living with hypertension, seeking care at the urban health centre in Dakshinpuri (N=1069)*

Factor	Total	Controlled BP N (%)	aOR	95% CI	p-value
Fixed effects					
Year					
2022	317	172 (54)	Ref		
2023	263	186 (71)	2.16	1.46 - 3.18	<0.01
2024	489	272 (56)	1.13	0.77 - 1.66	0.52
Age					
Gender					
Male	327	168 (51)	Ref		
Female	742	462 (62)	1.67	1.19 - 2.34	<0.01
Diabetes as a comorbidity					
No	555	340 (61)	Ref		
Yes	514	290 (56)	0.71	0.52 - 0.98	0.04
Missed visit proportion					
Year of registration					
2021	507	318 (63)	Ref		
2022	301	171 (57)	0.74	0.51 - 1.07	0.11
2023	103	56 (54)	0.80	0.46 - 1.41	0.44
2024	158	85 (54)	0.78	0.47 - 1.28	0.32
Random effects					
Unique ID intercept			Variance	95% CI	
			0.73	0.31 - 1.75	

*Persons with hypertension who were included in the calculation of blood pressure control rate were included in this model. BP: Blood pressure, aOR: adjusted Odds Ratio, CI: Confidence interval, Ref: Reference variable

Table 3: Number (%) of individuals living with hypertension, seeking care at the urban health centre in Dakshinpuri, with missed follow-up visits* in 2022, 2023 and 2024†

% of visits missed per year	0%	>0-20%	>20-40%	>40-60%	>60-80%	>80-100%‡
2022 N=320 (%)	12 (4)	5 (2)	27 (8)	105 (33)	83 (26)	88 (27)
2023§ N=264 (%)	1 (<1)	10 (4)	35 (13)	94 (36)	70 (27)	54 (20)
2024 N= 498 (%)	5 (1)	31 (6)	51 (10)	127 (26)	111 (22)	173 (35)

*If the individual does not visit the UHC for a follow-up visit at least once in the month, it is considered a missed visit

†Among those who visited the UHC at least once in the year, excluding those registered in the last quarter of the year

‡An individual newly registered in that year may have 100% missed visits if they never came for a follow-up visit that year

§No data available for 57 individuals who newly registered in 2023

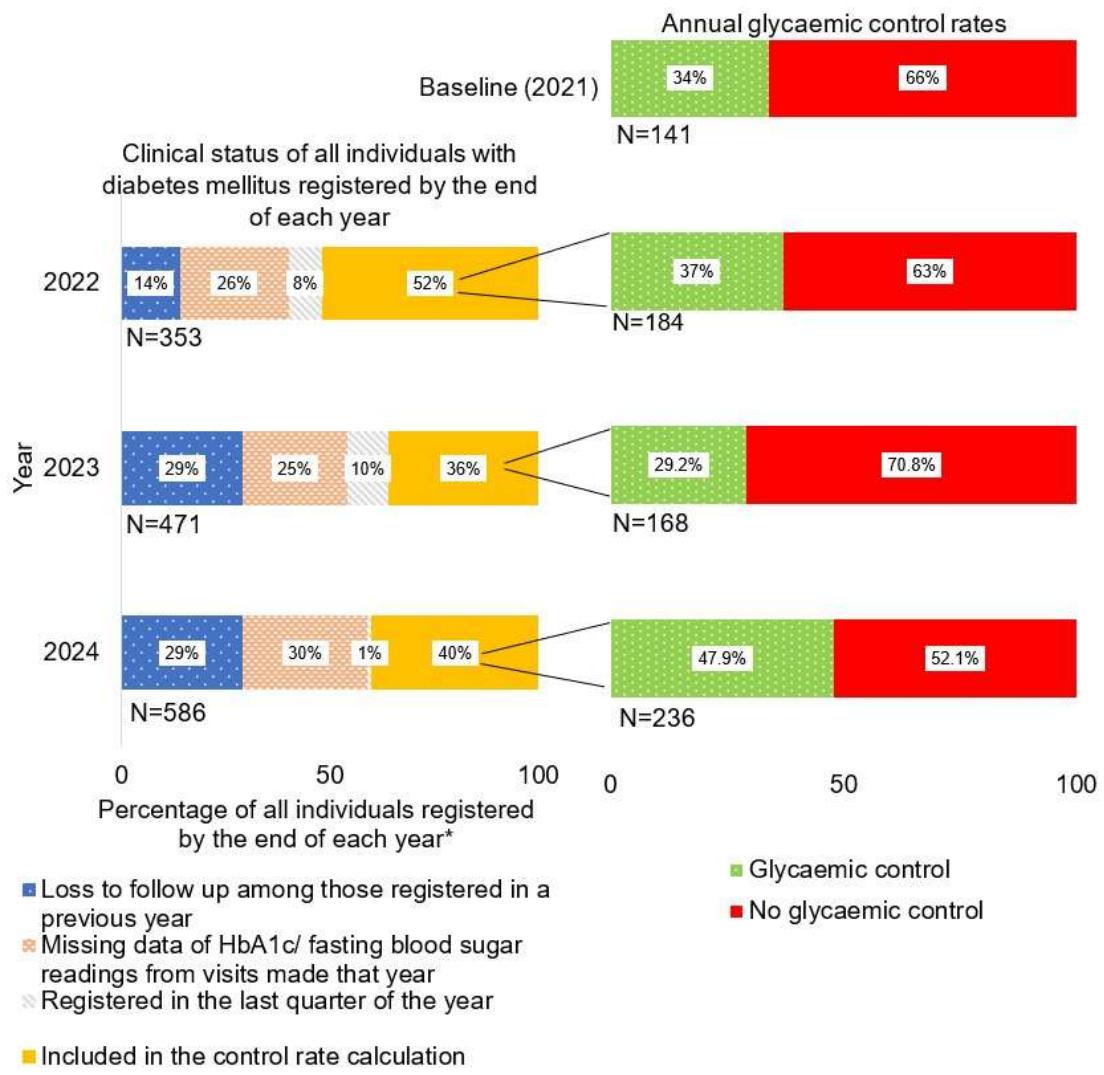
Hypertension management and outcome details: By the end of 2024, 705 individuals living with hypertension had registered for care at the UHC. At the start of the QI initiative in 2021, the proportion of individuals with BP control among those who had been diagnosed with HTN ≥ 3 months prior was 52%. In 2022, the annual BP control rate was 54%. In 2023 it was 71% and in 2024, it was 56% (Figure 2). Compared with 2022, the odds of achieving BP control were significantly higher in 2023, whereas no significant difference was observed in 2024. Females had 67% higher odds of BP control than men, while individuals with diabetes had 29% lower odds of control. Age, proportion of missed visits and year of registration were not found to be significantly associated with BP control (Table 2).

Between 13% and 28% of individuals who had registered for HTN care in the UHC were lost to follow up in a subsequent year (Figure 2). Among the individuals with HTN who visited the UHC at least once in a particular year (excluding those registered in the last quarter), less than 5% made monthly visits (Table 3). The median proportion of missed follow-up visits was 67% (IQR: 50%-83%) in 2022, 58% (IQR: 42%-75%) in 2023 and 67% (IQR: 45%-83%) in 2024.

The BP control rates for persons living with HTN

with diabetes and without diabetes have been depicted in Supplemental Fig. 1, and details of their missed visits and loss-to-follow-up rates have been included in Supplemental Table 1 and Supplemental Fig. 2 respectively (see the supplementary file).

Diabetes mellitus management and outcome details: Between October 2021 and December 2024, 586 individuals living with DM had registered for care at the UHC. At baseline, in the last quarter of 2021, the proportion of individuals with glycaemic control among those who had been diagnosed with DM ≥ 3 months prior was 34%. The annual glycaemic control rate in 2022 was 37%, in 2023 it was 29% and in 2024, it was 48% (Figure 3). Compared with 2022, glycaemic control was significantly lower in 2023, but not significantly different in 2024. Increasing age was associated with slightly higher odds of glycaemic control, and a higher proportion of missed visits was associated with slightly lower odds. Persons with HTN as a comorbidity had 74% higher odds of achieving glycaemic control. Year of registration was not significantly associated with glycaemic control for those who registered in 2022 or 2023; however, individuals who registered in 2024 had substantially lower odds of control, as compared to 2021 (Table 4).



*Including those registered in previous years

Figure 3: Year-wise clinical status of all individuals living with diabetes mellitus registered for care in the urban health centre in Dakshinpuri, from October 2021 to December 2024

Table 4: Factors associated with glycaemic control between 2022 and 2024 among individuals living with diabetes, seeking care at the urban health centre in Dakshinpuri (N=588)*

Factor	Total	Controlled sugar N (%)	aOR	95% CI	p-value
Fixed effects					
Year					
2022	184	68 (37)	Ref		
2023	168	49 (29)	0.60	0.36 - 0.99	0.04
2024	236	113 (48)	1.68	0.98 - 2.88	0.06
Age			1.02	1.01 - 1.05	0.03
Gender					
Male	169	63 (37)	Ref		
Female	419	167 (40)	1.02	0.64 - 1.63	0.94
Hypertension as a comorbidity					
No	231	68 (29)	Ref		
Yes	357	162 (45)	1.74	1.08 - 2.79	0.02
Missed visit proportion					
Year of registration					
2021	314	128 (41)	Ref		
2022	155	51 (33)	0.71	0.42 - 1.19	0.19
2023	70	38 (54)	1.08	0.53 - 2.24	0.83
2024	49	13 (27)	0.26	0.11 - 0.63	<0.01
Random effects					
Unique ID intercept		Variance	95% CI		
	0.73		0.20 - 2.58		

* Persons with diabetes who were included in the calculation of glycaemic control rate were included in this model.

aOR: adjusted Odds Ratio, CI: Confidence interval, Ref: Reference variable

Table 5: Number (%) of individuals with diabetes mellitus, seeking care at the urban health centre in Dakshinpuri, with missed follow-up visits* in 2022, 2023 and 2024†

% of visits missed per year	0%	>0-20%	>20-40%	>40-60%	>60-80%	>80-100%‡
2022 N=277 (%)	11 (4)	2 (1)	23 (8)	83 (30)	78 (28)	80 (29)
2023§ N=219 (%)	0 (0)	11 (5)	25 (11)	77 (35)	56 (26)	50 (23)
2024 N= 408 (%)	5 (1)	20 (5)	40 (10)	107 (26)	86 (21)	150 (37)

*If the individual does not visit the UHC for a follow-up visit at least once in the month, it is considered a missed visit

†Among those who visited the UHC at least once in the year, excluding those registered in the last quarter of the year

‡An individual newly registered in that year may have 100% missed visits if they never came for a follow-up visit that year

§No data available for 68 individuals who newly registered in 2023

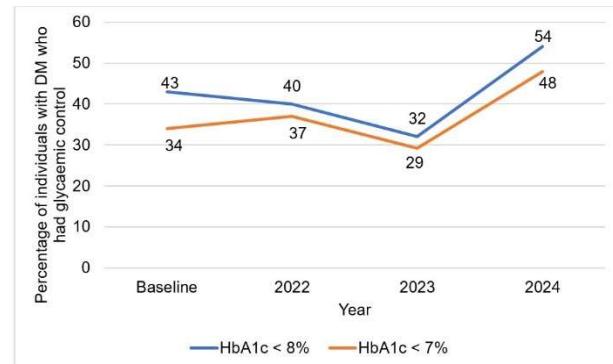


Figure 4: Proportion of individuals living with diabetes mellitus seeking care at the urban health centre in Dakshinpuri with glycaemic control at baseline, 2022, 2023 and 2024, using HbA1c cut offs of 8% and 7%

Between 14% to 29% of individuals who had registered for DM care in the UHC were lost to follow up in a subsequent year (Figure 3). Among the individuals with DM who visited the UHC at least once in a particular year (excluding those registered in the last quarter), less than 5% made monthly visits (Table 5). The median proportion of missed follow-up visits was 67% (IQR: 50%-83%) in 2022, 58% (IQR: 50%-75%) in 2023 and 67% (IQR: 50%-83%) in 2024. Figure 4 includes the annual glycaemic control rates calculated using an HbA1c cut off of 8%, compared to 7%.

The glycaemic control rates for persons living with diabetes with HTN and without HTN have been depicted in Supplemental Fig. 3, and details of their missed visits and loss-to-follow-up rates have been included in Supplemental Table 1 and Supplemental Fig. 2 respectively (See the Supplementary file).

DISCUSSION

This study was conducted as a three-year follow-up of a quality improvement initiative which took place in 2021 to improve NCD record keeping in an urban primary healthcare centre in Delhi, India. We assessed the sustainability of the initiative over time and also used the data available in the records to determine select clinical outcome indicators, to help inform further patient care.

Maintaining health records for individuals living with NCDs was sustained over three years with a high sus-

tainability score of 96.2%. A number of factors contributed to the sustainability, including strong leadership, the transition to digital records, process adaptability, staff involvement and improved clinical decision-making.

Good leadership has been found to be essential for effective quality improvement. When leaders are engaged, improvement has been found to be faster.¹⁷ This QI initiative is a prime example of how strong leadership enabled sustained, improved quality of services provided at a health care facility. The faculty members from the Community Medicine department, through their technical support and administrative powers, guided the sustained implementation of effective changes. Over the course of three years, their supportive supervision, open communication and motivation enabled the team to modify and sustain the changes.

Maintaining digital health records benefits patients as well as healthcare providers by instantly providing accurate, updated data. In the context of this UHC, record keeping enabled monitoring an individual's NCD status and thus eased clinical decision making, an improvement over past practice. It also helped calculate control rates for HTN and DM and enabled the identification of individuals who had missed visits or were lost to follow up. Such indicators had never been calculated at the UHC previously, due to the dearth of NCD records. In a larger context, the benefits of digitalisation include telemedicine and location independent access to medical information, including old records, the physical copies of which patients may have misplaced.¹⁸ Recognizing the importance of digitalisation, Ayushman Bharat Digital Mission was launched in India in 2021 with the aim of creating a unified online platform for India's healthcare system, including creating longitudinal electronic health records of every citizen.¹⁹

Process adaptability was demonstrated when a challenge was faced in sustaining the quality improvement initiation in the first half of 2023. The NCD record files were becoming difficult to maintain because of their high number, and due to the increasing patient load in OPD, quarterly data entry into EpiCollect5 was being neglected. The digital records had a large proportion of missing data regarding visits and BP readings, though every patient's BP was being checked. It was decided to post one junior trainee doctor in the pharmacy, on a rotational basis, to enter every NCD patients' data, while medicines were be-

ing dispensed. This adaptation ensured that data was captured in real time, and missing BP data decreased substantially the following year to 1%. Additionally, this process contributed to junior doctors' training, since reviewing multiple prescriptions familiarized them with the prescribing practices being followed, which increased their own confidence in managing NCDs. Additionally, since two doctors were reviewing the patients' health related details, the second doctor could ensure that SOPs were being followed by the first. This may have contributed to the high BP control rates attained in 2023. Due to the high doctor patient ratio in our setting, practicing this strategy was possible. However, it may not always be feasible in other settings where human resources are scarce. There, rather than assigning the role to a doctor, any support staff could be given the responsibility of data entry, for example, under the National Program for Non-Communicable Diseases in India, this responsibility has been given to the staff nurse.²⁰

Despite achieving a high sustainability score in maintaining NCD records, there remains scope for improving the outcome indicators at this UHC, which were derived from the recorded data. We found that there was a large proportion of missing glycaemic data, abundant patients with missed visits and fluctuations in control rates, which could be attributed to the challenges faced in delivering NCD care over the three years.

The UHC opened at 10am, and most people living with DM were unable to fast till that late. This problem, along with the absence of HbA1c testing at the UHC, meant that valid data to measure glycaemic control were not readily available. Patients with DM were referred to nearby mohalla clinics to get their HbA1c tested, which they found inconvenient because of the long lines and the need for repeated visits. Most of the patients were satisfied with just having their random blood sugar routinely measured in the UHC, which was of no use in determining control, despite counselling them extensively on the need for more valid measures. In 2024, missing glycaemic data increased because of multiple reasons. In the first quarter of the year, health department officials ordered mohalla clinics to stop testing bloods of patients referred from other facilities.²¹ As the year progressed, blood tests were halted at these clinics all together and one of the mohalla clinics in Dakshinpuri was also closed down.²²

The prevalence of loss-to-follow-up and missed visits were high, with very few individuals attending the UHC monthly. This could be attributed to the large migrant population served by the UHC, many of whom may have relocated, the wide availability of nearby government and private healthcare facilities, and the limited operating hours of the UHC, which made monthly visits challenging for employed individuals, as it required missing work. Other longitudinal studies conducted in poor Indian primary care settings too found high loss-to-follow-up rates, indicating the challenge in retaining patients with chron-

ic diseases in care.^{23,24} The high prevalence of missed visits is a cause for concern because proxy visits and missed visits have been found to be significantly associated with an uncontrolled NCD status.²⁵⁻²⁷

Using the cohort monitoring approach, wide fluctuations in BP and glycaemic control were witnessed over the three years. There was a large drop in BP control in 2024, possibly due to the acute shortage of drugs faced in the UHC and mohalla clinics.^{28,29} NCD drugs were low in supply, with impending stock outs, because of which individuals living with NCDs were given weekly prescription refills instead of monthly refills, compelling them to pay out of pocket to buy medications from pharmacies, skip doses or return weekly to a crowded clinic for a follow-up. Other factors too may have contributed to fluctuating glycaemic and blood pressure control rates, including changing healthcare providers, unhealthy lifestyle practices, poor compliance to prescriptions, and improper prescribing practices, none of which were measured in this study.

Other studies in similar settings have also reported low control rates, and longitudinal cohort monitoring studies have observed fluctuations in these rates over time. In a cross-sectional study conducted in another urban resettlement colony in Delhi in 2023, it was found that out of 789 previously diagnosed HTN patients on medication, only 36.12% had their BP under control.³⁰ The authors attributed this to possible clinical inertia and failure to step-up treatment by doctors. The glycaemic control rate of individuals living with DM visiting our UHC in 2023 was similar to that found among individuals living with DM in the same community at that time (31.3%).³¹ In an urban primary health centre in Pondicherry, India, where cohort monitoring of BP control was undertaken, the 6 monthly BP control rates ranged between 77.7% and 44.4%, with a 33.3% drop seen within 6 months. In the India Hypertension Control Initiative, despite employing all the WHO HEARTS suggested strategies such as NCD monitoring, counselling on healthy lifestyles, following evidence-based treatment protocols, having quality assured medications and technology, providing team-based care and patient centred care, the quarterly control rates still fluctuated, falling up to 20% within one quarter in a state.³²

For our facility to improve its control rates, it is important that efforts be focussed on getting patients with missed visits or who were lost to follow up back into the system, or ensure that they are receiving regular care from other qualified practitioners. Secondly, research addressing drug shortages needs to be conducted. Prescription audits should be done routinely to ensure that SOPs are being followed. It should be ensured that patients understand the prescription and lifestyle measures they have been advised. Conducting a qualitative study among the individuals seeking care here may provide reasons for uncontrolled BP and sugar levels which can accordingly be addressed. Another quality improvement ini-

tiative is currently ongoing to ensure adequate fasting blood sugar and HbA1c testing for those with diabetes, which would likely decrease missing data.

This study has multiple strengths. To the best of our knowledge, this is the first paper to assess the sustainability of QI activities at a primary health centre in India. In this study, BP as well as glycaemic control rates were calculated using WHO's recommended cohort monitoring approach, as compared to most other studies which only measured BP control. All individuals seeking care for DM or HTN in the UHC were included, thus eliminating any selection bias, and data collection was part of the routine care provided to them, so no extra time was spent on their part. Trained doctors were responsible for entering the data present in passbooks online, thus increasing its reliability. However, this study has limitations as well. Reasons for fluctuations in the BP and glycaemic control rates were not determined. There was incomplete data for some patients due to loss to follow-up and missed visits; we couldn't explore the reasons. This could have impacted the control rates calculated. Our study focused on the control rates for HTN & diabetes; we couldn't assess the proportion of patients with complications. Lastly, since this study took place in a UHC with limited diagnostic facilities, run by doctors from a tertiary care medical college, it limits the generalisability.

CONCLUSION

A quality improvement initiative was implemented at a UHC in Delhi in 2021, which resulted in a significant increase, from 0% to 100%, in the availability of health records for individuals living with NCDs. This initiative has been sustained for three years, after which it achieved a high sustainability score of 96.2%. Key factors which contributed to its sustainability include the transition to digital records, strong leadership, processes adaptability, staff involvement and improved clinical decision-making.

Analysis of the data obtained from three years of digital health records revealed that several outcome indicators fell short of desired levels. This emphasises a crucial point, that collecting data is necessary but not sufficient. In resource-constrained settings, clinical outcomes depend on factors beyond record keeping, such as the external health environment, continuous drug and diagnostics availability, and patients' behaviours. To improve the control rates at the UHC, action is required on these systemic and behavioural determinants, in addition to sustained digital data capture.

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Availability of Data: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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