An Assessment of Quality of Documented Diabetes Care Provided at PIH-Supported Non-Communicable Diseases Clinics in Rwanda

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Scholarly Report Title: An Assessment of Quality of Documented Diabetes Care Provided at PIH-Supported Non-Communicable Diseases Clinics in Rwanda

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Acknowledgements

Abstract:

Diabetes presents an increasing burden globally as a leading cause of disability and cardiovascular diseases. To prevent the complications of diabetes, patient retention and quality care, including adherence to guidelines by clinicians, is critical. This project explored the documentation of key patient information and the care provided by the Non-Communicable Diseases (NCD) program at ten Inshuti Mu Buzima health care facilities between June 2012 and June 2015. The current standards of diabetes care have been adapted from the "PIH Guide to Chronic Care Integration for Endemic Non-Communicable Diseases-Rwanda Edition."

Providers document care delivered into a paper record and this is then transferred into the electronic medical record system (EMR), which has been adapted in all NCD clinics. We reviewed EMR data to measure: (1) completeness of baseline demographic and clinical history information important for patient follow-up and care, and (2) rates of documented delivery of recommended care. Descriptive statistics was used to describe the level of documentation of all measures.

We found that documentation of patients' address was excellent with only 1% missing, but about one quarter of patients had missing information for other demographic and clinical history information including marriage status (27%), occupation (28%), HIV status (25%), smoking status (22%), and alcohol use (25%). Phone number was largely missing (75%).

Rates of documented receipt of recommended care varied at intake and on follow-up care. There were good levels of documentation of basic routine measures including blood pressure, pulse, and weight at both intake and follow-up visits. Documentation of delivery of less frequent routine measures like creatinine, HbA1c, proteinuria, and monofilament testing were much lower. Foot examination for ulcers was well documented at intake (76%), but very poor for

follow-up visits (1%). Documentation of blood sugar was low at intake (only 41%) and completely absent at follow-up (0%).

Overall, there were suboptimal levels of documented care. There are many factors that could contribute to the level of documentation seen. These include: (1) gap in care delivery, (2) a gap in documentation in paper charts, and (3) gap in EMR documentation. There is likely a combination of all factors at play. The next steps will be to identify the cause of these observed results, and subsequently implement necessary quality improvement initiatives.

Glossary of Abbreviations

NCDs	Non-Communicable Diseases
PIH	Partners In Health
IMB	Inshuti Mu Buzima (Partners In Health)
EMR	Electronic Medical Record
M&E	Monitoring and Evaluation

Section I

BACKGROUND

Non-Communicable Diseases in the Developing World

Cardiovascular diseases, cancers, diabetes, chronic lung diseases, and other non-communicable diseases (NCDs) are collectively the leading causes of death worldwide, accounting for as much as 68% of all deaths (1). Despite the lower prevalence in low and middle-income countries (LMIC) (2) more than 80% of all premature deaths from NCDs happen in these settings (3). This disproportionate mortality burden is in part due to lack of knowledge and systems to provide the long-term chronic care services necessary, especially when high burden of acute, infectious conditions still exists.

Due to rapid urbanization and globalization, the burden of NCDs is expected to increase tremendously over the next few years, with the greatest increase projected to be in the African region(2). To halt the current and future burden of NCDs in developing countries, initiatives are needed to increase access to quality chronic care services for NCDs, a goal hampered by limited resources in many settings. The importance of adhering to chronic care services on the outcomes of NCD care is indisputable, regardless of setting. A recent study conducted in Rwanda in youth with type I diabetes showed that, like richer countries, patient retention and periodic HbA1c testing are important in achieving glycemic control(4). Another study conducted in Iran demonstrated that control of cardiovascular risk factors was significantly better in diabetes patients who received a regular course of treatment, over a longer period of time(5).

Chronic Disease Care in Rwanda

By 2010, the Rwanda Ministry of Health (MOH) was able to build a decentralized chronic care system that was able to provide access to antiretroviral therapy to over 80% of HIV patients(6). However, gaps existed in the delivery of chronic care services for non-communicable diseases (NCDs) which, in 2005,

accounted for as much as 40% of hospitalizations(6). Considering the shared barriers in chronic care delivery for infectious and non-infectious diseases, PIH and the Rwanda MOH began the initiative to integrate NCD care with other existing chronic care services such as HIV and TB. Since 2007, integrated PIH-supported NCD programs have been implemented at three district hospital-level clinics and disseminated to seven health centers in an effort to decentralize complex chronic care services from referral centers. This decentralization effort by the MOH involved approaches to allow diagnosis and treatment of endemic NCDs by community nurses, clinical officers, and generalists physicians, decreasing the reliance on specialists and allowing broader geographical reach (Figure 1). These programs now serve over 3000 patients, with more than 80% from rural communities(6) and enable treatment of several chronic disease conditions including diabetes, hypertension, cardiovascular disease, neurological disorders, and chronic kidney disease. These NCD clinics follow care guidelines defined by the *PIH Guide to Chronic Care Integration for Endemic Non-Communicable Diseases—Rwanda Edition*. This integrated approach to NCD care has been proven to be an effective model in other resource-limited settings like Cambodia and Ethiopia(7,8). However, challenges to chronic care delivery persist even with the implementation of such programs. These include failure to provide appropriate follow-up care, low patient-retention rate, and low adherence to care guidelines.

Diabetes in the Developing World and Beyond

The worldwide burden of diabetes, especially type 2 diabetes, is growing rapidly due to urbanization, aging populations, and growing trend towards physical inactivity. In 2014, 422 million adults were living with diabetes, compared to 108 million in 1980. This, when standardized for age, is almost double in global prevalence of the disease from 4.7% to 8.5% in the adult populations(10). With this global trend, the most rapid increases in prevalence since 1980 are seen in low-income countries and the eastern Mediterranean and African regions. This increasing prevalence of diabetes poses a significant challenge, especially in low-income countries, and its proper management is especially important considering that it is a leading cause of many preventable, disabling complications and death. Diabetes is not only a risk

factor for cardiovascular disease, but is also a leading cause of renal diseases, limb amputations, and blindness, all of which occur at a much higher rate in developing countries(11). Data from the WHO also shows that the age-standardized mortality rates due to high blood glucose are highest in the eastern Mediterranean and the south-east Asian regions, and notably in the African region despite having the lowest prevalence of diabetes(10). Also reflecting the change in diseases-related burden, Kengne et al found that the highest incident of absenteeism from work in Namibia was due to diabetes-related complications, rather than HIV/AIDS(11). Diabetes complications also lead to unnecessary hospitalizations and undue financial burden on families and the health care sector, as more high-cost services must be provided. These complications result most often from failure of early diagnosis, or lack of provision of appropriate chronic care required for effective diabetes management.

In Rwanda, it is estimated that there are over 194,300 cases of diabetes diagnosed in adults and about 5000 diabetes-related deaths in 2015 (12,13). At one national referral center, diabetes was listed as the 5th most common diagnosis of mortality and morbidity(14).

Improving Diabetes Care in Low Income Countries

In 2005, the first global guidelines by The International Diabetes Federation was developed with the unique effort of developing guidelines sensitive to resource limitations as experienced in low income countries. However, in the global context and among low-income countries, there is wide variability in funding and expertise among countries and regions in a country that limits generalizability of international care guidelines. This calls for modified guidelines taking into considerations the unique infrastructure and resource limitations in different regions. With this in mind, PIH and the MOH of Rwanda outlined diabetes care guidelines to complement its decentralized NCD initiative. Sample protocols for diagnosis and treatment of diabetes on initial presentation and for routine care are outlined in Figure 2. The use of clear guidelines and the efforts to maintain adherence to these guidelines are only a few measures to improve the quality of care provided for diabetes and to increase ability of the health

care system to handle the increased burden of diabetes and its complications.

The Electronic Medical Record

The role of the electronic medical record in improving health care for chronic illnesses is well established, even in the developing world. With the rapid rises in HIV and its requirement for long term care and follow-up, the electronic medical record represented a valuable tool in an attempt to improve documentation, monitoring and management of patients in the developing world. The proposed benefits of the EMR are several and include improvement in efficiency, effectiveness, and overall quality of care. However, the implementation of the electronic medical record comes with significant challenges even in high resource settings. In the developing world, the lack of robust health care and information technology infrastructure offers even more unique challenges to implementation and continued use. One significant benefit to the use of an EMR system is the improved efficiency of data collection and analysis for research and health care quality assessment, a function that is very improvement in the long-term improvement of chronic disease management and health system improvement. In 2007, PIH Rwanda began the implementation of an electronic medical record system to its NCD programs. By the time of this study and the time periods studied (2012-2015), all PIH-supported NCD sites were equipped with system of transferring patient data from patient charts to the electronic medical record.

Section II

Aims of Study

The aim of our study was to examine the quality of diabetes care services, to identify some factors that influence the quality of care offered by PIH-supported NCD programs in Rwanda, and to assess the current capability of the electronic medical record to provide such information.

We define quality of care as the extent of adherence to standards of diabetes care and the completeness of documentation.

There were three specific aims for this project:

1) Assess the completeness of documentation of key demographic information for patients in diabetes care;

2) Assess performance on adult care delivery measures based on guidelines in the *PIH Guide to Chronic Care Integration for Endemic Non-Communicable Diseases—Rwanda Edition*

3) Make recommendations for improvement in diabetes care and for use of the electronic medical record, based on aims 1-2.

We expect that the results of this study would contribute directly to ongoing quality improvement efforts in the delivery of diabetes care, as well as other non-communicable, chronic diseases at PIH-supported NCD programs.

Student Role

The student was responsible for data cleaning, analysis, presentation and interpretation of data in this study. Valuable input was provided by research mentors, onsite clinicians and other researchers on site.

Section III

METHODS

Study Design

This is a IRB-approved retrospective review of data entered into the EMR system for patients enrolled in the diabetes program between June 1, 2012 and June 1, 2015, a period by which all

current NCD clinics have been active and have a system for recording patient data in the

electronic medical record (Harvard IRB15-1154; IMBRC/PIH-Rwanda IRB 574/RNEC/2014).

Setting

In Rwanda, PIH supports healthcare delivery with the local government in three rural districts. As of June

2015, NCD programs serving over 3000 patients were established at 7 health centers and 3 district

hospitals located in the Kirehe, Burera and South Kayonza districts in Rwanda. Patients with diabetes

from all 10 of these sites were included in this study.

Diabetes Management

At district hospitals, care is provided by two trained nurses who have received didactic and practical

training on management of diabetes and other NCDs. Diabetes-specific clinics are held weekly. At health

centers, diabetes care is provided at weekly NCD clinics, that encompass diabetes, HIV, TB and other

chronic diseases (Figure 1). Training of health center clinicians in management of specific diseases is

supplemented by didactic training provided by district hospital clinicians. Quality assurance is also

supplemented through a long-term mentorship program, the Mentoring and Enhanced Supervision at

Health Centers (MESH) program. This program supports continued quality of nurse and clinician care by

having senior, district hospital nurses periodically supervise clinicians at different health centers and is

key to the success of the decentralized chronic disease program.

Clinics are equipped with equipment to assess a patients' weight, height, blood pressure, creatinine, blood

glucose, and Hemoglobin A1c (HbA1c). Ophthalmologic evaluation requires referral to district hospitals.

Sample clinical guidelines for diabetes care on presenting and follow-up visits as outlined in the *PIH*

Guide to Chronic Care Integration for Endemic Non-Communicable Diseases—Rwanda Edition are

shown in Figure 2 (6).

Care for patients presenting to weekly clinics is recorded in paper charts. This is later transcribed into the electronic medical record by non-clinically trained data officers. This transcription may happen the day of or weeks later depending on availability of officers.

Study Population

We aimed to assess care of patients currently enrolled in the NCD program for diabetes care. Three different inclusion criteria were applied depending on the measures being assessed:

1. Demographics, clinical history, each routine visit: All patients actively enrolled in IMB facilities for diabetes care.

2. Initial/Index visit: All patients who enrolled in the diabetes care program for the first time between June 1, 2012 and June 1, 2015.

3. Periodic measures: all patients who have been in the program for at least 12 months since inception of the NCD program, allowing opportunity to assess care over a minimum of one year

Variables of Interest

We assessed documentation of demographic variables, clinical history, and required care variables on patients' initial and scheduled follow-up visits based on the guidelines for care. These variables are documented in Table 1.

Data Collection and Analysis

Data from the electronic medical record were cleaned and analyzed using descriptive statistics in STATA v14 (College Station, TX: StataCorp LP). We measured completeness of documentation of all measures indicated above. Documentation was calculated as indicated below:

- **Demographic, clinical history, and initial visit**: Percent of patients with a missing value for relevant measures. 95% confidence intervals (95% CI) are reported.

- **Each Routine Visit:** Percent of each patient visit where a given measure was undocumented. Standard deviations (SD) are reported.

- **Periodic Routine Measures:** Percent of recommended care not delivered over given time in care. Standard deviations (SD) are reported.

Section VI

Results

Population:

A total of 451 patients were seen for diabetes, with the majority in treatment for type II diabetes (83%). The mean age was 51 years, with only 9 patients in the pediatric population (2%). Most patients were farmers (72%) and only 22% of patients achieved education above the primary level. 83% of patients were followed primarily at the district hospital level (Table 2).

Demographic Variables

The degree of documentation of demographic variables is outlined in Table 3. More than 99% of patients had documentation of age, sex, and location. Most patients had documentation of their education level, occupation, and marital status. 75% of patients did not have a phone number documented.

Clinical History

Documentation of clinical history is outlined in Table 4. Most patients had documentation of smoking status, HIV status, alcohol use, and family history of diabetes, with undocumented values seen in 22%, 25%, 25%, and 30% of patients, respectively. 33% of patients did not have their diabetes type documented, and 45% of patients did not have a recorded date of their diagnosis. A history of hospitalizations was not recorded in 65% or ability to work was not recorded in 69% of patients.

Initial Care

Documentation of measures that should be routinely documented on initial visit are shown in Table 5. On initial visit, blood pressure, pulse and weight were undocumented in 18%, 20% and 24% of patients respectively. Height was more commonly undocumented (49%). Most patients had undocumented values of blood sugar (59%), check for neuropathy (73%), kidney function test or plan to check (94%). Peripheral edema and foot sores were undocumented in 19% and 24% of patients respectively, and 39% of patients did not have documentation of follow-up visit plan.

Routine/follow-up care

Documentation for routine measures that should be done at each visit is shown in table 6. Weight, blood pressure, and pulse were documented at most visits, with undocumented values seen in 13%, 7%, and 16% of visits respectively. However, point of care glucose and check for foot sores were universally undocumented. Most patients also show undocumented check for medication compliance (79%), symptoms of hypoglycemia (65%), and lack of food (74%).

When accounting for the total time patients have spent in the program, only 35% of required HbA1c tests were documented (one every six months) and only 2.3% of all patients had the appropriate number of HbA1c tests documented for the time they were enrolled. For proteinuria, which is also to be done every 6 months, only 4% of the required tests were documented and less than 1% of patients had the appropriate number of tests documented for the time enrolled. Creatinine and monofilament testing, routinely done

annually, had documentation of 29% and 50% of required exams done respectively. Overall, 7% and 18% of patients had documentation of required number of creatinine and monofilament tests over the period of their enrollment. There is no trend in level of documentation over the course of three years. Figure 3 shows the percent of patients receiving at least one measure of HbA1c, proteinuria, monofilament test, and creatinine by year.

Section V

DISCUSSION

Overall, the results of this assessment indicated better documentation of demographic information when compared to clinical history. The relatively good documentation of demographic information, except for phone number, may owe just to its relative simplicity to collect and the high requirement for address as a tool for communication in Rwanda. The lack of phone number on the other hand, is not surprising considering that many patients residing in very rural areas may still not have a cellphone. This makes efforts at maintaining patient follow-up more challenging. Documentation of clinical history elements was highly variable and substandard. The relatively poor documentation of smoking history, alcohol use, and HIV status is surprising considering the importance of these measures in understanding the patients' risk category for cardiovascular diseases. Even poorer documentation of elements such as inability to work and hospitalizations might be due to tendency to omit if negative, even though this is expected to be documented in the chart. The results also demonstrated significant gaps in documentation of care at intake and routine follow-up visits. The data indicated that simple measures like blood pressure, pulse, and weight were routinely documented for intake and follow-up visits compared to things that were "less commonplace", but nonetheless important diabetes care measures like HbA1c, monofilament, and proteinuria testing.

The level of documentation seen here is likely due to multiple factors relating to both data entry and clinical care. The multi-level system of data entry currently employed allows for several areas for errors

that contribute to poor EMR documentation. This system involves data recording in paper charts by clinicians and subsequently transcription of information from the paper charts to the electronic medical record by non-clinically trained data officers. Deficiencies could be inherent to the paper charts such as design can make it difficult for clinicians to record properly and accurately in the spaces required especially within the time-constraints of seeing multiple patients per clinic day. Clinician factors such as legibility of hand-writing and diligence in entering information in appropriate sections also play a role. Additionally, errors likely arise with translation from paper charts to the EMR by data officers who are unable to make sense of gaps in clinical recording. Illegible information in chart, non-streamlined chart design, fatigue and time limitations with transcribing large amounts of information, and lack of oversight in data entry also likely contribute to inadequate and ineffective recording of patient data into the electronic medical record by data officers. Some key observations point to the current inadequacy of data entry in contributing to this gap in data documentation and supports the idea that current data does not accurately represent care provided in the clinics. For example, the level of documentation of point of care glucose testing on follow-up visits is alarming considering its pivotal role in guiding diabetes care at each visit. From informal student observation in the diabetes clinic at Rwinkwavu District Hospital on several occasions, blood sugar was routinely measured and recorded in paper charts for all diabetes patients and was key in directing management recommendations for each patient. However, 100% of patients in our sample do not have a blood sugar documented in the electronic medical records on their routine visits. This striking gap between my observation and the data points to the hypothesis that these results may also indicate a gap in the data quality rather than a gap in care delivery. Additionally, data from the MESH program where higher level nurses from district hospitals observe the performance of health center clinicians shows for example that blood sugar was not documented in only 8.5% of 234 observed health center visits (Figure 4). While observation may confound care provided in a clinic and hence limit the accuracy of the MESH data, such a big difference in the level of reported levels of documentation is likely due to inefficiencies intrinsic to the documentation of data into the EMR system. While a properly adapted EMR system should demonstrate the level of clinical care performed, the many barriers to EMR

implementation, such as infrastructure and human resource limitations, in low-resource settings like Rwanda make achieving this particularly difficult.

However, despite the obvious gap in EMR documentation, there are also obvious gaps in care delivery. The poor recording of some measures like HbA1c, monofilament, proteinuria and creatinine testing and relatively good records of more "routine" things like blood pressure, pulse, and weight could point towards a gap in the adherence to certain clinical guidelines. This could be due to just lack of knowledge or attention to the clinical guidelines, lack of resources, inefficient procurement and supply delivery systems, and poor patient follow-up. A lack of resources is not unreasonable considering the often-laborious system of procurement and sometimes just a plain lack of certain items in the country or at given health centers and district hospitals.

Overall, while further understanding of the factors contributing to these results is required, there are three major potential factors influencing the data observed here:

1. Gap in paper documentation, where care is delivered but not recorded in patient charts or recorded in the incorrect space.

2. Gap in EMR documentation, where the data in EMR is not representative of information in paper charts.

3. Gap in care delivery, where care is not delivered at all.

Further improvements in delivery of quality care in diabetes and other chronic disease conditions will require thorough quality improvement initiatives to improve adherence to care guidelines and creating more error-proof and strict requirements for documentation in both paper charts in the clinic and data entry by data officers outside the clinic.

Suggestions for Future Work

A multi-level, step-wise approach to system improvement is required to encourage both improvement in adherence to care guidelines and in EMR documentation (Figure 5). A thorough

assessment to identify exact barriers to clinical care and data entry is first required. This may take the form of survey to health care providers and data officers. Among the improvement initiatives that may be deemed necessary are:

Improvements in the clinic:

    a. Implementation of Clinical Decision Support Systems: While clinicians may often be aware of recommended guidelines for care, there are very few clinical decision supports or reminders to assists in ensuring tests are done routinely. Future work focused on improving adherence to guidelines could include continued emphasis on routine process measures and recording, through implementation of flow charts in clinic and through more focused MESH program initiatives.

    b. Improvements to the patient chart: While paper charts continue to be required in the clinic, improvement in paper charts to allow better clarity and space for diabetes data is required. Paper charts may also be designed as a tool for clinical decision support by reinforcing a streamlined, or 'check-box', approach to each patient visit.

    c. Using the EMR as Decision Support Tool: While an electronic medical record is not available in clinic, the EMR system could be used to generate data for patients on clinic days, highlight key missing information, and prompt clinicians on recommended required exams.

2. *Improvements in Data Entry:*

There are likely issues with data entry itself, likely owing to lack of clinical training by data officers. Some suggestion to improve quality of data entry include:

    a. Train officers to identify anomalous values and clarify with clinicians when necessary.

    b. Require officers to flag missing or anomalous values, and resolve with clinic teams

    c. Do periodic concordance investigation to identify gaps in the paper-to-EMR translation

Conclusion

Overall, this study using EMR-retrieved data highlights suboptimal levels of documentation of demographic information and care delivery measures among PIH-supported NCD clinics in Rwanda. The results of the study indicate not only gaps in care delivery, but also significant gaps in the accuracy of data from the EMR. As such, while the EMR may still serve a valuable function of providing demographic and clinical information on the patient population, it currently has limited functionality as a tool for assessing care quality, and specifically adherence to clinical guidelines. Further study is needed to identify the exact barriers to guideline adherence and to complete and accurate data entry so that tailored quality improvement initiatives can be made. Improvements in EMR documentation should over time foster improved adherence to clinical care guidelines and continue to contribute to improved management of chronic diseases in Rwanda and other low-income countries as these diseases become greater burden in the developing world.

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Figures

Figure 1: Integration model of human resources in chronic care decentralization (Source: PIH Guide to Chronic Care Integration for Endemic Non-Communicable Diseases—Rwanda Edition).
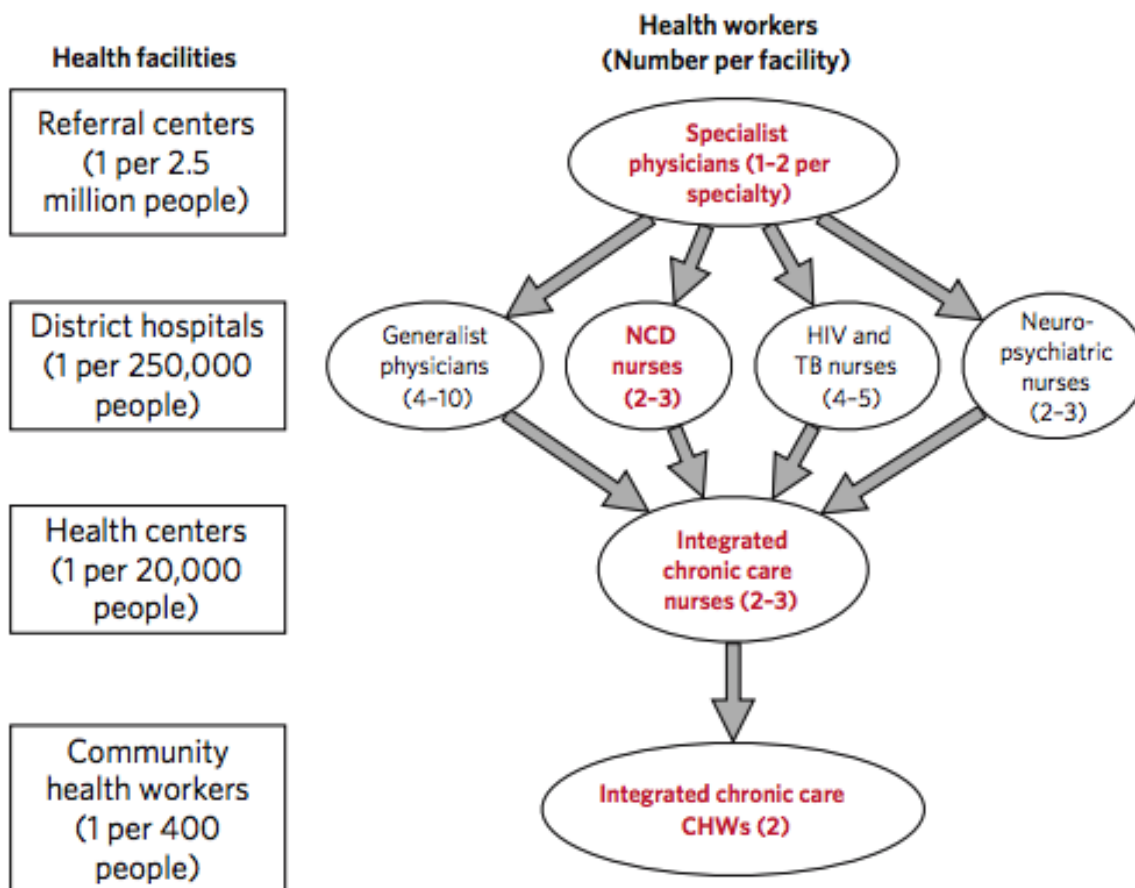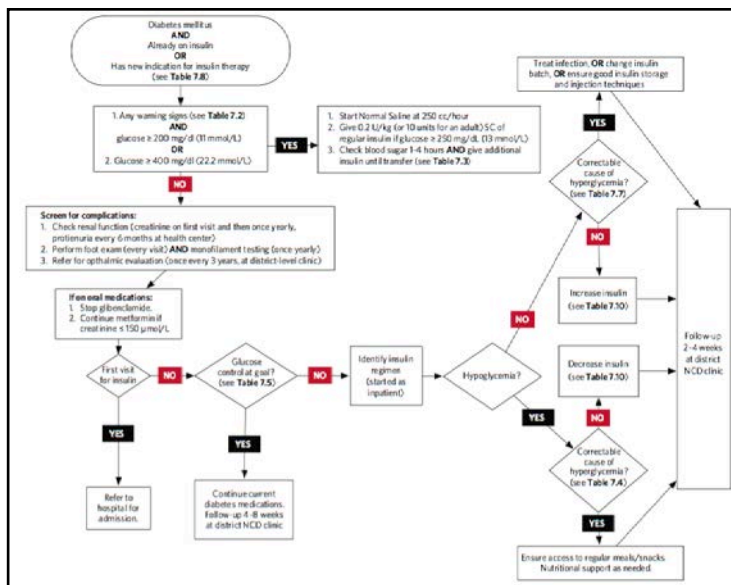
Figure 2: Example of diabetes care guidelines on initial and routine visit (Source: *PIH Guide to Chronic Care Integration for Endemic Non-Communicable Diseases—Rwanda Edition*). NB. 1) Frequency of evaluation for foot ulcer listed as N/A is currently recommended for each visit. "Correctable cause of hyperglycemia" in flowchart should read "correctable cause of hypoglycemia".

	Prevalence[52-54]	Mode of evaluation	Frequency of evaluation	Action if abnormal
Peripheral neuropathy	35%–70%	Monofilament sensory testing of the feet. If a microfilament is not available, proprioception can be tested. Patients may also complain of neuropathic pain (burning, electrical sensations) in the feet	Once yearly	Intensify treatment regimen if possible. Consider treating neuropathic pain with amitriptyline 25 to 100 mg per day orally. Shoes if needed. Counsel on foot protection
Foot ulcer	1.7%–10%	Visual inspection, probe evaluation to rule out osteomyelitis	n/a	Referral to district hospital for possible debridement and broad-spectrum antibiotics
Retinopathy or sight-threatening eye disease	5%–35%	Fundoscopic evaluation or retinal photography	Once every 3 years, performed at a district hospital with an ophthalmic clinical officer. More frequent follow-up if established retinopathy.	Intensify treatment regimen if possible. Referral for evaluation at an ophthalmic center if needed for intervention
Cataracts	8.7%–25%	Fundoscopic evaluation	Once every 3 years performed at a district hospital with an ophthalmic clinical officer	Referral for evaluation at an ophthalmic center for intervention
Albuminuria	18%	Urine dipstick	Every six months	Intensify treatment regimen if possible. Add an ACE inhibitor (e.g., lisinopril, 5 mg per day orally)
Nephropathy	19%–34%	Serum creatinine testing	Yearly	Intensify treatment regimen if possible. Add an ACE inhibitor if no counterindication (e.g., lisinopril, 5 mg per day orally)

Figure 3: Percent of patients receiving at least one measurement per year. Note that Proteinuria and HbA1c are to be delivered twice per year; hence percent of patients receiving 'appropriate care' is a significantly lower value
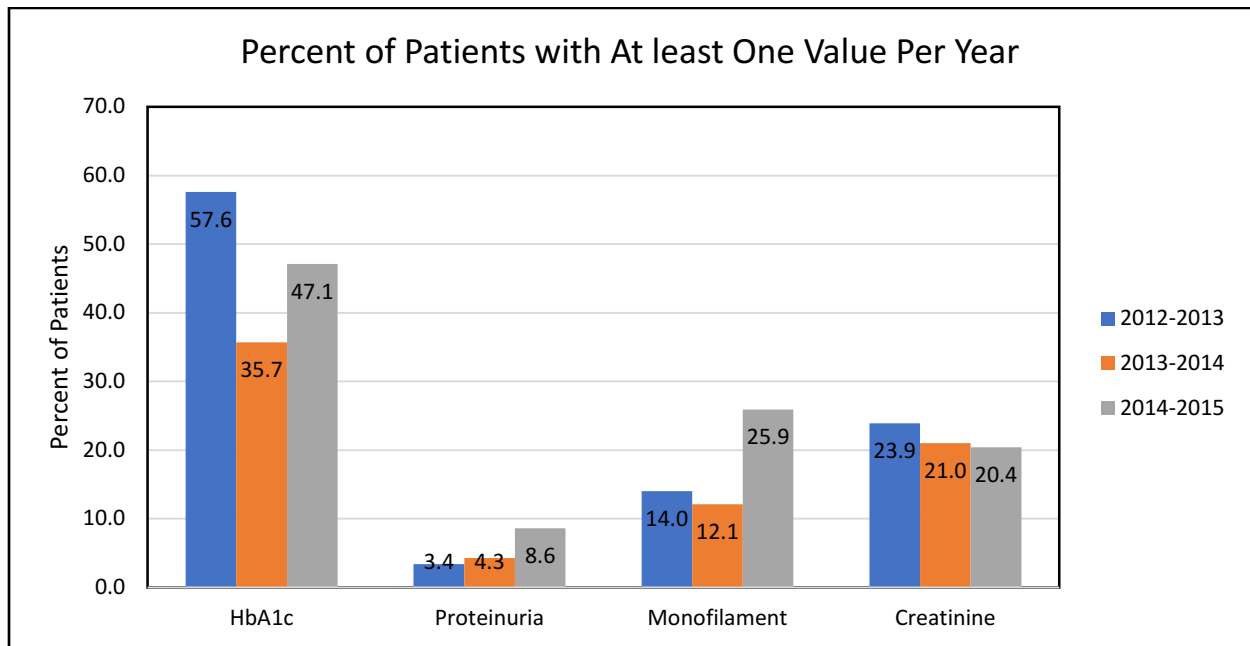

Percent of Patients with At least One Value Per Year

Figure 4: Comparison of Documentation as Observed in EMR and that reported in the MESH Program .

Figure 5: Suggested multi-level system-improvement approach

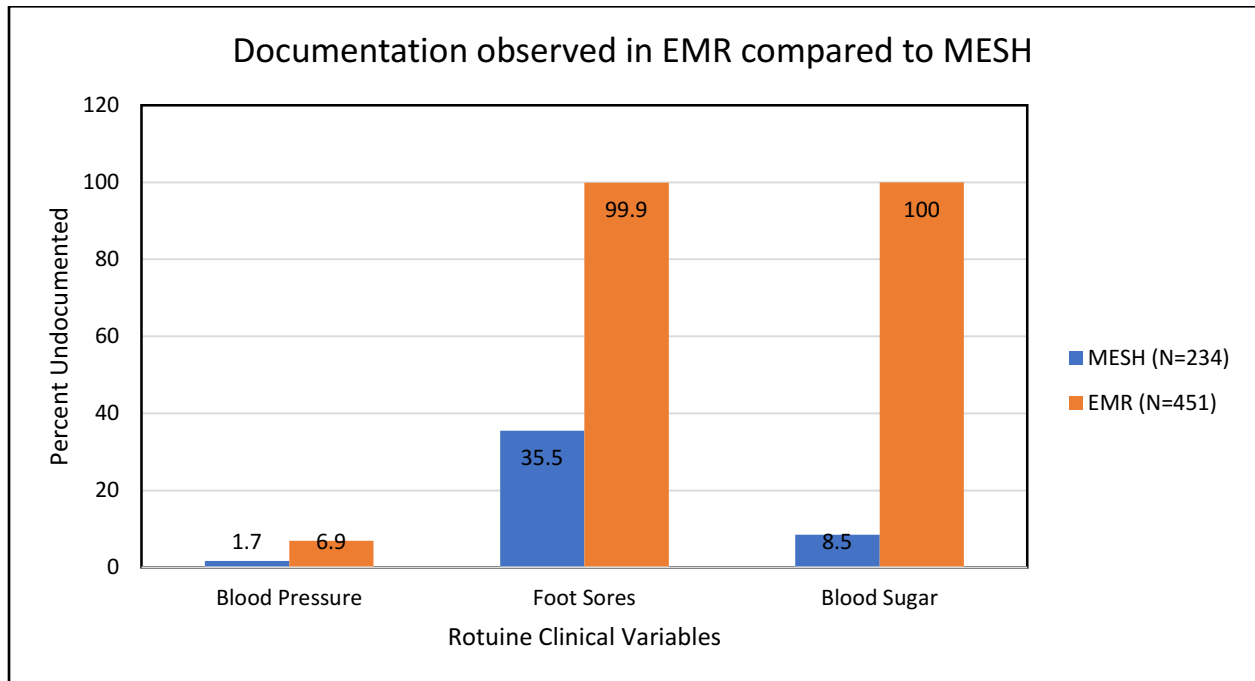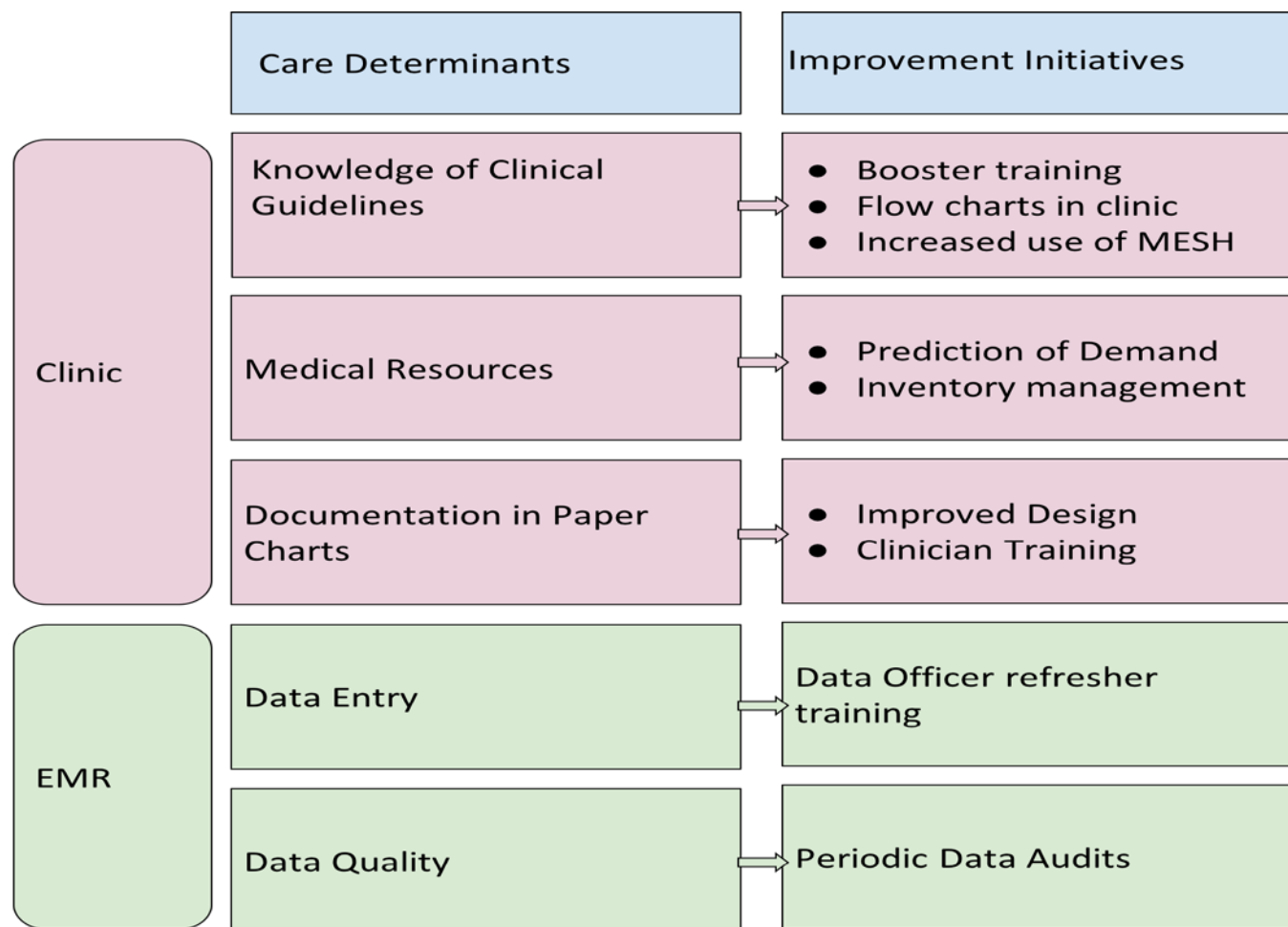| Care Determinants	Improvement Initiatives
Clinic	
Knowledge of Clinical Guidelines	• Booster training • Flow charts in clinic • Increased use of MESH
Medical Resources	• Prediction of Demand • Inventory management
Documentation in Paper Charts	• Improved Design • Clinician Training
EMR	
Data Entry	Data Officer refresher training
Data Quality	Periodic Data Audits

Figure 5: Suggested multi-level system-improvement approach

TABLES

Table 1: Variables of interest

Demographic Variables (N=451)	Clinical History (N=451)	Initial Visit Care (N=251)	Routine Visit Care	
			Each Visit (N=451)	Periodically (N=354)
- Date of Birth - Sex - District - Sector - Cell - Village - Primary Care Giver - Education Level - Occupation - Marriage Status	- Medication Allergies - HIV Status - Smoking Status - Alcohol Use - Family History - Date of Diagnosis - Type of Diabetes - Hospitalizations	- Blood Pressure - Pulse - Weight - Height - Blood Sugar - Monofilament Test - Creatinine - Peripheral Edema - Foot Sores - Follow Up Schedule	- Blood Pressure - Pulse - Weight - Blood Sugar - Foot Sores - Ever Missed Medications - Symptoms Of Hypoglycemia - Lack Of Food	- Hba1c Every 6 Months - Proteinuria Every 6 Months - Creatinine Yearly - Monofilament Test Yearly - Ophthalmological Exam Every Three Years

Table 2: Patient characteristics

Patient Characteristics	N	Percent
Gender (N=451)		
Female	259	57.4
Male	192	42.6
Age (N=451)		
Less than 18	9	2.0
18 to 40	98	21.7
40 to 60	191	42.4
Great than 60	153	33.9
Occupation (N=326)		
Farmer	236	72.4
Other, Employed	59	18.1
Other, unemployed	31	9.5
Education Level (N=263)		
None	55	20.9
Primary Education	151	57.4
Secondary or Above	57	21.7

Patient Characteristics	N	Percent
Marriage Status (N=330)		
Married	234	70.0
Single	40	12.1
Divorced/Widowed	56	17.0
HIV Status (N=340)		
Positive	19	5.6
Negative	229	67.3
Unknown	92	27.1
Smoker Status(N=350)		
Non-smoker	255	72.9
Previous Smoker	80	22.8
Current Smoker	15	4.3
Alcohol Use (N=339)		
Never	159	46.9
In The Past	130	38.3
Currently	50	14.7
Family History (N=314)		
No	244	77.7
Yes	70	22.3
Diabetes Type (N=303)		
Type 1	53	17.5
Type 2	250	82.5
Years Since Diagnosis (N=247)		
Less than two years	40	16.2
Two to five years	121	49.0
Greater than five years	86	34.8
Resident District (N=447)		
Kirehe	166	37.1
Kayonza	157	35.1
Burera	50	11.2
Other	74	16.6

Table 3: Documentation of Demographic Information and Clinical History

Variable	Not documented (N=451)	Percent not documented (95% CI), %
Demographic Information		
Date of Birth	0	0 (0)
Sex	0	0 (0)
District	4	0.9 (0-2)
Sector	4	0.9 (0-2)
Cell	5	1.1 (0-2)
Umudugugu(Village)	13	2.9 (1-4)
Phone Number	337	74.7 (71-79)
Education Level	188	41.7 (37-46)
Occupation	125	27.7 (24-32)
Marriage Status	121	26.8 (23-31)

Table 4: Documentation of Clinical History

Clinical History	Not documented (N=451)	Percent not documented (95% CI), %
Medication Allergies	372	82.5 (79-86)
HIV Status	111	24.6 (21-29)
Smoking Status	101	22.4 (19-26)
Alcohol Use	112	24.8 (21-29)
Family History of Diabetes	137	30.4 (26-35)
Date of Diagnosis	205	45.2 (41-50)
Type of Diabetes	148	32.8 (28-37)

| Too Sick to Work | 312 | 69.2 (65-73) |
| Hospitalizations | 295 | 65.4 (61-70) |

Table 5: Documentation of Care at Initial Visit

Initial Visit Measure	Not documented (N=251)	Percent not documented (95% CI), %
Blood Pressure	46	18.3 (14-23)
Pulse	49	19.5 (15-24)
Weight	59	23.5 (18-29)
Height	122	48.6 (42-55)
Blood Sugar	149	59.4 (53-65)
Foot sensitivity	184	73.3 (68-79)
Creatinine/Creatinine Plan	237	94.4 (92-97)
Peripheral Edema	47	18.7 (14-24)
Foot Sores	61	24.3 (19-30)
Follow-up Visit Scheduled	97	38.6 (33-45)

Table 6: Documentation at Care at Routine Visits. Percentages indicate the average number of visits where the measure is undocumented.

Routine Clinical Measures To be Documented at Each Visit (N=451)	Average Percent Not documented (SD)
Weight	13.4 (17.7)
Blood Pressure	6.9 (14.0)
Pulse	16.3 (18.2)
Foot Sores	99.9 (0.7)
Blood Sugar	100 (0)
Medication Compliance	78.9 (26.3)
Symptoms of Hypoglycemia	64.9 (35.9)
Lack Of Food	73.5 (29.4)

Table 7: Documentation of Periodic Process Measures

Clinical Measure (N=354)	Average Percent of required tests completed (SD), %		Percent of Patients Receiving Appropriate # of tests, %	At least one in 2014-2015 (%)
	Bi-annually test	Annual test		
HbA1c	35 (35)		2.3	47.1
Proteinuria	4 (1)		0.3	8.6
Creatinine		29 (37)	6.5	20.4
Monofilament Test		50 (10)	18.1	25.9