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Completeness and accuracy of Simple App digital hypertension records in Colombo, Sri Lanka

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Abstract:

High-quality digital clinical records are essential for continuity of care, patient follow-up, and program monitoring in hypertension services. The Simple App is used in primary care settings to record blood pressure, blood sugar, medicines, and follow-up details. This clinical audit assessed the completeness and accuracy of hypertension-related digital records in selected facilities under the Regional Director of Health Services, Colombo. A descriptive record-based clinical audit was conducted from August to October 2025 in seven health facilities. A total of 189 eligible hypertension records entered in the Simple App were reviewed using a standardized completeness and accuracy tool. Completeness was defined as the presence of required fields, while accuracy was assessed by comparing completed digital entries with corresponding paper-based clinic records. Overall completeness was 93.3% (2116/2268 fields), and overall accuracy among completed fields was 91.3% (1933/2116 fields). Completeness was highest for patient name and age (100.0% each), while lower completeness was observed for blood sugar (73.5%), patient history (84.7%), and contact number (87.3%). Accuracy was high for gender (98.9%), patient history (98.1%), blood pressure (97.3%), and blood sugar (96.4%), but lower for address (71.3%), patient name (83.6%), and health number (87.4%). The Simple App demonstrated generally strong digital documentation performance. However, selected demographic and follow-up-related fields require targeted quality improvement, regular feedback, and supportive supervision.

Keywords—clinical audit; digital health records; hypertension; data quality; primary care; Sri Lanka

I. INTRODUCTION

Hypertension is one of the most important modifiable risk factors for cardiovascular disease, stroke, kidney disease, and premature mortality. It is also a long-term condition that requires repeated measurement, regular review, consistent treatment, and careful follow-up. For this reason, the quality of clinical documentation is not a minor administrative issue; it is a core part of safe and effective hypertension care [1].

Primary care facilities are increasingly expected to manage a large burden of noncommunicable diseases. In such settings, digital health tools can support standardization of care, reduce dependence on fragmented paper records, and provide managers with timely information for monitoring. The World Health Organization HEARTS technical package emphasizes standardized treatment protocols, team-based care, access to essential medicines, risk-based care, and systems for monitoring, all of which depend on reliable clinical records [2].

In Sri Lanka, national guidance on hypertension management promotes identification, treatment, and follow-up of patients with hypertension at the primary healthcare level [3]. The Simple App was introduced as a practical digital platform to support the recording of blood pressure, blood sugar, medications, and follow-up information at patient visits. It also includes dashboard functions intended to help program managers monitor service performance and hypertension control [4].

However, digitalization alone does not guarantee high-quality data. If required fields are missing, if patient identifiers are entered incorrectly, or if digital entries do not match clinic records, the usefulness of the system is reduced. Incomplete contact details may impair follow-up, inaccurate health numbers may affect record linkage, and inaccurate medication data may have implications for clinical safety. Therefore, assessing data quality is an essential step in strengthening digital hypertension care.

Clinical audit is a practical method for comparing current practice against agreed standards and identifying areas for quality improvement. This audit was conducted in selected primary care facilities under the Regional Director of Health Services (RDHS), Colombo, to assess two key domains of Simple App data quality: completeness of required digital fields and accuracy of completed entries when compared with paper-based clinic records.

The main objective of this audit was to determine the level of completeness and accuracy of hypertension-related records entered in the Simple App. The secondary institutions identify data fields and facilities with relatively lower performance, describe variation in data quality across components and institutions, and propose targeted actions for improving digital record reliability.

II. MATERIALS AND METHODS

A. Study design

A descriptive clinical audit was conducted using a record-based design. The audit assessed whether digital hypertension records entered in the Simple App met predefined standards for completeness and data concordance with paper-based clinic records.

B. Study setting and period

The audit was carried out in seven health facilities under RDHS Colombo. These included five Primary Medical Care Units (PMCU Boralasgamuwa, PMCU Kohuwala, PMCU Wellampitiya, PMCU Sedawatta and PMCU Madiwela) and two Divisional Hospitals (DH Maligawatta and DH Thalangama). Data collection was conducted from August to October 2025.

C. Audit population and eligibility criteria

The audit population consisted of hypertensive patients registered in the Simple App at the selected facilities during the audit period. The final dataset included 189 eligible records. First-visit records were excluded because they did not contain sufficient follow-up or management information required for assessing the full set of completeness and accuracy indicators.

D. Audit criteria and standards

The audit assessed two main criteria: digital record completeness and data concordance. Completeness was defined as the presence of required demographic, clinical, and follow-up fields in the Simple App. Data concordance was defined as agreement between Simple App entries and the corresponding paper-based clinic records. The expected audit standard was 100% completeness and 100% concordance for the assessed fields.

TABLE I. AUDIT CRITERIA, OPERATIONAL DEFINITIONS, AND STANDARDS

Audit criterion	Operational definition	Expected standard	Data source
Digital record completeness	Required demographic, clinical, and follow-up fields are present in the Simple App record.	100% of expected fields completed	Simple App record
Data concordance/ accuracy	Completed Simple App fields match the corresponding paper-based clinic record without significant discrepancy.	100% of completed fields are accurate	Simple App and paper clinic record

E. Data collection tool and variables

Data was collected using the Simple App Colombo Completeness and Accuracy Tool. The tool was developed to capture key fields required for patient identification, clinical monitoring, and follow-up in hypertension management. Each field was assessed first for completeness. Accuracy was assessed only for fields that were completed in the digital record.

TABLE II. DATA FIELDS ASSESSED IN THE AUDIT AND THEIR RELEVANCE

Domain	Field assessed	Relevance to hypertension care/data quality
Demographic/ identification	Patient name	Supports patient identification and record matching.
Demographic/ identification	Patient age	Supports clinical interpretation and risk assessment.
Demographic/ identification	Patient gender	Supports demographic reporting and clinical interpretation.
Demographic/ identification	Health number	Supports unique identification and record linkage.
Follow-up/contact	Contact number	Supports appointment reminders, tracing, and continuity of care.
Follow-up/contact	Address	Supports patient tracing and service planning.
Clinical	Diagnosis	Confirms hypertension-related clinical status.
Clinical	Blood pressure	Core measurement for monitoring hypertension control.
Clinical	Blood sugar	Relevant for comorbidity screening and risk assessment.
Clinical	Patient history	Provides clinical context for management decisions.
Treatment	Medications	Supports safe prescribing and treatment monitoring.
Continuity of care	Follow-up	Supports planned review and continuity of care.

F. Data collection process

For each eligible patient record, the data collector reviewed the corresponding Simple App record and paper-based clinic record. A field was coded as complete when the relevant data element was present in the Simple App. A completed field was coded as accurate when the Simple App entry matched the paper-based record. Missing entries, spelling discrepancies in identifiers, incorrect numbers, incorrect clinical values, and mismatched follow-up details were recorded as data quality gaps.

G. Data quality assurance

A standardized tool was used to maintain consistency across institutions. Field definitions were applied uniformly, and data were collected electronically using Epicollect to support real-time aggregation and reduce transcription errors. Facility-level findings were reviewed in aggregate so that results could be used for quality improvement rather than individual blame.

H. Data analysis

Data was summarized using frequencies and percentages. Overall completeness was calculated as the number of completed fields divided by the number of expected fields. Overall accuracy was calculated as the number of accurate.

Overall performance was strong, with more than nine out of ten expected fields completed and more than nine out of ten completed fields matching the corresponding paper-based record. However, the audit standard of 100% completeness and 100% accuracy was not fully achieved, indicating room for targeted quality improvement.

TABLE III. OVERALL DATA QUALITY ASSESSMENT OF SIMPLE APP RECORDS

Metric	Total possible/ eligible fields	Actual performance	Percentage
Completeness	2268 expected fields	2116 completed fields	93.3%
Accuracy	2116 completed fields	1933 accurate fields	91.3%

III. RESULTS

A. Overall audit coverage

A total of 189 hypertension records were audited across seven health facilities. As 12 fields were assessed for each record, the total expected number of data fields for completeness assessment was 2268. Accuracy was assessed only among completed fields.

B. Component-wise completeness and accuracy

Component-level analysis showed that some fields were consistently well completed, while others had important gaps. Patient name and age were completed in all records. Blood pressure, diagnosis, and medication fields also showed high completeness. The weakest fields for completeness were blood sugar, patient history, and contact number. Accuracy was high for gender, history, blood pressure, and blood sugar, but lower for address, patient name, and health number.

TABLE IV. COMPLETENESS AND ACCURACY BY DATA COMPONENT

Component	Completeness (yes/total)	Completeness (%)	Accuracy (yes/ completed)	Accuracy (%)
Patient name	189/189	100.0	158/189	83.6
Patient age	189/189	100.0	179/189	94.7
Patient gender	187/189	98.9	185/187	98.9
Health number	175/189	92.6	153/175	87.4
Contact number	165/189	87.3	158/165	95.7
Address	181/189	95.8	129/181	71.3
Diagnosis	186/189	98.4	173/186	93.0
Blood pressure	187/189	98.9	182/187	97.3
Blood sugar	139/189	73.5	134/139	96.4
Patient history	160/189	84.7	157/160	98.1
Medications	186/189	98.4	167/186	89.8
Follow-up	172/189	91.0	160/172	93.0

Accuracy was assessed only among completed fields.

TABLE V. COMPLETENESS VARIATION BY DATA COMPONENT

Component	Complete (yes)	Incomplete (no)	Total fields	Chi-square contribution
Patient name	189	0	189	13.58
Patient age	189	0	189	13.58
Patient gender	187	2	189	9.63
Health number	175	14	189	0.15
Contact number	165	24	189	10.87
Address	181	8	189	1.84
Diagnosis	186	3	189	7.91
Blood pressure	187	2	189	9.63
Blood sugar	139	50	189	117.94
Patient history	160	29	189	22.57
Medications	186	3	189	7.91
Follow-up	172	17	189	1.59
Total	2116	152	2268	214.80

Overall chi-square for variation in completeness by component: $\chi^2 = 214.80$, $p < 0.001$.

The largest contribution to incompleteness came from blood sugar, followed by patient history and contact number. This pattern suggests that core demographic fields and blood pressure measurements were prioritized, while fields perceived as less immediate or more context-dependent were more likely to be missed.

TABLE VI. ACCURACY VARIATION BY DATA COMPONENT

Component	Accurate (yes)	Inaccurate (no)	Completed fields	Chi-square contribution
Patient name	158	31	189	22.60
Patient age	179	10	189	4.50
Patient gender	185	2	187	2.10
Health number	153	22	175	17.90
Contact number	158	7	165	3.90
Address	129	52	181	85.40
Diagnosis	173	13	186	8.70
Blood pressure	182	5	187	6.80
Blood sugar	134	5	139	6.20
Patient history	157	3	160	1.60
Medications	167	19	186	12.30
Follow-up	160	12	172	9.40

Overall chi-square for variation in accuracy by component: $\chi^2 = 181.40$, $p < 0.001$.

The largest accuracy problem was observed for the address, followed by the patient's name and health number. These are mostly patient identification and tracking fields. In contrast, clinical values such as blood pressure and blood sugar showed high accuracy when they were recorded.

C. Facility-wise performance

Facility-level analysis showed that overall data quality was high in most institutions, but there was meaningful variability. Completeness ranged from 78.6% at DH Maligawatta to 99.7% at PMCU Wellampitiya. Accuracy ranged from 80.1% at PMCU Boralasgamuwa to 99.1% at PMCU Wellampitiya.

TABLE VII. COMPLETENESS AND ACCURACY BY HEALTH FACILITY

Facility	Records audited	Complete (yes/total)	Complete (%)	Accuracy (yes/completed)	Accuracy (%)
PMCU Boralasgamuwa	39	437/468	93.4	350/437	80.1
PMCU Kohuwala	60	697/720	96.8	647/697	92.8
DH Maligawatta	23	217/276	78.6	189/217	87.1
PMCU Wellampitiya	29	347/348	99.7	344/347	99.1
PMCU Sedawatta	15	151/180	83.9	143/151	94.7
DH Thalangama	10	115/120	95.8	110/115	95.6
PMCU Madiwela	13	152/156	97.4	150/152	98.7
Total	189	2116/2268	93.3	1933/2116	91.3

TABLE VIII. COMPLETENESS VARIATION BY HEALTH FACILITY

Facility	Complete (yes)	Incomplete (no)	Total fields	Chi-square contribution
PMCU Boralasgamuwa	437	31	468	0.005
PMCU Kohuwala	697	23	720	13.95
DH Maligawatta	217	59	276	94.63
PMCU Wellampitiya	347	1	348	22.40
PMCU Sedawatta	151	29	180	25.46
DH Thalangama	115	5	120	1.21
PMCU Madiwela	152	4	156	4.14
Total	2116	152	2268	161.79

Overall chi-square for variation in completeness by facility: $\chi^2 = 161.79$, $p < 0.001$.

TABLE IX. ACCURACY VARIATION BY HEALTH FACILITY

Facility	Accurate (yes)	Inaccurate (no)	Completed fields	Chi-square contribution
PMCU Boralasgamuwa	350	87	437	70.90
PMCU Kohuwala	647	50	697	1.93
DH Maligawatta	189	28	217	5.02
PMCU Wellampitiya	344	3	347	27.26
PMCU Sedawatta	143	8	151	2.15
DH Thalangama	110	5	115	2.65
PMCU Madiwela	150	2	152	10.32
Total	1933	183	2116	120.20

Overall chi-square for variation in accuracy by facility: $\chi^2 = 120.20$, $p < 0.001$.

DH Maligawatta and PMCU Sedawatta contributed substantially to the variation in completeness. PMCU Boralasgamuwa contributed most to the variation in accuracy, mainly due to inaccuracies in identification and follow-up-related fields. PMCU Wellampitiya showed the strongest combined performance and may offer useful workflow practices for peer learning.

D. Fields requiring priority improvement

The audit identified a small number of fields that require immediate attention because they were either frequently incomplete or frequently inaccurate. These fields have direct implications for patient follow-up, identification, clinical safety, and reliability of program monitoring.

TABLE X. PRIORITY FIELDS BELOW 90 PERCENT PERFORMANCE AND SUGGESTED INTERPRETATION

Field/ performance gap	Observed performance	Main implication	Suggested improvement focus
Blood sugar completeness	73.5%	Highest missing-field burden	Review whether blood sugar is required for all visits and standardize when it should be entered.
Patient history completeness	84.7%	Clinical context may be unavailable for follow-up decisions	Introduce a short mandatory history/update field or structured tick box.
Contact number completeness	87.3%	Weakness in follow-up and tracing	Verify patient contact details at each visit.
Address accuracy	71.3%	Patient tracing and identification risk	Use a verification step and standard address format.
Patient name accuracy	83.6%	Identification mismatch risk	Check spelling against the clinic record or health number at registration.
Health number accuracy	87.4%	Record linkage risk	Recheck the number entry before saving the record.
Medication accuracy	89.8%	Treatment safety risk	Confirm drug name, dose, and frequency against the clinic prescription.

TABLE XI. STRONG-PERFORMING FIELDS THAT SHOULD BE MAINTAINED

Field/ performance indicator	Observed performance	Interpretation
Patient name completeness	100.0%	Demographic identifier consistently present
Patient age completeness	100.0%	Demographic field consistently present
Patient gender accuracy	98.9%	Very high concordance with the clinic record
Blood pressure completeness	98.9%	Core clinical measurement is well recorded
Blood pressure accuracy	97.3%	Clinical value is reliably transferred
Blood sugar accuracy	96.4%	Accurate when the field was completed
Patient history accuracy	98.1%	Accurate when documented
Medication completeness	98.4%	The treatment field is usually recorded

E. Facility-specific improvement priorities

The facility-level findings indicate that a single generic intervention may be insufficient. Some facilities require support for completeness, while others require support for accuracy and verification. The proposed priorities are based on the observed performance pattern in each facility.

TABLE XII. FACILITY-SPECIFIC PRIORITY AREAS FOR QUALITY IMPROVEMENT

Facility	Main priority	Key fields requiring attention	Suggested facility-level action
PMCU Boralasgamuwa	Accuracy	Address, health number, name and follow-up accuracy	Introduce registration verification and weekly record review.
PMCU Kohuwala	Accuracy	Medication and name accuracy	Add prescription cross-check before completion of consultation.
DH Maligawatta	Completeness	History, blood sugar, contact number and follow-up completeness	Clarify workflow responsibility for filling clinical and follow-up fields.
PMCU Wellampitiya	Maintain performance	Very high completeness and accuracy	Use as a peer-learning site for other facilities.
PMCU Sedawatta	Completeness	Contact number and blood sugar completeness	Strengthen registration and follow-up detail collection.
DH Thalangama	Maintain/improve	Minor gaps in blood sugar completeness and health number accuracy	Continue supportive supervision with targeted checking.
PMCU Madiwela	Maintain performance	Generally, high completeness and accuracy	Continue periodic review and share good practices.

TABLE XIII. PROPOSED QUALITY IMPROVEMENT ACTION PLAN BASED ON AUDIT FINDINGS

Step	Action	Purpose	Responsible level	Suggested timeline
1	Standard operating procedure	Define required fields, responsibility, and timing of data entry	RDHS NCD team/facility MOIC	Within 1 month
2	Short refresher training	Focus on health numbers, address, medicines, and follow-up data	Program coordinator and facility staff	Within 1-2 months
3	Registration verification step	Check name, health number, contact number, and address before saving	Registration/data entry staff	Routine
4	Monthly facility feedback	Share completeness and accuracy percentages with each institution	RDHS team	Monthly
5	Peer-learning visit	Use high-performing sites to demonstrate workflow	RDHS team and MOICs	Quarterly
6	Repeat audit	Measure improvement after corrective actions	Audit team	After 3-6 months

IV. DISCUSION

This clinical audit showed that digital documentation of hypertension care using the Simple App was generally strong in the selected primary care facilities under RDHS Colombo. Overall completeness was 93.3%, and overall accuracy among completed fields was 91.3%. These results suggest that healthcare workers can use the digital platform effectively for most required fields and that digital recordkeeping has the potential to support continuity of care and program monitoring.

Despite the overall good performance, the audit standard of 100% completeness and 100% data concordance was not achieved. This is important because a digital system is only as reliable as the data entered into it. In hypertension management, missing or incorrect fields can lead to missed follow-up, difficulty tracing patients, incorrect interpretation of program performance, and possible clinical risk if treatment data are inaccurate.

The strongest completeness results were seen for patient name, age, gender, diagnosis, blood pressure, and medication fields. This indicates that core fields directly linked to the consultation and clinical decision-making were generally prioritized. Blood pressure completeness and accuracy were particularly high, which is encouraging because BP is the central measure for monitoring hypertension control.

The lowest completeness was observed for blood sugar, patient history, and contact number. Blood sugar may not have been measured or entered at every visit, and this may explain part of the lower completeness. However, if blood sugar is expected as part of routine cardiovascular risk assessment or diabetes comorbidity screening, clearer guidance is needed when it should be recorded. Patient history completeness was also variable, suggesting that staff may require a more structured and time-efficient way to capture relevant history updates.

The accuracy findings highlight a different problem. Address, patient name, and health number were the weakest fields for accuracy. These are mainly patient identification and tracking fields rather than direct clinical measurements. This suggests that errors may occur during registration, spelling, copying from paper records, or updating patient details. Such errors may appear small, but they can affect patient matching, continuity of care, and future data linkage.

Facility-level variation was another important finding. PMCU Wellampitiya and PMCU Madiwela showed very strong performance, while DH Maligawatta had lower completeness, and PMCU Boralasgamuwa had lower accuracy. This pattern suggests that data quality is influenced not only by the app but also by local workflow, staff roles, workload, supervision, training, and verification practices.

The findings are consistent with the broader principle emphasized in hypertension quality improvement program standardized protocols and monitoring systems that require reliable data. WHO HEARTS promotes systematic monitoring as part of primary care hypertension control, and digital tools such as Simple can support this function when data entry is complete and accurate [2,4]. Therefore, improving data quality should be considered part of clinical quality improvement rather than a separate administrative task.

A practical response should combine training, workflow redesign, and ongoing feedback. Training alone may not be sufficient if staff do not have a clear process for checking identifiers, updating contact details or verifying medication entries. A short standard operating procedure, facility dashboards, mandatory fields where appropriate, and monthly feedback can convert audit findings into sustained improvement.

The audit also shows the value of separating completeness from accuracy. A field can be present but incorrect. For example, address completeness was high, but address accuracy was low. This means that focusing only on missing data would fail to detect a major quality gap. Future digital health monitoring should therefore include both completeness indicators and periodic concordance checks against source records.

The main implication for RDHS-level program management is that facility-specific support is needed. High-performing facilities can be used as peer-learning sites, while facilities with specific gaps can receive targeted supportive supervision. Repeating the audit after corrective action would allow the program to measure improvement and close the audit cycle.

A. Strengths and limitations

The main strength of this audit is that it assessed both completeness and accuracy across multiple facilities using a standardized tool. It also examined data quality at both the component level and the facility level, which allowed more practical identification of improvement priorities. However, the audit had some limitations. It was limited to selected facilities under RDHS Colombo and therefore may not represent all primary care settings in Sri Lanka. It was record-based and did not explore in depth the reasons for incomplete or inaccurate entries. The audit also did not assess whether data quality affected clinical outcomes such as blood pressure control or appointment adherence.

TABLE XIV. LIMITATIONS AND THEIR IMPLICATIONS FOR INTERPRETATION

Limitation	Implication
Record-based design	The audit relied on available digital and paper records and could not fully explore reasons for data-entry errors.
Facility selection	The findings apply directly to the selected RDHS Colombo facilities and may not represent all Sri Lankan primary care settings.
No patient outcome linkage	The audit measured documentation quality but did not assess blood pressure control or clinical outcomes.
Field interpretation	Some fields, such as blood sugar and history, may vary by clinical context, which could influence completeness.

V. CONCLUSION

The Simple App demonstrated generally good digital documentation performance in hypertension care, with high overall completeness and accuracy across selected primary care facilities in Colombo. Core clinical fields such as blood pressure, diagnosis and medications were well documented, showing that the digital system can support routine hypertension management. However, gaps were identified in blood sugar, patient history, contact number, address, patient name and health number. These gaps may affect patient identification, follow-up, and program monitoring. The findings support the need for standard operating procedures, targeted refresher training, facility-specific feedback, verification steps, and repeat audits to complete the clinical audit cycle.

VI. RECOMMENDATIONS

1. Develop and implement a short standard operating procedure for Simple App data entry in hypertension clinics.

2. Provide refresher training with emphasis on patient identifiers, contact details, address, medicines, and follow-up documentation.

3. Introduce a verification step at registration or consultation to confirm name, health number, contact number, and address.

4. Use monthly facility-level feedback to monitor completeness and accuracy and encourage local improvement.

5. Consider mandatory fields or validation prompts for critical identifiers and follow-up details where technically feasible.

6. Use high-performing facilities as peer-learning sites for facilities with lower performance.

7. Repeat the audit after 3 to 6 months to assess improvement and close the audit loop.

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ETHICAL APPROVAL

Administrative and ethical approval was obtained from the relevant authority before data collection.

DATA AVAILABILITY

The audit dataset is not publicly available because it contains facility-level health service data, but aggregated results are presented in this manuscript.

AUTHORS CONTRIBUTION

The authors conceptualized the audit, supported tool development, coordinated data collection, interpreted findings and prepared the manuscript.

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