PREVALENCE OF ERROR-PRONE ABBREVIATIONS

A REVIEW OF DISCHARGE SUMMARIES IN GENERAL MEDICAL WARDS IN KENYATTA NATIONAL HOSPITAL

A research proposal in partial fulfilment of the requirement for the award of the degree of Masters of Medicine (Internal Medicine), University of Nairobi, College of Health Sciences,

Department of Clinical Medicine and Therapeutics

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H58/74716/14

DECLARATION

Student Declaration

I declare that this research proposal is my original work and has not been presented in any other university or institution for the award of the degree or any academic credit.

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Supervisor's declaration

This research proposal has been submitted for consideration with approval of my university supervisors.

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ACKNOWLEDGEMENT

This proposal for thesis has only been made possible by guidance and encouragement from my supervisors, Professor Ogola and Dr Maritim, kind words and guidance from various faculty members and the incessant drive to be better from my classmates and friends.

DEDICATION

I dedicate the time and effort put into this project to my wife and family

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ABBREVIATIONS:

CCC: Comprehensive Care Centre

DAMA: Discharged against medical advice

GMC: General Medical Council

ISMP: Institute of Safe Medication Practices

JC: The Joint Commission

KNH: Kenyatta National Hospital

KNH-UON ERC: Kenyatta National Hospital - University of Nairobi Ethics and Review Committee

LAMA: Left against medical advice

MMD: Mosby's Medical Dictionary

MOPC: Medical outpatient clinic

NCC MERP: National Coordinating Council for Medication Error Reporting and Prevention

NMC: Nursing and Midwifery Council

OMG: 'Oh my god'

RMH: Royal Melbourne Hospital

TB clinic: Tuberculosis clinic

TID: Trust Intranet Medical Dictionary

ZS: Zoheb Suleman

ABSTRACT/ EXECUTIVE SUMMARY.

BACKGROUND

Accurate documentation in the medical profession is vital. Shorthand use and abbreviation in medical notation is commonplace. Ambiguity and use of error prone abbreviations are known to be associated with poor patient care. Miscommunication due to wrongful interpretation of abbreviations may lead to mismanagement of patients and poor patient outcome. There is paucity in literature regarding use of shorthand in medical notation in the developing world. This study attempted to bridge this knowledge gap.

OBJECTIVE:

To determine the frequency of error-prone abbreviations and proportion of ambiguous shorthand in discharge summaries.

METHODOLOGY:

This was a retrospective, descriptive study at Kenyatta National Hospital (KNH). 288 discharge summaries were selected at random, distributed evenly between the medical wards 7A, 8A, 8B, 8D. Discharge summaries written during the time period 1st January 2015 and 31st December 2015 were randomly selected. A review was used to get the frequency of shorthand, abbreviations and more specifically error-prone abbreviations in each discharge summary. Standard comparative lists of error-prone abbreviations were used. Frequency of these error-prone abbreviations was determined and simple surveys were carried out to demonstrate the most commonly used abbreviations. Abbreviations and shorthand was categorized into one of four different groups based on their level of appropriateness (1). Primary outcome was prevalence of error prone abbreviations in medical discharge summaries from General medical wards in KNH. Secondary outcomes were categorization of

abbreviations used based on their degree of ambiguity. Data was compiled onto Microsoft Excel® spread sheet format and analysed by Stata® 12.

RESULTS:

We analysed 288 discharge summaries, we found the prevalence of error prone abbreviations to be 5.8%. The most common category of abbreviations was universally understood (category 1) which was 78%, followed by inappropriate/ambiguous (category 3) which was 12.5%, followed by understood in context (category 2) at 9% and lastly unknown (category 4) at 0.5%.

CONCLUSION:

Error prone abbreviations are common in medical discharge summaries, occurring at a frequency of one in seventeen words (5.8% of total words used). The majority of abbreviation use was appropriate and universally accepted, however the prevalence of inappropriate and unknown abbreviations was significant at 13%. This has potential implications on safe and effective patient care. Education regarding use of error prone abbreviations and standardized shorthand in medical notation has clinical value.

RECOMMENDATIONS:

We recommend that a list of institution approved abbreviations should be available to staff in the medical wards. We also recommend that education to health care professionals regarding the use of error prone abbreviations should be done routinely.

CHAPTER 1: INTRODUCTION AND LITERATURE REVIEW

1.1 Background and introduction

The use of shorthand and abbreviations in medical note taking and documentation is commonplace (1). A discharge summary is a vital document that contains important information regarding a patient's recent admission meant to be conveyed from doctor to doctor in the same specialty or between different healthcare professionals for example internal medicine, surgery, physiotherapy, nutrition etc.

The General Medical council's (GMC in the United Kingdom) 'Good Clinical Care' advice to doctors is to keep accurate and clear clinical records that can be understood by colleagues (2) (3). The Nursing and Midwifery Council (NMC, United Kingdom) in their Code recommend that any entries made in paper or electronic records should be clearly written, and not include unnecessary abbreviations, jargon or speculation (3,4).

In our setup, a discharge summary is given to all patients upon discharge from the ward. The discharge summary contains vital information regarding patient bio data, the duration of admission, the admitting ward, consultant, diagnosis, patient complaints, physical examination findings, investigation, management, discharge medication and follow up dates and the respective clinic(s). In Kenyatta National Hospital (KNH), the same form is filled both for discharge summaries and death summaries. Forms are manually filled in duplicate using carbon paper. The original form is given to the patient and a duplicate kept in the patient file records.

A different doctor to the admitting one may discharge the patient. Patients are usually followed up in either a medical outpatient clinic (MOPC) or specialty clinic for example,

renal, chest, tuberculosis clinic (TB clinic) or comprehensive care centre (CCC). At the respective clinic, the patient may be reviewed by another member of the medical team or another healthcare professional. Follow up dates are usually days or sometimes weeks later.

Quite often, the handwritten medical discharge summary is the only piece of communication conveying vital patient information from the ward, to the respective follow up clinic. Patients are often required to know and understand important information about their drug dosages and diagnosis (5). When this is not forthcoming, the discharge summary plays an important role in communication.

In our time conscious profession, various reasons such as high patient turnover and increased workload, use of shorthand and abbreviations in medical note taking and discharge summaries is common. Miscommunication due to wrongful interpretation of abbreviations may lead to mismanagement of patients and poor patient outcome. It is a case of "writing little and communicating less" (5). Shorthand/abbreviation used by one cadre of healthcare professionals may not be easily interpreted by another (or even within the same) cadre. Ambiguous and inappropriate abbreviation makes communication even more difficult. Furthermore, there are abbreviations known to be error-prone and more liable to misconstrued, for example µg (microgram), I. U (international unit) and this could lead to mismanagement of patients (7). Different abbreviations are used for the same word and some abbreviations can have different meanings.

1.2. Literature review

Shorthand as defined by the Oxford English Dictionary (6) is a method of rapid writing by means of abbreviations and symbols, used especially for taking dictation. They also define abbreviations as a shortened form of a word or phrase for example *SKU is the abbreviation for Stock Keeping Unit.* Acronym is defined as an abbreviation formed from the initial letters of other words and pronounced as a word e.g. *NASA.*

Clinical handover of a patient on discharge from a hospital generally occurs using a discharge summary. A discharge summary contains information about events during care of a patient by a provider or organization. It is produced during a patient's stay in hospital as either an admitted or non-admitted patient and issued when or after the patient leaves the care of the hospital. Clinical handover of a patient especially from acute care to the community setting is a known area for potential risk and patient harm. Discharge summaries are critical for providing well-coordinated and effective clinical handover because they are the primary communication mechanism between hospitals and primary healthcare providers.

Correct documentation in the medical profession cannot be emphasized enough. Shorthand use and abbreviation in medical notation is common. Ambiguity and use of error prone abbreviations are known to be associated with impaired patient care. Standardized lists and guidelines on error-prone abbreviations have been published (7) . In 1996, National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) published the first list of error-prone abbreviations (updated in 2014) and called for their abandonment from clinical practices (8). Extensive lists have also been released by the Institute of Safe Medication Practices (ISMP) (9), the Joint Commission on Accreditation of Healthcare Organizations (JC) (10) and the New South Wales Therapeutic Advisory Group, updated in 2009 by the Australian Commission on Safety and Quality in Healthcare (11). One of the most extensive lists of error-prone abbreviations is from the ISMP and has been the

foundation of subsequent lists and guidelines. The ISMP list contains The Joint Commission's "minimum list" of dangerous abbreviations, acronyms, and symbols that must be included on an organization's "Do Not Use" list. The Australian Commission on Safety and Quality in Healthcare has incorporated the ISMP list and an updated 2011 version of this guideline is available online. This updated list is the standard comparative benchmark that we used in our study. In December 2016, The Australian Commission on Safety and Quality in Healthcare released their recommendations for terminology, abbreviations and symbols used in medicines documentation (11). Apart from a list of safe terms, abbreviations and dose designations for medicines they also outline some of the principles for safe, clear and consistent terminology for medicines.

Implementation of these guidelines has not been studied adequately. A study by Samaranayake et al (12) has shown education regarding proper documentation practices has impacts the use of error-prone abbreviations. There is paucity in literature regarding use of shorthand in medical notation. Only a few studies have been done in an internal medicine setup and fewer still using discharge summaries.

A study by Politis et al in 2014 (1) which sought to describe the frequency of inappropriate and ambiguous shorthand in discharge summaries was carried out in the General Medical Units at the Royal Melbourne Hospital, Australia (RMH). Their system uses electronic discharge summaries. Eighty discharge summaries were reviewed. All abbreviations were assigned into four categories of appropriateness. The study found that the discharge summaries contained 840 abbreviations used on 6269 occasions. 20.1% of all words were abbreviations. 6.8% of the 6269 occasions of shorthand used were categorized as being 'Understood but inappropriate and/or ambiguous' or 'Unknown' (category 3 or 4) which equated to 1.4% of all words, averaging 5.4 words per discharge summary. They concluded that abbreviations are commonly used in discharge summaries in general medical units precisely at a frequency of one in five words. The majority of shorthand used though

appropriate and universally accepted (44% of total abbreviations), there is still frequent use of ambiguous, inappropriate (6% of total abbreviations) or unknown (1% of total abbreviations) shorthand. The most common inappropriate or ambiguous abbreviation (category 3) at a frequency of 5.4% was 'GEM' referring to the geriatric evaluation and management unit at RMH. 'AP' at a frequency of 2.8% referred to alkaline phosphatase. The study recommended the need for better awareness and education regarding use of shorthand in clinical notation.

This was one of the few studies done in an internal medicine setup, furthermore on discharge summaries. Merits of this study were that they formulated a method of validating the categorization of abbreviations into levels of appropriateness.. The study was carried out in a large teaching hospital with a large population of qualified and trainee doctors.

This study used electronic discharge summaries as it is a computerised health management system compared to KNH where a manual input handwritten system is used. Entry fields and parameters in a computerised system will vary from the discharge summary forms used here. Variables such as legibility of discharge summaries may alter some outcomes. This study did not assess the prevalence of error-prone abbreviation which is our primary objective.

A study by M.J. Dooley et al in 2010 (7) looked at the prevalence of error-prone abbreviations used in medication prescribing for hospitalized patients. It was a multi-hospital evaluation carried out across three Australian hospitals. The study basis was that use of error prone abbreviations in prescribing was a potential cause of error that may lead to medication error. The frequency and type of error-prone abbreviations was determined in an inpatient setting. They looked at inpatient prescription charts. 369 (76.9%) patients had one or more error-prone abbreviations. 8.4% of orders had at least one error-prone abbreviation. 29.6% of these abbreviations were considered to be high risk for causing significant injury.

The study by Dooley et al was significant in that the frequency of error-prone abbreviations of 8.4% was lower than the rates of between 30% and 33% published in other settings (7). A reason given for this finding could be that the hospitals included in the study had undergone targeted education for medical staff concerning error-prone abbreviations, with local case examples given of abbreviations that had previously led to grievous patient harm. This supports the idea that safe documentation practices can be taught. This study however did not assess the clinical impact of error-prone abbreviations on adverse drug reactions.

A study by S.Sinha et al in 2010 (3) carried out in a hospital in the UK assessed the understanding of commonly used abbreviations in the medical records among healthcare professionals. It was a cross-sectional observational study on abbreviation use in general surgical inpatient medical records, randomly selected. They used admissions over a 10 day period in October 2008. Selected abbreviations in the form of a standard questionnaire were shown to different members of a multidisciplinary team to examine interpretation and knowledge. 209 questionnaires were analyzed. The average correct response was 43%. Foundation year 1 (F1) doctors (which is comparable to medical officer interns in our health care system) scored the highest, compared to dieticians who scored the lowest (20%). Different abbreviations were also scored as to percentages of correctness. Certain abbreviations most often used by nurses (e.g. OTT) achieved a 75% correct response by them as compared to 11% by F1 students ($p<0.001$). Similarly, abbreviations such as COBH ($p=0.025$) and LUTS ($p<0.001$) (3), although mostly correctly answered by junior doctors, were poorly answered by nurses. Junior doctors (foundation year 1 and 2, senior house officers and registrars) scored more correct answers probably by working in a wider sphere where they had a more extensive abbreviation repertoire as compared to consultants, nurses

and other allied healthcare professionals who were exposed to only limited areas of their specialty.

Sinha et al concluded that most healthcare professionals have poor knowledge of commonly used abbreviations. They suggested use of unambiguous and approved list of abbreviations to facilitate good communication in patient care.

J.E Sheppard et al in 2007 (13) carried out an audit in the UK to assess the frequency, nature and understanding of abbreviations in medical records. They looked at abbreviation use and meaning in paediatric handover sheets and medical notes. Two standards were used, the Trust Intranet Medical Dictionary (TID) and Mosby's Medical Dictionary (MMD). A collection of abbreviations was shown to healthcare professionals to examine interpretation of abbreviations.

Twenty five handover sheets were surveyed finding a total of 2286 abbreviations used, with 221 different abbreviations (13). The standards recognized 14% (TID) and 20% (MMD) of these abbreviations 168 sets of medical notes had a total of 3668 abbreviations with 479 different abbreviations; the standards recognized 15% (TID) and 17% (MMD). Some words had different forms of abbreviations meaning the same thing e.g. normal (N, NI, NAD) and some abbreviations had multiple interpretations differing from the intended meaning e.g. TOF (tetralogy of Fallot, trachea-oesophageal fistula) (13). Paediatric doctors recognized 56-94% and other healthcare professionals recognized 31-63%. Sheppard et al (13) concluded that abbreviation use was common in paediatric notation. Difficulties in interpretation were demonstrated. The use of standardized abbreviations to avoid confusion was suggested.

Samaranayake et al in 2014 (12) studied the effectiveness of a ‘Do Not Use” list and perceptions of healthcare professionals on error prone abbreviations. It was an uncontrolled observational study carried out in a tertiary hospital in Hong Kong. They assessed the use of error-prone abbreviations included in the ‘Do Not Use” list before, after its introduction and after the first reinforcement. 3,238 prescriptions were reviewed. The use of error-prone abbreviations in the ‘Do Not Use” list decreased from 7.8 to 3.3% after its introduction ($P<0.001$) and to 1.3% after the first reinforcement ($P<0.001$). They concluded that a ‘Do Not Use” list is effective in reducing error-prone abbreviations. Reinforcements of this list have been shown to improve adherence (12). Hence education forums on error-prone abbreviations in hospitals can lead to improvements in safe documentation practices and improve medical practice in patient management.

CHAPTER 2: STUDY JUSTIFICATION AND OBJECTIVES

2.1 STUDY JUSTIFICATION

Correct documentation in the medical profession is important. Shorthand use and abbreviation in medical notation is widespread. Ambiguity and use of error prone abbreviations are known to be associated with impaired patient care. There is paucity of literature regarding use of shorthand in medical notation. Safe documentation practices can be taught. Use of institution-derived acceptable abbreviation and do-not-use abbreviation lists can be formulated and hence standardize the shorthand and abbreviations used for clearer communication between healthcare professionals.

This study will help fill the knowledge gap in KNH, by determining the prevalence of error-prone abbreviations, use of inappropriate abbreviations and could help in the formulation of an institution specific list of error prone abbreviations. Tutorials on the use of error prone abbreviations, safe documentation practices, and acceptable abbreviations could be implemented by the institution. This may have an impact on patient management.

2.2 RESEARCH QUESTION

What is the magnitude of the use of error-prone abbreviations in discharge summaries in general medical wards at Kenyatta National Hospital (KNH).

2.3 STUDY OBJECTIVES

2.3.1 Broad objective:

- To determine the prevalence of error-prone abbreviations and the level of ambiguity of shorthand and abbreviations used in medical discharge summaries.

2.3.2 Specific objective:

- To determine the frequency of error prone abbreviations in medical discharge summaries from General medical wards.
- To get the proportion of abbreviations and shorthand that is ambiguous.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Study design: Retrospective, descriptive study.

3.2 Study Population:

Discharge summaries from a medical ward during the time period 1st January 2015 to 31st December 2015 as found in the records office originating from the general medical wards. KNH has eight medical wards: 7A, 7B, 7C, 7D, 8A, 8B, 8C, 8D. 7C is a specialist skin and chest ward, 8C predominantly oncology. Specialist wards were excluded as our study was directed at general medical wards only, reason being difference in admission and discharge rates and mechanisms for inter-ward transfer. Four general medical wards out of six were selected, in this case 8A, 8B, 8D, 7A. Each ward has approximately one admitting day per week, following a set rota, keeping total admissions and discharges fairly even between them. This would be sufficient to eliminate ward bias and also fall within our sampling frame.

3.3 Study site:

Kenyatta National Hospital (KNH) Established in **1901** with a bed capacity of 40, Kenyatta National Hospital (KNH) became a State Corporation in **1987** with a Board of Management and is at the apex of the referral system in the Health Sector in Kenya. KNH has 50 wards, 22 out-patient clinics, 24 theatres (16 specialized) and Accident & Emergency Department.

Kenyatta National Hospital is the oldest hospital in Kenya; it was renamed from the King George VI to Kenyatta National Hospital after Jomo Kenyatta following independence from the British. It is currently the largest referral and teaching hospital in the country.

KNH currently has a capacity of 1800 beds and over 6000 staff members.

The records department was the principal area of data collection Data records systems are computerised. Files with the physical discharge summaries are traceable from the records department with help from the records clerks. There are approximately equal discharges per ward per month. KNH being a referral hospital, the largest in the region, sees a wide spectrum of disease ranging from infectious disease, cardiology, gastrointestinal disorders, haematological, and oncology cases to name just a few.

3.4 Study period:

This study was conducted from December 2016 to March 2017.

3.5 Data selection:

Discharge summaries from January 2015 to 31st December 2015 from 4 medical wards : 8A, 8B, 8D, 7A.

3.6 Inclusion criteria:

1. Discharge summaries from General medical wards 8A, 8B, 8D, 7A.
2. Discharge summaries written by any of clinical officer, clinical officer intern, medical officer, medical officer intern, senior house officer Internal medicine.
3. Discharge summaries written during the time period: 1st January 2015 to 31st December 2015.

3.7 Exclusion criteria:

1. Patients who absconded, or were discharged against medical advice (DAMA), or signed leaving against medical advice (LAMA) forms.
2. Discharge summaries that have not been signed off i.e. "DOCTOR NAME" and "SIGN" fields in the discharge summary left blank.

3. Illegible discharge summaries for any cause including poor quality carbon copies.

3.8 SAMPLE SIZE

Daniel's formula (14) was used to calculate sample size.

$$n = \frac{Z^2 P(1-P)}{d^2}$$

Where

n = sample size,

Z = Z statistic for a level of confidence,

P = expected prevalence or proportion (in proportion of one; if 20%, P = 0.2),

d = precision (in proportion of one; if 5%, d = 0.05).

Daniel's formula was used to calculate sample size for an infinite population (where the population is greater than 50,000).

Based on the study carried out in Australia (1), the prevalence of shorthand was 20%. Using this proportion with a 95% confidence interval and 5% precision, the sample size was estimated to be at 245 discharge summaries.

3.9 METHODS

The principal investigator required access to discharge summaries from the medical records office. 288 discharge summaries were selected at random, distributed evenly between the medical wards 7A, 8A, 8B, 8D. This meant that 6 discharge summaries were selected from each month of the calendar year for each ward to ensure equal numbers of discharge summaries analysed per quarter. Discharge summaries written during the time period 1st January 2015 and 31st December 2015 were used. Sampling method was done by systematic sampling where every 3rd discharge summary used for data extraction from all the summaries until sample size of 72 from each ward was met.

Data was manually entered using the data collection tool (appendix A). All words were counted manually. Abbreviations were noted down. Error prone abbreviations were indexed. Thereafter all entries were input to a spread sheet on MS Excel.

An audit helped get the frequency of error-prone abbreviations and shorthand in each discharge summary. A standard comparative list of error-prone abbreviations was used from the New South Wales Therapeutic Advisory Group, Australian Commission on Safety and Quality in Healthcare (11) to make an index of error prone abbreviations (appendix B). Each error prone abbreviation had a code number which could be used to formulate tallies. Frequency of these error-prone abbreviations was determined and simple surveys were carried out to show the most commonly used abbreviations. This was used to form a list of the most common error-prone-abbreviations in medical discharge summaries in KNH.

Abbreviations and shorthand were categorized into one of four different groups based on their level of appropriateness (as per politis; OMG study) (1). The same tool as a method of validation was used in our study (*Table 1 below*). Categories included: 1. Universally

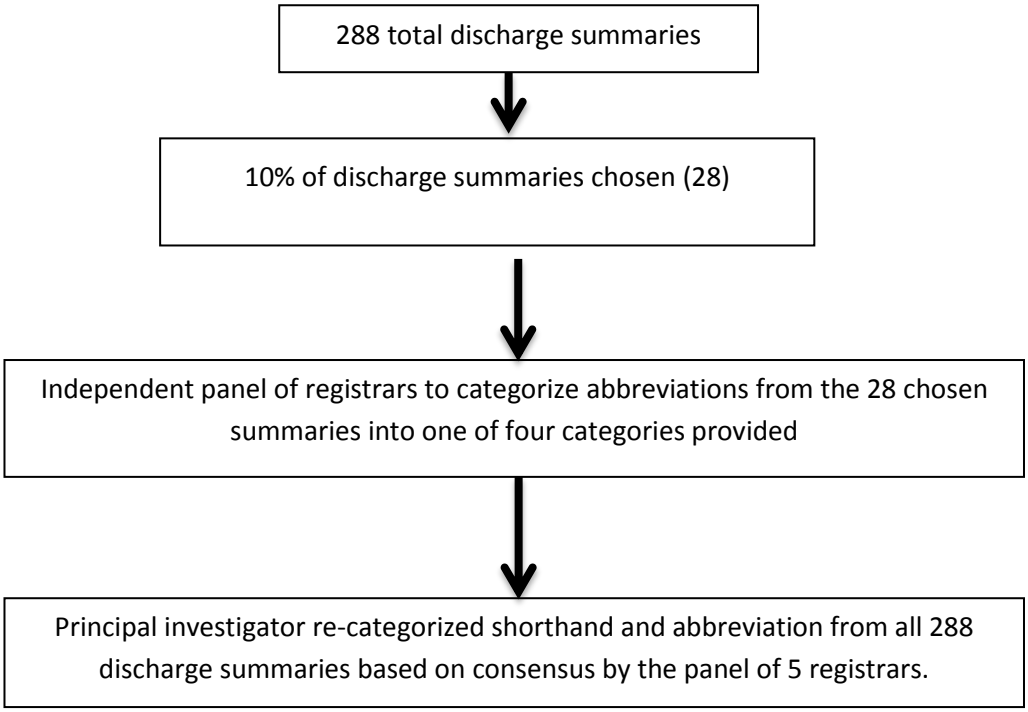
understood, no context needed; 2. Understood only in context; 3. Understood but inappropriate and /or ambiguous; 4.Unknown.

Initial categorisation of all shorthand was undertaken by the principal investigator and then revised according to consensus with registrars from internal medicine and surgery. A panel of 5 medical staff from KNH, were selected at random using convenience sampling from the medical and surgical wards. 2 surgical registrars were included so as to reduce bias as to the understanding of an abbreviation by people in different cadres of the medical profession. as described by Sinha et al (3). They were each given 28 (10% of the 288) discharge summaries, twenty three of which were selected at random and the other five selected because they contained at least one category 4 (category 4; unknown) abbreviations. This method of verification and categorization has previously been described by Politis et al (1). They were requested to independently categorize the abbreviations into one of the four possible categories provided, thereafter the responses were reviewed by the principal investigator and specific criteria for each category were revised and re-categorized.

Table 1: Categorization of abbreviations

Category	**Explanation**
1	'Universally accepted and understood even without context'.
2	'Understood when in context'.
3	'Understood but inappropriate and/or ambiguous'.
4	'Unknown'.

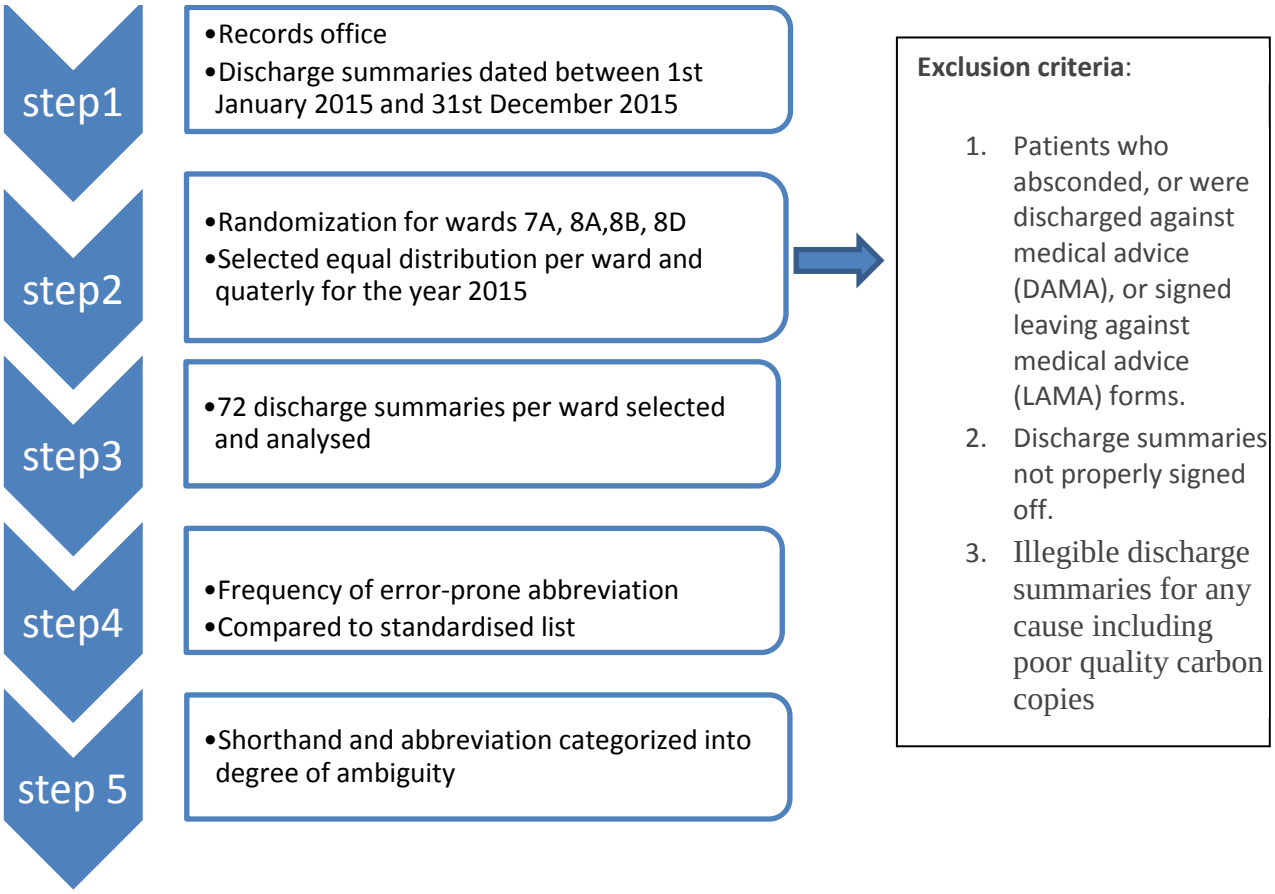
Figure 1: Validation of shorthand categorization into levels of ambiguity



3.10 DATA COLLECTION, MANAGEMENT AND ANALYSIS:

Data collection

Figure 2: Flowchart showing data recruitment procedure



Data was collected from the discharge summaries in the records office, compiled onto Microsoft Excel® spread sheet format.

Data analysis

Data was manually entered into spread sheets. Data was analysed using computer software called Stata® 12 (a data analysis and statistical software). Descriptive statistics were calculated for the prevalence of all error prone abbreviations and other abbreviations

3.11 ETHICAL CONSIDERATIONS

1. Permission was sought from the Kenyatta National Hospital/University of Nairobi Ethics and Research Review Committee (KNH/UON-ERC) to analyze the data collected from this study as part of the thesis dissertation. Copies of this Protocol, as well as any subsequent modifications to the document was presented to the above named committee for written approval prior to commencing the study.

2. Permission was sought from the Kenyatta National Hospital administration prior to commencing data collection.

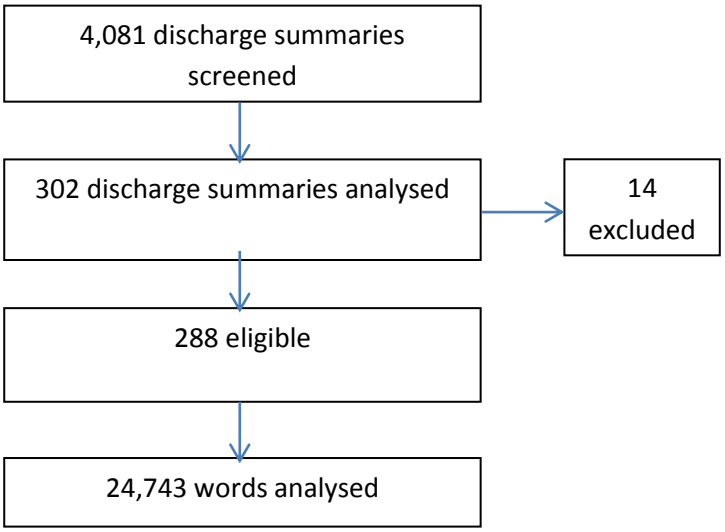
3. Confidentiality- this was maintained at all times; no personal identification data from discharge summaries was recorded. No information concerning the individual study findings will be released to any unauthorized third party without prior written approval of the study institution or the Ethics Research Committee.

4. Information sharing- important findings will be made available to policy makers at the Ministry of Health, the study findings will also be presented to the University of Nairobi, Department of Clinical Medicine and Therapeutics staff and students. We also hope to publish these results so as to disseminate the knowledge gained and hope to contribute to the improvement of documentation practices in Kenyatta National Hospital.

CHAPTER 4: RESULTS

4.1 Subject selection

Figure 3: <u>Flowchart showing subject selection.</u>



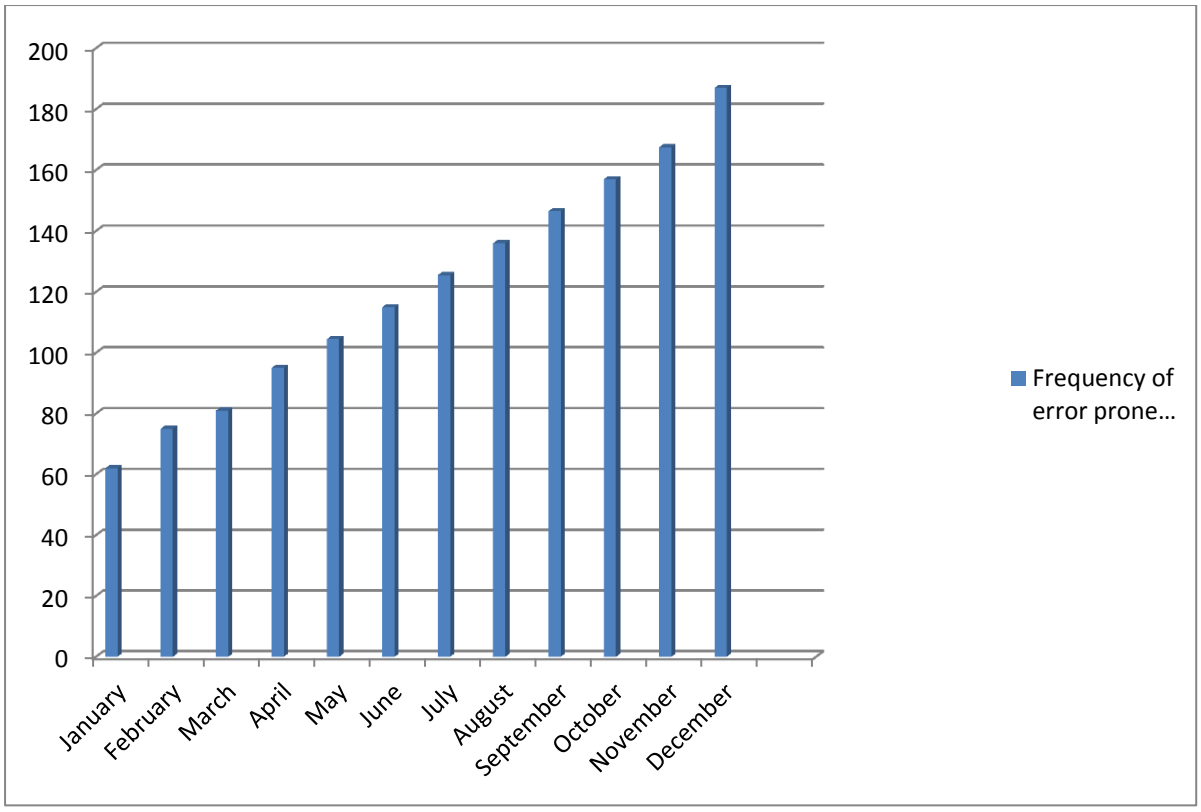
A total of 24,743 words were analysed manually from the 288 discharge summaries sampled. 12,129 abbreviations were present, 49.5% of total words. The average number of abbreviations per discharge summary was 42.1. Total number of error prone abbreviations occurring was 1,438. The prevalence of error prone abbreviation use was 5.8% of all words. One error prone abbreviation was used approximately every seventeenth word. The mean error prone abbreviation was 5 per discharge summary (SD 5.2) with a minimum of 0 and a maximum of 43 in a single discharge summary. The average words per discharge summary in the various wards 7A, 8A, 8B, 8D were 81, 82, 88 and 92 respectively.

4.2 Prevalence of error prone abbreviations.

Table 2: Total number of error prone abbreviations per ward

Ward	**Number of error prone abbreviations**	**Percentage of discharge summaries with error prone abbreviations**
Ward 7A	324	83
Ward 8A	369	88
Ward 8B	370	84
Ward 8D	372	86
Ward not indicated	3	100
Total	1438	

Figure 4: Frequency of error prone abbreviations per month in the medical wards in KNH



Total error prone abbreviations were 1,438 with all four wards contributing approximately 25% to the total. The last quarter of the year had the highest number of error prone abbreviations. December had the most number of error prone abbreviations at 187.

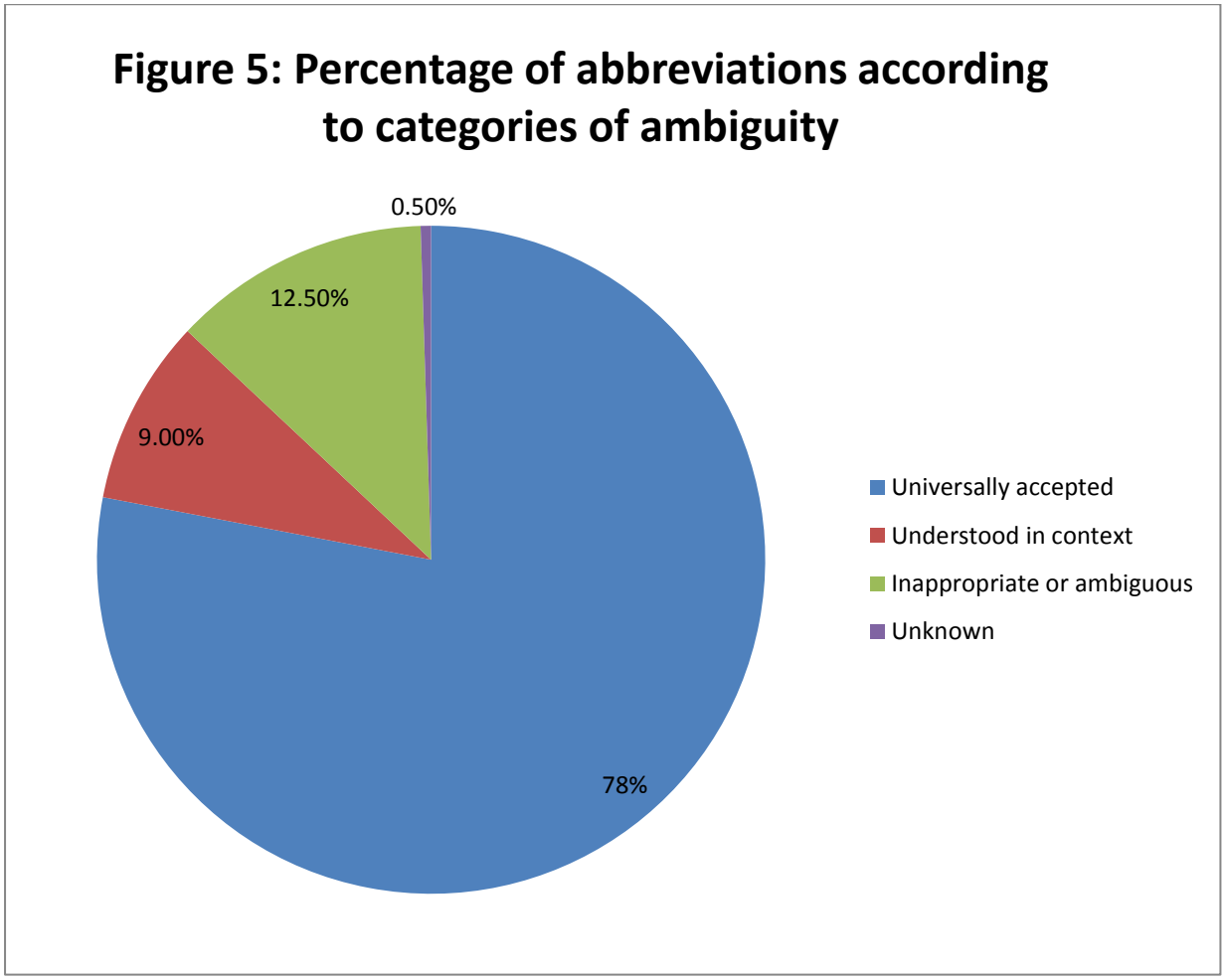
Table 3: Frequency of types of error prone abbreviations in discharge summaries

	Proportion discharge summaries with error type n(%)	**Total number of errors in discharge summaries**	**Average number of errors per discharge summary**
Error 1	4 (1.4%)	5	0.02
Error 10	20 (6.9%)	41	0.14
Error 11	122 (42.4%)	310	1.08
Error 20	28 (9.7%)	33	0.11
Error 25	6 (2.1%)	9	0.03
Error 27	3 (1.0%)	3	0.01
Error 28	4 (1.4%)	6	0.02
Error 30	44 (15.3%)	80	0.28
Error 31	147 (51.0%)	359	1.25
Error 33	100 (34.7%)	260	0.90
Error 34	30 (10.4%)	33	0.11
Error 36	4 (1.4%)	4	0.01
Error 37	24 (8.3%)	33	0.11
Error 38	7 (2.4%)	7	0.02

Error 39	49 (17.0%)	59	0.20
Error 40	58 (20.1%)	95	0.33
Error 45	10 (3.5%)	11	0.04
Error 47	36 (12.5%)	37	0.13
Error 49	37 (12.8%)	53	0.18
Error 51	4 (1.4%)	7	0.02

There were 20 different types of error prone abbreviations found in the discharge summaries sampled. An index of error prone abbreviations can be found in the appendix (see appendix B). Use of error prone abbreviations was found to be frequent but was limited to only certain types from the extensive list.

4.3 Categorisation of abbreviations



CHAPTER 5: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 DISCUSSION

The use of abbreviations and shorthand is used frequently in medical discharge summaries, including those that are error prone, ambiguous (category 3) and unknown (category 4). Prior to undertaking our study, there was paucity of data concerning the prevalence of error prone abbreviations and in general, abbreviation/shorthand use in medical notation in medical facilities in Kenya. The majority of abbreviations used are universally accepted, however not all primary healthcare providers may have the same level of understanding as that of specialty registrars in our hospital. This has impact on safe and effective patient care and highlights the importance of good medical note taking and the proper transfer of information from the discharging hospital to another facility or primary healthcare provider.

Our study was similar to previous studies as they have also been done in tertiary set ups, notably in Hong kong by Sinha et al, the United Kingdom by Sheppard et al and Australia by Dooley et al and Politis et al. Many studies have used electronic data recording systems e.g. Politis et al (1) where they described the frequency of inappropriate and ambiguous shorthand in discharge summaries. Our study looked at the use of shorthand and abbreviation in hand written notes from discharge summaries in the medical wards as opposed to electronic discharge summaries. We also used a similar method of categorization of abbreviations into levels of ambiguity. In contrast to our study, they did not look at use of error prone abbreviations in their study. A study by M.J. Dooley et al (7) looked at the prevalence of error-prone abbreviations used in medication prescribing for hospitalized patients. It was a multi-hospital evaluation carried out across three Australian hospitals. They looked at inpatient prescription charts and classified error prone abbreviations as high risk and low risk with the help of clinical pharmacologists. Our study did not look at inpatient prescription charts, possibly leading to a slightly lower prevalence of error prone

abbreviations. Furthermore we did not classify error prone abbreviations into high or low risk. Both Dooley et al and our study did not look at any possible adverse patient outcome relating directly to use of error prone abbreviations. It was out of the scope of our study and could thus be undertaken as a follow up to this study.

The prevalence of error prone abbreviation of 5.8% was comparable to Dooley et al (7) who found 8.4% prevalence in their study. This was lower than the figures published in other studies which showed rates of 30 to 33% (16,17,18). This was likely because our study strictly looked at error prone abbreviations in discharge summaries and we did not look at inpatient drug charts, fluid charts or outpatient prescriptions. Error prone abbreviations are mostly prescription errors (8,9.10,11). In some of the discharge summaries we analysed, the authors outlined inpatient treatment sheets, discharge drugs, dosages, frequencies and routes of administration. In other discharge summaries for example only the drug name would be included without the dose and frequency.

Dooley et al had comparable results to ours and lower than previous studies elsewhere, possibly because the three hospitals included in the study had undergone targeted education for medical staff with local case examples being used of abbreviations that had led to grievous patient harm. Even though KNH has no routine training, we possibly had a lower prevalence of error prone abbreviations as we did not look at treatment sheets and drug charts. Error prone abbreviations are predominantly prescription errors according to the standardized lists published previously (8,9,10,11). Educational interventions have been shown to be effective in reducing unsafe abbreviations (19).

We discovered that more error prone abbreviations occurred in the last quarter of the year with December having the highest number of error prone abbreviations from 26 discharge summaries (9% of the total 288). A postulation was that the academic year starts from September in the University of Nairobi with a new intake of medical registrars. New

doctors or clinical officers in the wards may be untrained in proper documentation practices. There were 20 different types of error prone abbreviations occurring in the 288 discharge summaries analysed. These error types were indexed using the ISMP 2015 list of error prone abbreviations (9) and New South Wales Therapeutic Advisory Group Recommendations for Terminology, Abbreviations and Symbols used in the Prescribing and Administration of medicines 2011 (11). Most abbreviations used were category 1 (universally accepted) which was 78%, followed by category 3 (inappropriate/ ambiguous), category 2 (understood in context) and category 4 (unknown). This differed from Politis et al as we had more abbreviations in category 3. This could be because we included error prone abbreviations in our study which we categorised as inappropriate i.e a category 3 type of abbreviation. Even though the majority of abbreviations were appropriate and understood, we still found a significant percentage of abbreviations that were inappropriate and unknown. This is noteworthy as it has important implications on patient care.

Numbers of error prone abbreviations may differ based on the hospital setup with different cadres and level of specialization of medical staff. This may influence abbreviation use and understanding. KNH has a large number of interns and registrars rotating in various departments in supervised training programs; combined with one of the highest patient turnovers in this geographical region this may lead to pressure of time and increase in shorthand use (almost half of all words per discharge summary) and use of error prone abbreviations. Conversely, institution organized training programs may help with proper documentation and medical note taking, control abbreviation use and thereby medication errors.

The mean frequency of abbreviations and shorthand found in our study was 49.5% of the total number of words analysed. There was not much difference between the four wards assessed. This was significantly higher than the prevalence of 20.1% found in the study done

by Politis et al. In their study they looked at 80 electronic discharge summaries. These contained 840 abbreviations used on 6269 occasions.. Our sample size was much larger and the fact that we have a manual data recording system with handwritten inpatient files, treatment sheets and discharge summaries most likely contributed to this difference. Our study did not look at legibility of handwritten discharge summaries. The ISMP has included both handwritten and typewritten abbreviations in their categorization. Type written documentation is also prone to use of error prone abbreviations. Poorly written or illegible hand writing may impact on patient care. Our study focused on the systems in place in our institution making it a benchmark for future studies that can explore legibility of handwriting, error prone abbreviations and any adverse outcomes resulting from their use.

The use of abbreviations and shorthand primarily is to reduce the workload in the note taking process. Easily recognizable and universally acceptable abbreviations do exist. As we have seen however, some abbreviations are understood in context only whilst some are ambiguous. When presented with considerable workload as health care workers, we are bound to abbreviate certain terms and notations. The manual entry system we use in our hospital may have contributed directly to the high prevalence of abbreviation use (almost half of all words written). In addition to this we found that the printed forms for discharge summaries had limited space available to fill in significant patient details like diagnosis, physical findings, investigations and management. There was sometimes pressure to fill in a lot of these details into a limited space, on a one page document. Assessing the quality of discharge summaries was not our primary goal. This could be undertaken as a follow up study. A separate section for discharge prescriptions instead of inputting everything into one block as discharge instructions may help reduce the prevalence of error prone abbreviations and shorthand use.

As an extension to our observation about word crowding in a limited space, we also assessed the frequency of abbreviation use in the diagnosis data entry field of a discharge summary. Discharge summaries are a means of communication, from the hospital to the patient and to other primary healthcare providers. Patients want to/need to know about their diagnosis. This information should be legible and easily understood. We found 48.3% of diagnoses in the 288 discharge summaries sampled had at least 2 abbreviations in the diagnosis section. This meant that patient diagnosis had a potential for misinterpretation by the patient or primary care giver. It should be noted that this was not a primary objective of our study. Future studies could assess patient understanding of information provided on discharge summaries or medical notes.

This study showed that all 288 discharge summaries were left incomplete, with at least one or more sections left empty. 99% of discharge summaries had no author designation indicated. This depended on the author indicating by suffix/ prefix their designation of senior house officer (SHO), medical officer intern (MOI) and so on. A significant proportion of discharge summaries had incomplete bio data records for the patient. For the clinic timings and booking section, 89% had the clinic indicated. 96.2% of discharge summaries had the firm section left blank. Almost all discharge summaries had the name of the clinician filled in and all were signed, which was part of the inclusion criteria. This helped show that discharge summaries should be completed well, adding strength to our suggestion that training on proper documentation practices be carried out involving all cadres of healthcare professionals. This additional information collected could possibly be used in the future as part of a post-hoc analysis

5.2: STUDY LIMITATIONS

1. Although the tool to validate categorization of abbreviations by degree of ambiguity had previously been utilized by Politis et al (1), the tool has not been validated in our setup. A panel of five faculty members were used to help with categorization of shorthand to minimize bias.
2. This study being a pilot study in our setup did not look at adverse outcomes which may be directly related to use of error-prone abbreviations. It was out of the scope of the pilot study. It is one of the recommendations that future studies may look at this aspect.
3. This study did not take into account legibility of discharge summaries due to handwriting as a variable to ambiguity.

5.3 CONCLUSION

Error prone abbreviations are common in medical discharge summaries, occurring at a frequency of one in seventeen words (5.8% of total words used). The majority of abbreviation use is appropriate and universally accepted, however the prevalence of inappropriate and unknown abbreviations was significant at 13%. This has potential implications on safe and effective patient care. Education regarding use of error prone abbreviations and standardized shorthand in medical notation has clinical value.

5.4 RECOMMENDATIONS

We recommend that a list of institution approved abbreviations should be available to staff in the medical wards. Routine education on proper documentation practices and use of acceptable abbreviations be carried out. Assessment on quality of discharge summaries could be undertaken for our hospital.

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APPENDIX

Appendix A: DATA COLLECTION TOOL

Questionnaire number:

Part 1: Background information

Please indicate Ward:

Patient number:

What is the diagnosis?

How many abbreviations in the diagnosis?

Date of admission: **Date of discharge:**

Author: please circle one (clinical officer/ intern, medical officer/ intern/ registrar)

1. Clinical officer

2. Clinical officer intern

3. Medical officer

4. Medical officer intern

5. Registrar/ senior house officer

Age of the patient

Sex of the patient

Address of the patient

Completed (tick for yes)

Clinic	
Firm	
Day	
Date	
Time	
Name	
Sign	

How many words are there total in the discharge summary?

How many abbreviations are there per discharge summary?

How many error-prone abbreviations are there per discharge summary?

Were all the discharge summary fields completed (yes/no?)

Part two: Primary objective: error-prone abbreviations

Abbreviation	Intended meaning	YES	NO
µg	Microgram		
AD, AS, AU	Right ear, left ear, each ear		
OD, OS, OU	Right eye, left eye, each eye		
BT	Bedtime		
Cc	Cubic centimetres		
D/C	Discharge or discontinue		
IJ	Injection		
IN	Intranasal		
HS hs	Half-strength At bedtime hours of sleep		
IU**	International unit		
o.d. or OD	Once daily		
OJ	Orange juice		
Per os	By mouth, orally		
q.d. or QD**	Every day		
qhs	Nightly at bedtime		
qn	Nightly or at bedtime		
q.o.d. or QOD **	Every other day		
q1d	Daily		
q6PM, etc.	Every evening at 6 PM		
SC, SQ, sub q	Subcutaneous		
ss	Sliding scale (insulin) or ½ (apothecary)		

SSRI SSI	Sliding scale regular insulin Sliding scale insulin		
i/d	One daily		
TIW or tiw	3 times a week		
U or u**	Unit		
UD	As directed (“ut dictum”)		
Trailing zero after decimal point (e.g., 1.0 mg)**	1 mg		
“Naked” decimal point (e.g., .5 mg)**	0.5 mg		
Abbreviations such as mg. or mL. with a period following the abbreviation	mg mL		
Drug name and dose run together (especially problematic for drug names that end in “l” such as Inderal40 mg; Tegretol300 mg)	Inderal 40 mg Tegretol 300 mg		
Numerical dose and unit of measure run together (e.g., 10mg,	10 mg 100 mL		

100mL)			
Large doses without properly placed commas (e.g., 100000 units; 1000000 units)	100,000 units 1,000,000 units		
APAP	Acetaminophen		
ARA A	vidarabine		
AZT	zidovudine (Retrovir)		
CPZ	Compazine (prochlorperazine)		
DPT	Demerol-Phenergan-Thorazine		
DTO	Diluted tincture of opium, or deodorized tincture of opium (Paregoric)		
HCl	hydrochloric acid or hydrochloride		
HCT	Hydrocortisone		
HCTZ	hydrochlorothiazide		
MgSO4**	magnesium sulphate		
MS, MSO4**	morphine sulphate		
MTX	methotrexate		
NoAC	novel/new oral anticoagulant		
PCA	procainamide		
PTU	Propylthiouracil		
T3	Tylenol with codeine No. 3		
TAC	triamcinolone		
TNK	TNKase		

TPA or tPA	tissue plasminogen activator, Activase (alteplase)		
ZnSO4	zinc sulphate		
"Nitro" drip	nitroglycerin infusion		
"Norflox"	norfloxacin		
"IV Vanc"	intravenous vancomycin		
Other drug abbreviations		Number:	

<u>Part three: Categorisation of ambiguity of abbreviations</u>

Please indicate which abbreviation is present in the discharge summary and categorise its level of ambiguity according to the following:

1. Universally understood, no context needed.

2. Understood only in context.

3. Understood but inappropriate and /or ambiguous.

4. Unknown.

Total category 1 ☐

Total category 2 ☐

Total category 3 ☐

Total category 4 ☐

Abbreviation	**Category of ambiguity (1-4)**

Appendix B: <u>INDEX FOR ERROR PRONE ABBREVIATIONS</u>

Abbreviation	Intended meaning	Index no.
µg mcg or ug	Microgram	1
AD, AS, AU	Right ear, left ear, each ear	2
OD, OS, OU	Right eye, left eye, each eye	3
BT	Bedtime	4
Cc	Cubic centimetres	5
D/C	Discharge or discontinue	6
IJ	Injection	7
IN	Intranasal	8
HS hs	Half-strength At bedtime hours of sleep	9
IU**	International unit	10
o.d. or OD	Once daily	11
OJ	Orange juice	12
Per os	By mouth, orally	13
q.d. or QD**	Every day	14
qhs	Nightly at bedtime	15
qn	Nightly or at bedtime	16
q.o.d. or QOD **	Every other day	17
q1d	Daily	18
q6PM, etc.	Every evening at 6 PM	19
SC, SQ, sub q	Subcutaneous	20
ss	Sliding scale (insulin) or ½ (apothecary)	21

SSRI SSI	Sliding scale regular insulin Sliding scale insulin	22
i/d	One daily	23
TIW or tiw	3 times a week	24
U or u**	Unit	25
UD	As directed (“ut dictum”)	26
Trailing zero after decimal point (e.g., 1.0 mg)**	1 mg	27
“Naked” decimal point (e.g., .5 mg)**	0.5 mg	28
Abbreviations such as mg. or mL. with a period following the abbreviation	mg mL	29
Drug name and dose run together (especially problematic for drug names that end in “l” such as Inderal40 mg; Tegretol300 mg)	Inderal 40 mg Tegretol 300 mg	30
Numerical dose and unit of measure run together (e.g., 10mg, 100mL)	10 mg 100 mL	31
Large doses without properly placed commas (e.g., 100000 units; 1000000 units)	100,000 units 1,000,000 units	32
Drug name abbreviations eg APAP	Acetaminophen	33
ARA A	vidarabine	
AZT	zidovudine (Retrovir)	
CPZ	Compazine (prochlorperazine)	

DPT	Demerol-Phenergan-Thorazine	
DTO	Diluted tincture of opium, or deodorized tincture of opium (Paregoric)	
HCl	hydrochloric acid or hydrochloride	
HCT	Hydrocortisone	
HCTZ	hydrochlorothiazide	
MgSO4**	magnesium sulphate	
MS, MSO4**	morphine sulphate	
MTX	methotrexate	
NoAC	novel/new oral anticoagulant	
PCA	procainamide	
PTU	Propylthiouracil	
T3	Tylenol with codeine No. 3	
TAC	triamcinolone	
TNK	TNKase	
TPA or tPA	tissue plasminogen activator, Activase (alteplase)	
ZnSO4	zinc sulphate	
Stemmed drug names “Nitro” drip	nitroglycerin infusion	34
“Norflox”	norfloxacin	
“IV Vanc”	intravenous vancomycin	
symbols		
X3d	For 3 days	35
>And <	More than and less than	36

/ (slash mark)	Separates two doses or indicates per	37
@	At	38
&	And	39
+	Plus or and	40
°	Hour	41
Φ or ⌀	Zero , null sign	42
OW	Once weekly	43
SL or S/L	sublingual	44
TID	Three times a day	45
6/24	Every 6 hours	46
1/7	For one day	47
1/2	Half	48
i, ii,iii,iv (Roman numerals)	1,2,3,4 etc	49
10*6 etc	one million	50
BID, bid	Twice a day	51

Appendix C: Completion of discharge summary domains from medical wards in KNH

Domain		**Frequency (n)**	**Percent (%)**
Designation of author of prescription	No author	284	99
	MOI	2	0.7
	SHO	1	0.3
Patient address	Indicated	34	11.8
	Missing	254	88.2
Clinic	Indicated	256	88.9
	Missing	32	11.1
Firm	Indicated	11	3.8
	Missing	277	96.2
Date of **clinic**	Indicated	237	82.3
	Missing	51	17.7
Time of **clinic**	Indicated	211	73.3
	Missing	77	26.7
Name of discharging clinician	Present	287	99.7
	Missing	1	0.3
Signature of discharging clinician	Indicated	288	100
	Missing	0	0
Complete discharge summary	Yes	0	0
	No	288	100

Appendix D: Types of Error prone abbreviations

Table 7: Top 5 types of error prone abbreviations

Error type	**Total number of discharge summaries with error type**	**Total number of errors in discharge summaries**	**Abbreviation**	**Intended meaning**
31	147	359	Numerical dose and unit of measure run together (e.g., 10mg, 100mL)	10 mg 100 mL
11	122	310	o.d. or OD	Once daily
33	100	260	Drug name abbreviations eg AZT	Zidovudine
40	58	95	+	Plus or and
39	49	59	&	And

Appendix E: budget and rationale:

ITEM	QUANTITY	UNIT PRICE	TOTAL (KSH)
SUPPLIES			
Biro Pens	4	20.00	80.00
Pencils	2	12.00	24.00
Box file	2	150.00	300.00
Spring files	2	120.00	240.00
Pencils sharpener	1	45.00	45.00
White out pen	1	85.00	85.00
Folder	1	120.00	120.00
Staple	1	245.00	245.00
Paper Punch	1	550.00	550.00
Staple Remover	1	235.00	235.00
Note book	2	85.00	170.00

TOTAL SUPPLIES			**2,094.00**
OTHERS			
Printing	1	8,000.00	8,000.00
Photocopying	400	3.00	1,200.00
Final proposal booklet	8	500.00	4,000.00
Ethic committee book	1	2,000.00	2,000.00
TOTAL OTHER			**15,200.00**
Communication	1	5,000.00	5,000.00
Transport	1	5,000.00	5,000.00
Data Statistician	1	20,000.00	20,000.00
TOTAL PERSONNEL			**30,000.00**
TOTAL EXPENSES			**47,294.00**

This budget includes the cost of supplies (which would include stationery) and others which consists of printing, photocopying, and ethics charges. Total personnel costs include; transport costs to and from Kenyatta National Hospital, communication and data analysis by the statistician. Total will amount to 47,294.00 Kenyan shillings only.