Early identification and elective inpatient management of high-risk people living with diabetes diagnosed with COVID-19 decreases morbidity and mortality: a quasi-experimental study

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DECLARATION

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ABSTRACT:

Introduction:

The Diabetes-COVID-19 relationship is complex, resulting in increased morbidity and mortality. In response to this enhanced vulnerability of people living with diabetes (PLWD) to COVID-19 morbidity and mortality, the Western Cape Department of Health established a telemedicine team (the VECTOR team) that fast tracked at-risk PLWD diagnosed with COVID-19 into the Hospital of Hope (HOH), a temporary intermediate health care facility (ICHF) established as a field hospital to cater for the anticipated overburdening of the acute hospitals in the Cape Metro. This study evaluated the effects of implementing a telemedicine mediated rapid admission process and applying a tertiary hospital practice guideline (the High Risk Diabetes-COVID-19 protocol - HRDCp) for treating high risk PLWD who were electively admitted to a field hospital.

Aim*:*
To assess the impact of early admission and application of a clinical practice guideline (HRDCp) developed for use at a specialised tertiary facility for the inpatient care of PLWD who were diagnosed with COVID-19, on clinical outcomes in a generalist run, intermediate healthcare facility.

***Methods*:**
Using a retrospective quasi-experimental study design applied to the clinical dataset for the HOH, patients admitted prior to the implementation of the clinical protocol (control group) were compared to those admitted via the telemedicine team, who received care using the clinical protocol (experimental group). A total of 183 patients were included in this study. Using secondary data from the hospital clinical dataset, baseline characteristics, inpatient clinical cou and clinical outcomes were compared between these two groups.

Findings:
The key findings showed that the experimental and control groups were similar at baseline for age, gender, renal function and co-morbidity. Glucose control on admission was better in the experimental than in the control group [HbA1C 8.1 vs 9.3% (p=0.013); HGT 10.2 vs 10.7 g/dL (p=0.039)].The experimental group needed less oxygen (p<0.001), less antibiotics (p<0.001), and less steroids (p=0.003), while the control group had a higher incidence of acute kidney injury during admission (p=0.046). The median inpatient glucose control was better in the experimental group (8.3 vs 10.0; p=0.006). The two groups had statistically similar clinical outcomes for discharge home (94% vs 89%), escalation in care (2% vs 3%) and inpatient death (4% vs 8%).

Ethical considerations: Ethics approval was obtained from the Human Research Council University of Cape Town. (HREC 502/2020)

Conclusions:

This study demonstrated a novel approach that foregrounds risk of adverse outcomes as criteria for elective admission. Aggressive management had comparably good outcomes versus the usual practice of waiting for severe disease to arise and subsequent emergency admission. While showing non-inferiority to usual care in terms of clinical outcomes, it is suggested that significant savings were made in terms of financial costs and emotional distress.

INTRODUCTION AND LITERATURE REVIEW

In November 2019, the world was informed of the first cases of Coronavirus Disease in 2019 (COVID-19) caused by SARS-CoV-2, which rapidly escalated into a full-blown pandemic in early 2020. In Italy, it was noted that diabetes mellitus (DM) was three times more prevalent in patients with severe COVID- 19 than in the general population.[1] It was thus anticipated that DM would also predispose to increased severity of COVID -19 in South Africa.[1]

South Africa is a lower-middle income country that lacks data on the role of intermediate care services in the health system.[2] In preparation for the COVID-19 pandemic, the government set up field hospitals to ensure that patients infected with COVID-19 would be adequately treated in an already strained health system. In Cape Town, the first field hospital, the 862-bed Hospital of Hope (HoH) was erected in the Cape Town International Convention Centre (CTICC). It was set up in May 2020 and admitted the first patient on 8 June 2020.The HoH offered inpatient intermediate care which included oxygen support, intravenous fluid and medical management, access to mobile x-rays, physiotherapists, dieticians, social workers, an onsite pharmacy and support from a nearby laboratory.[3]

DM is a global public health problem and is one of the leading causes of morbidity and mortality worldwide.[1] This is especially concerning in South Africa where the healthcare system is not only overwhelmed by the escalating prevalence of non-communicable diseases (NCD's) but carries an additional burden of disease due to the Tuberculosis and HIV epidemics.[1]

DM can be regarded as a chronic inflammatory condition characterised by multiple metabolic and vascular abnormalities. There is also a dysregulated immune response increasing the diabetic patient's risk of infections.[4] This, together with an augmented inflammatory process, may contribute to the underlying mechanism that leads to a higher propensity to infections with worse outcomes.[4] Evidence suggests that SARS –COV-2 induces a vigorous innate immune response leading to a "cytokine storm" which is thought to play a critical role in the high mortality of patients with COVID-19.[5] The "cytokine storm" is a crucial cause of Acute Respiratory Distress Syndrome (ARDS), a systemic inflammatory response, and multiple organ failure.[6] The onset of dyspnoea and ARDS usually occurs at a median of 5 and 8 days, respectively.[7] Recently, the pulmonary pathology of SARS-CoV-2 infection was shown to be diffuse alveolar damage, alveolar oedema with proteinaceous exudates, thickening of alveolar walls, desquamation of pneumocytes and hyaline membrane formation, all indicative of ARDS.[8] The presence of Type 2 DM (T2DM) with chronic inflammation and other associated co-morbidities may allow unrestricted viral replication and trigger heightened levels of inflammation, hyper-immune reaction, and greatly exacerbate the response to SARS-CoV-2.[5]

A retrospective multi-centre study in Hubei Province, China investigated 952 patients with pre-existing T2DM who were also diagnosed with COVID-19. This study suggested that PLWD required more medical interventions and had a significantly higher mortality [7.8% versus 2.7%; adjusted hazard ratio (HR), 1.49] and multiple organ injury than those without DM.[9] This study also found that if glycaemic variability was maintained between 3.9 and 10mmol/l, there was a significant reduction in medical interventions, major organ injuries and all-cause mortality.[9] Glycaemic variability has been shown to be an important indicator and a possible risk predictor for death and other complications in individuals with T2DM.[10] Efforts to ensure good inpatient glycaemic control are therefore the cornerstone in the management of PLWD who are diagnosed with COVID-19. To obtain good glycaemic control in the context of field hospitals with rapid turnover of patients and inexperienced staff, the use of clinical protocols assumes increased importance.

In a systematic review and meta-analysis that included 475 publications, the weighted prevalence of mortality in hospitalised COVID-19 patients with DM (20.0 %, 95 % CI: 15.0–26.0; I^2, 96.8 %) was 82 % (1.82-time) higher than that in non-DM patients (11.0 %, 95 % CI: 5.0–16.0; I^2, 99.3 %). The prevalence of mortality among DM patients was highest in Europe (28.0 %; 95 % CI: 14.0–44.0) followed by the United States (20.0 %, 95 % CI: 11.0–32.0) and Asia (17.0 %, 95 % CI: 8.0–28.0. The weighted prevalence of DM among hospitalized COVID-19 patients was 20 % (95 % confidence interval [CI]: 15–25, I^2, 99.3 %).[37]

National guidelines and standards of care for DM are now available in many countries.[11] Translation of practice recommendations from Developed countries to the practical care of PLWD living in Developing countries is challenging as there is differential access to various aspects of care. [11]

Davies *et al* (2020) showed that COVID-19 and DM co-morbidity had dramatically higher mortality rates than COVID-19 patients without DM.[12] Local data also similarly demonstrated that there is an increased mortality in patients diagnosed with COVID-19 who were older in age, had diabetes mellitus, hypertension and renal impairment.[13] It was therefore decided to offer high risk PLWD an elective admission to the CTICC HOH, with the hypothesis that this would prevent increased morbidity and mortality. High risk PLWD (age >65 years, renal impairment) diagnosed with COVID-19 who did not fulfil criteria for acute hospital admission at the time of their COVID -19 diagnosis, were identified from the provincial data centre, and offered direct elective admission into the HoH via a telemedicine service (dubbed the VECTOR team).[13] Since there was a lack of robust scientific data, a consensus document on inpatient DM management in the form of inpatient practice guidelines were adapted from a nearby tertiary hospital, Groote Schuur Hospital, and implemented at the HoH.

This study evaluated the effect of implementing a practice protocol (the High Risk Diabetes-COVID-19 protocol - HRDCp) that pro-actively identified PLWD at high risk of adverse outcomes from COVID-19, offered them elective admission directly to the HoH, and applied a tertiary hospital practice guideline (Appendix A) for their inpatient glycaemic management. This was an important step in validating this guide for treating high risk PLWD in a field hospital and outside of a tertiary centre. This study demonstrated the benefits of using a tertiary hospital guideline in a less costly intermediate care centre.

This study has implications for other COVID-19 field hospitals, and possibly district level hospitals in South Africa, and could inform strategy to prevent deaths in this high risk cohort. Proving the successful application of guidance from tertiary hospitals in field hospitals with mentorship from specialists at tertiary centres, could help overcome the lack of access to specialist care in many parts of South Africa. Data from this pilot study could be used to design a larger more representative study assessing whether this innovative idea could be used more widespread to improve care of PLWD that access their care in peripheral hospitals.

Aims and Objectives of the Study:

Aims:

To assess the impact of early elective admission of high risk PLWD diagnosed with COVID-19 and the application of a clinical practice guideline (HRDCp) on clinical outcomes in a generalist-run, intermediate care facility.

This aimed to fulfil the following objectives:

A. To describe the demographics and baseline characteristics of high-risk PLWD electively admitted to the HoH, and compare with a control cohort of PLWD who received usual care.
B. To describe the inpatient clinical course of this cohort, and compare with a control cohort who received usual care.
C. To describe the clinical outcomes of this cohort, and compare with a control cohort who received usual care.

Method:

Study setting:

The district health system in the Western Cape comprises 6 districts, five rural and one located in urban Cape Town. The Cape Town Metro district is further subdivided into 8 sub-districts paired to form four sub-structures. It is to the sub-structure level that governance powers are decentralised. Hospitals in all these Metro sub-structures, and tertiary hospitals in Cape Town, referred patients to the HoH, according to agreed-upon referral criteria (Appendix B).

The HoH medical staff comprised of 7 teams. Each team had a team leader, who was a senior clinician in Family Medicine (5 teams), Internal Medicine (1 team) or Emergency Medicine (1 team). The cohort of patients (cases) included in this study were mostly cared for by Family Medicine-led teams. The HRDCp was implemented in the treatment of the experimental cohort of patients for inpatient management. Patients were preferably admitted for at least 8 days to ensure that they did not decompensate during the time period in which the "cytokine storm" was expected to occur.

Study Design:

This was a retrospective quasi-experimental study doing secondary analysis of an existing database that has Human Research Ethics Committee (HREC) approval (HREC ref: 502/2020) from the University of Cape Town. This study design was used to assess a real world intervention, retrospectively, between two pre-defined groups of PLWD.

Study population:

High risk PLWD satisfying the inclusion criteria were identified by using a database from the Western Cape Data Centre. Code-named VECTOR (Virtual Emergency Care Tactical OpeRation) a group of medical officers obtained data from the data centre, which ran an algorithm to generate a line list of high-risk PLWD with a COVID-19 diagnosis in a 10-day window. [13] These patients were then allocated to the medical officers who contacted them telephonically to offer them elective admission to the HOH.

All 61 patients who accepted admission to the HoH via the telemedicine (VECTOR) community group were included as the experimental group, while 122 purposively selected patients matching the inclusion criteria below in a 2:1 ratio were identified from those admitted prior to the introduction of the intervention (HRDCp) to make up the control group. The two groups were matched for age, gender and renal function.

Inclusion and exclusion Criteria:

- Type I or II Diabetes Mellitus with COVID-19 (PCR or clinical diagnosis) AND
    - Renal Impairment (Creatinine of more than 100) OR
    - Age older than or equal to 65 years of age.

Renal impairment was defined using the RIFLE criteria which included a raise in creatinine which results in Risk, Injury, Failure, Loss of kidney function, and End-stage kidney disease.[36] See Appendix F.

Exclusion criteria:

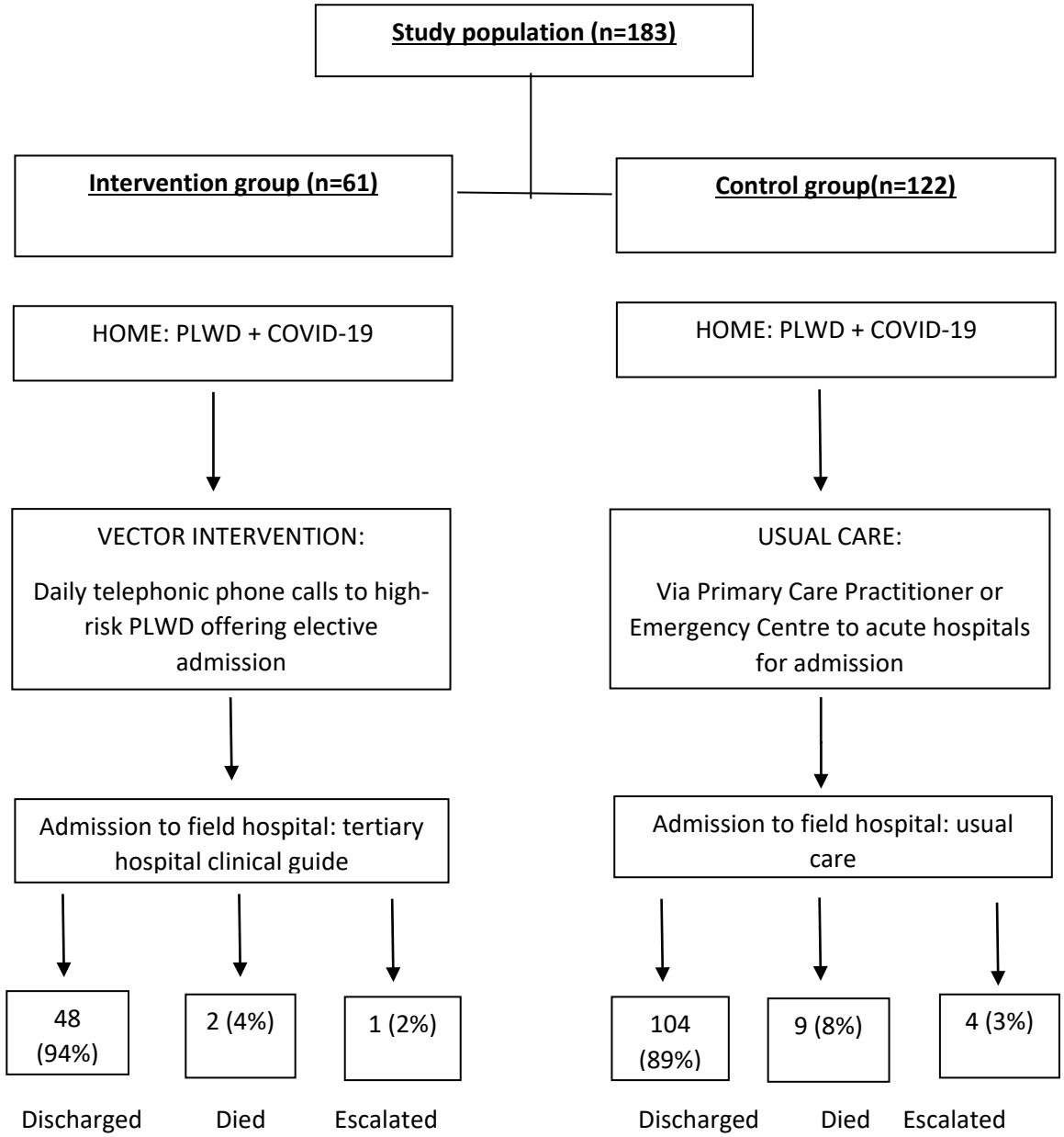
- Age younger than 65 and normal renal function
- For controls - admitted after the HRDCp was introduced, and not part of the VECTOR cohort

Data collection:

Data was extracted from the HoH clinical database (described earlier) using a data extraction tool that was designed by the research team and piloted on five PLWD who were not part of this study and modified accordingly.

The data extraction tool is attached as Appendix C.

Figure 1: Care pathways for intervention and control cohorts



**Missing data for final outcome [n=15 participants]*

Statistical analysis:

Data were analysed using Stata 14. Patient characteristics, co-morbidities and outcomes were compared using $\chi 2$ or Fisher's exact tests for categorical data and Wilcoxon rank-sum (Mann-Whitney) tests for continuous data. All statistical tests were two-sided with significance set at $\alpha=0.05$.

Ethical considerations:

Risks:

The study proposal was approved by the UCT HREC (HREC 502/2020 – Appendix E). Permission to access the records was obtained from the Provincial Research Committee of the Western Cape Department of Health. No identifying data was used during the assimilation of data in this study. There was no risk to patients in this study.

Benefits:

Data was collected on the inpatient treatment of PLWD. This will add to the limited pool of data on inpatient diabetes treatment available in the South African context.

Findings:

The VECTOR team contacted high-risk PLWD satisfying the inclusion and exclusion criteria during the period under study. All were offered elective admission but only 61 consented, forming the Experimental Group. For the Control Group, 122 PLWD were identified from the dataset and included in this group. The baseline characteristics and demographics of both populations are shown in Table 1.

The two groups were similarly matched for age (median 66yrs vs 65yrs), gender (identical ratios) and renal function [eGFR (mL/min/1.73 m^2)61 vs 66; p=0.546].

Table 1: Baseline characteristics of the study population.

Variable	Total sample	Experimental Group	Control Group	P-value	Missing data
Number of patients	183	61	122	-	-
Median age [IQR]	66 [62, 71]	66 [62, 71]	65 [61, 71]	-	-
Sex:					
Female	111 (61%)	37 (61%)	74 (61%)		
Male	72 (39%)	24 (39%)	48 (39%)	-	-
Median [IQR] HbA1C	9.1 [7.2, 11.1]	8.1 [7.1, 10.3]	9.3 [7.3, 12.1]	0.013	n=7

Median Creatinine [IQR]	81 [66, 104]	78 [65, 100]	83 [66, 110]	-	n=1
Median [IQR] eGFR	65 [52, 91]	61 [52, 90]	66 [52, 92]	0.548	n=2
Median [IQR] Hb	12.8 [11.5, 14.1]	12.4 [11.4, 13.9]	12.8 [11.6, 14.1]	0.406	n=11
Median [IQR] Hgt at admission	10.6 [7.2, 14.5]	10.2 [6.6, 13.1]	10.7 [7.8, 15.3]	0.039	n=39
Co-morbidities:					
Hypertension	141(82%)	44 (85%)	97 (82%)	0.624	
Chronic obstructive pulmonary disease/smoking	21 (12%)	3 (6%)	18 (15%)	0.127	
Overweight/Obesity	28 (16%)	6 (12%)	22 (18%)	0.259	
Ischaemic heart disease	10 (6%)	5 (10%)	5 (4%)	0.174	
CKD	25 (15%)	10 (19%)	15 (13%)	0.259	
HIV	8 (5%)	1 (2%)	7 (6%)	0.437	
CCF	17 (10%)	2 (4%)	15 (13%)	0.098	
Other[2]	80 (47%)	23 (44%)	57 (48%)	0.658	

[1] Individual patients may have more than one co-morbidity

[2]"Other" group includes: Hyperlipidaemia; peripheral vascular disease; hypothyroidism; peptic ulcer disease; asthma; liver disease; myeloma; myeloproliferative disease; cerebrovascular accidents; atrial fibrillation and flutter; osteoarthritis; gout; benign prostatic hypertrophy; dementia; neurocognitive disorders; left ventricular hypertrophy; lymphoma; burns; urinary tract infection; pulmonary and disseminated tuberculosis; polio; colon cancer; physical disabilities

[3]Missing data accounts for the missing percentages

There was no significant difference in any co-morbidity between the groups (Table 1). Hypertension was the most common co-morbidity (85% vs 82%) in both groups. The next most prevalent co-morbidities were Chronic Kidney Disease (CKD) (19%), overweight/obesity (12%) and ischaemic heart disease in the Experimental Group. Overweight/obesity (18%), chronic obstructive pulmonary disease (15%), chronic kidney disease (CKD) (13%) and congestive cardiac failure (13%) were prevalent in the Control Group.

On admission the Experimental Group had significantly better diabetes control than the Control Group [HBA1C 8.1% (7.1, 10.3) vs 9.3% (7.3, 12.1), p=0.013]; admission random glucose 10.2mmol/L (6.6, 13.1) vs 10.7mmol/L (7.8, 15.3), p=0.039].

Table 2: **Inpatient glycaemic control and interventions:**

Variable	Total Sample	Experimental Group	Control Group	P value	Missing Data
Median Hgt: *Median[IQR[*	9.4 [7.6, 11.8]	8.3 [6.9, 10.4]	10.0 [7.7, 12.5]	0.006	n=39
One or more hypoglycaemic episodes during admission: *Absolute no(proportion)*	44 (27%)	13 (25%)	31 (28%)	0.721	n=22
One or more hyperglycaemic episodes during admission: *Absolute no(proportion)*	117 (82%)	37 (82%)	80 (82%)	0.932	n=40
Hgt at discharge: *Median[IQR]*	7.7 [6.3, 10.2]	7.4 [5.3, 9.4]	8.1 [6.6, 10.8]	0.032	n=32
Insulin at admission: *Absolute no(proportion)*	63 (37%)	18 (36%)	45 (38%)	0.824	n=14
Insulin at discharge: *Absolute no(proportion)*	85 (51%)	22 (44%)	63 (54%)	0.244	n=16
Dietician: *Absolute no(proportion)*	54 (37%)	21 (46%)	33 (33%)	0.141	n=37
Oxygen[1] : *Absolute no:*					
Room air	60 (35%)	38 (73%)	22 (18%)	<0.001	n=11
Nasal cannula	78 (45%)	11 (21%)	67 (56%)	<0.001	n=11
Face mask (40%)	17 (10%)	2 (4%)	15 (13%)	0.071	n=18
Non-rebreather					

mask					
Double barrel*	15 (9%)	1 (2%)	14 (12%)	0.041	n=11
	3 (2%)	0 (0%)	3 (3%)	0.554	n=11
Days on oxygen:					
Median [IQR]	2 [0, 5]	0 [0, 1]	4 [1, 6]	<0.001	n=11
Antibiotic use:					
Absolute no(proportion)	46 (27%)	5 (9%)	41 (35%)	<0.001	n=13
Steroid use[1]:					
Absolute no(proportion)					
Oral use	80 (47%)	16 (30%)	64 (55%)	0.003	
Intravenous use	18 (11%)	0 (0%)	18 (15%)	0.001	n=13

* non-rebreather face mask oxygen plus nasal cannula oxygen

* missing data accounts for missing percentages in the table

The majority of participants in the experimental group (73%) only required room air in contrast to the participants in the control group where the majority required oxygen. 56 % (11) required nasal cannula oxygen and 28 % required some type of face mask oxygen. Participants in the experimental group required non-rebreather facemasks as their highest level of oxygen (2%) versus 12% in the control group (p=0.041), while some matched controls additionally required double barrel oxygen (3%) as their highest level of oxygen requirement.

Antibiotics were more commonly used in the control group (35% vs 9%; p<0.001). Corticosteroids (oral and intravenous) were also more commonly used in the control group (55% vs 15%; p<0.005).

Additionally, participants in the experimental group had significantly lower admission finger prick glucose results compared to those in the control group (8.3 vs 10.0mmol/L, p=0.006).The discharge glucose levels, insulin requirements and glucose-related adverse events were similar in both groups.

Table 3: Adverse events and clinical outcomes of participants admitted to the HoH.

Variable	Total sample	Experimental Group	Control Group	P-value	Missing data
Number of patients	183	61	122	-	-
Median [IQR] duration of stay	6 [3, 8]	5 [3, 8]	6 [4, 9]	0.040	n=12
Adverse events[1]	28 (16%)	4 (8%)	24 (20%)	0.046	n=11

AKI	5 (3%)	0 (0%)	5 (4%)	0.324	
DKA	8 (5%)	0 (0%)	8 (7%)	0.108	
Acute confusional state	4 (2%)	1 (2%)	3 (3%)	1.000	
Hypoglycaemia	8 (5%)	2 (4%)	6 (5%)	1.000	
Other					
Escalation to acute care	10 (6%)	1 (2%)	9 (8%)	0.286	n=11
Mortality	11 (6%)	2 (4%)	9 (8%)	0.508	n=11
Disposition/discharge					
Home	152 (90%)	48 (94%)	104 (89%)		
Acute care	5 (3%)	1 (2%)	4 (3%)		
Death	11 (7%)	2 (4%)	9 (8%)	0.667	n=15

[1] Individual patients may appear in more than one sub-group

[2]Missing data accounts for the missing percentages.

Table 3 indicates the adverse events and clinical outcomes that occurred in the two groups. Participants in the experimental group had a shorter hospital stay than those in the control group (5 vs 6 days, p=0.04). Acute kidney injury occurred less frequently in the experimental group (8% vs 20%, p=0.046). Less participants in the experimental group required escalation of care (2% vs 8%, p=0.286), although this was not statistically significant. Similarly, a lower proportion of participants in the experimental group died in hospital, though the difference was not statistically significant (4% vs 8%; p=0.508). The proportion of patients discharged home was similar (94% vs 89%).

OUTCOME MEASURES:

The Experimental Group had significantly better diabetes control than the Control Group [HBA1C 8.1% (7.1, 10.3) vs 9.3% (7.3, 12.1), p=0.013]. The discharge glucose levels, insulin requirements and glucose-related adverse events were similar in both groups.

In the experimental group, there was a shorter hospital stay(5 versus 6 days, p=0.04), less occurrence of Acute kidney injury(p=0.046), less escalation of care(p=0.286) and less mortality(p=0.508), although these were not statistically significant.

DISCUSSION:

The key findings of this study relate to the clinical course and outcomes in two groups of PLWD. High risk PLWD in the experimental group were managed with good outcomes at a field hospital. This will improve confidence in the future for the down referral of high-risk PLWD to intermediate care facilities.

Similar clinical outcomes were achieved without the extra cost and anxiety associated with acute hospital admissions.

Although the control and experimental cohorts were similar at pre-COVID-19 status, their COVID-19 clinical parameters were markedly different, explaining the significant differences in oxygen need, steroid use, antibiotic administration, and possibly glycaemic control. Hyperglycaemia, increased coagulation rate, and elevated release of pro-inflammatory cytokines all facilitate the severity of COVID-19 in PLWD.[14] The cytokine storm associated with SARS-CoV-2 is intensified by elevated concentrations of pro-inflammatory chemokines and cytokines in patients with underlying risk factors, ultimately converting it to a "cytokine super cyclone".[14] Further studies in this regard would be useful to validate that pre-emptive admission of high risk PLWD could prevent exacerbation of the COVID -19 storm and prevent associated mortality.

Acute kidney injury was found to be significantly more prevalent in the control group, this is likely to be multi-factorial but ultimately highlights that these participants had more severe COVID-19. In a study performed in Turkey which included 578 patients, the incidence of AKI at admission was higher in patients with CKD than those without CKD (52.1%vs 39.3% respectively, p=0.006).[15] In a study of 4020 consecutively hospitalized patients in Wuhan China, 285 were identified as having AKI and had an increased risk of inpatient mortality.[16] AKI, regardless of the cause, remains a key adverse event that clinicians should be wary of.

This study demonstrated that the most common co-morbidity amongst PLWD with COVID-19 at the HoH was hypertension. This is similar to other studies. In New York, a study amongst 5700 hospitalized patients with COVID-19 showed that 1808 patients (33.8%) had diabetes, 3026 (56.6%) had systemic hypertension while 1737 (41.7%) were obese.[17] Although the Body mass index (BMI) was recorded as raised in our study, exact values were not recorded and this was therefore difficult to interpret accurately. According to Crouse *et al*, 74% of PLWD were obese, which may have contributed to the increased risk observed in this population.[18] This study has lower values which may be indicative of the smaller sample size used in this study.

Using a tertiary-level clinical guideline proved to be a feasible option in this study, resulting in safe and effective management of diabetes compared to usual care. In the context of Diabetes-COVID-19 in a field hospital, where tight glycaemic control is an important goal, realistic protocols are important tools to guide management decisions. A multi-centered study in Hubei, of over 7000 cases of COVID-19 reported a significant correlation between well-controlled blood glucose and lower levels of inflammatory markers.[19] In Michigan, tailored protocols and algorithms were developed to improve glycaemic control for 200 patients admitted with COVID-19 and this allowed them to react to surges in glucose levels driven by disease activity and reduce the burden on the primary teams.[20]

There was no significant difference in mortality between the two groups, however, the slightly higher mortality in the control group is probably suggestive of more severe COVID-19 necessitating admission versus milder disease in the experimental group. Similarly, more participants in the control group required escalation of care compared to those in the experimental group, though this was not statistically significant.

The advantage of the process of admitting patients pre-emptively via the VECTOR telemedicine group included a less complicated stay with fewer patients requiring escalation of care or oxygen. Nasal cannula oxygen could be initiated at an earlier stage in the disease process in 22% of the participants in the experimental group, which may have reduced the need for escalation to more

intensive oxygen therapy and invasive interventions. The highest level of oxygen required for those in the experimental group was 40% face mask oxygen whilst in the control group some participants required non-rebreather masks and/or "double barrel" (nasal cannula and 40% facemask) oxygen.

An important finding is that the clinical outcomes of the two groups were similar. It is not possible to predict the clinical course for the participants in the experimental group had they not been offered elective admission. At the time, participants in the experimental group represented a group that had a high likelihood of requiring admission, needing critical care and dying. In this group 94% were discharged home without having to potentially endure the anxieties associated with admission to an acute hospital, most often via an emergency center. In China, a study including 1733 patients from hospital, after having been diagnosed with COVID-19, found that 23% of patients reported symptoms of anxiety or depression.[21]Another study in China reported that patients viewed their first three days in a COVID-19 ward negatively and 38% of patients screened positive for either anxiety or depression or both.[22] Multiple negative emotional states were reported at the time of their COVID-19 diagnosis including shock (n=36;72%), panic and anxiety (n=34;68%) and thoughts of "going to die" with 16% of patients rating high scores.[27]A study in China reported post-traumatic stress symptoms in 96.2% of patients. [23] Given the reporting of the burden of emotional turmoil in COVID-19 patients, one could assume that simplifying the pathway of admission for patients, as in this study, could reduce distress, anxiety and post-traumatic stress in high risk PLWD electively admitted with COVID-19.

Our study assists with strengthening the case for admitting high risk PLWD earlier during the course of their COVID-19 into an intermediate care facility which facilitated less complicated admission procedures and earlier oxygen therapy if required. It also demonstrated that elective admission of high risk PLWD had favourable glycaemic outcomes and assists with the validation of the use of standardized clinical practice guidelines outside of a tertiary care facility. This is supported by the study by David *et al* (2021) which described the cost effectiveness of the telemedicine (VECTOR) intervention and demonstrated reductions in mortality across all risk strata in excess of 20% with pre-emptive hospital admission of high risk PLWD, which demonstrated positive qualitative outcomes based on improved patient experiences.[13]

Total cost-to-company of the VECTOR intervention was approximately R728 000.00 prior to the second wave averaging out at R19.00 per call for the first 3842 patients each receiving an average of 10 calls.[13] Weighed against the cost of inpatient care, this compares quite favourably. In the experimental group the cost of emergency admissions, acute hospital stays, increased oxygen and medication consumption would have been significantly lower, if costing measures had been applied to it. A cost per admission of R75 127 was estimated for inpatient management of severe and critical COVID-19 patients in a general ward. [24] A study conducted in South Africa in 2007 estimated that the unit cost per acute inpatient days was between US dollars 38.04-103.68. In 2007 this would have equated to approximately R270.46 and R737.16.[25] Taking inflation into account, this rand value in 2021 would be ZAR 572-1 562 per patient daily.[26] The implied cost savings for eliminating the acute hospital stays in the experimental group in our study would warrant further investigation and would be immensely important in the current resource constrained environment.

Limitations of the study include the small sample size, missing clinical data and the fact that this study compared PLWD not satisfying usual admission criteria to those that met the usual criteria for admission i.e., at admission they had more severe COVID-19. Another Limitation of the study is that the design is of a quasi-experimental design which does not use random sampling in constructing experimental and control groups and has low internal validity.[35] Using non-uniform comparison groups can limit generalization of the findings because non-controlled variables may have influenced

the results. While useful for health systems research , the strength of the evidence is not equal to a randomised controlled trial due to uncontrolled confounding factors in real life. Larger, randomized-controlled trials are required comparing the outcomes of glycaemic management at a field hospital of PLWD with similar COVID-19 disease severity. The telemedicine group at a later stage admitted patients that were not only high risk, but intermediate and low risk. These patients did not strictly fulfil the inclusion criteria but were included in this study because they were a part of the diabetic cohort that were admitted to the intermediate care facility. A sub-analysis was later performed to include the patients who strictly fulfilled high risk criteria. The study was limited in that it did not investigate the management of the patient beyond the intermediate care setting. However, this pilot study is re-assuring in that high-risk PLWD, from a safety point-of-view, could be adequately managed at a field hospital.

CONCLUSION:

This study compared a novel approach to managing risk for adverse outcomes by early admission and tight diabetes control to usual practice of waiting for severe disease to arise and subsequent emergency admission. While showing non-inferiority to usual care in terms of clinical outcomes in the context of a field hospital, it is suggested that savings were made in terms of medical complications, financial cost, emotional distress and the psychosocial dimensions of COVID-19.

Further studies should look at how technology can assist in the co-ordination of care across all levels of the health system, the role of clinical risk factors as criteria for elective escalation of health care, and ways to enhance interdisciplinary, inter-facility, and vertical collaborations.

Conflict of Interest:

The researcher was directly involved with the management of the diabetic patients at the intermediate care facility and this may have presented a bias in presentation of the results.

No financial conflict of interest identified.

No academic bias identified.

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APPENDICES:

APPENDIX A: **Groote Schuur Practice guidelines for patients with Diabetes and COVID-19**

Please see attached PDF document Appendix A1 and Appendix A2

APPENDIX B: **Referral criteria for community diabetics to the CTICC Hospital of Hope Intermediate Care Facility**.

APPENDIX C: **Data Extraction tool**

Please see attached Excel document Appendix C.

APPENDIX D: **Supplementary Table 1, Table 2 and 3 and Supplementary Figures 1,2,3,4 and 5**.

APPENDIX E: **HREC 502/2020**

APPENDIX F: **RIFLE CRITERIA**

APPENDIX A: **Please see attached pdf document.**

APPENDIX B: **Referral criteria for community people living with diabetes(PLWD) to the CTICC Hospital of Hope Intermediate Care Facility**

- Type I or II diabetes mellitus with COVID-19 (PCR or clinical diagnosis) AND
  - Renal Impairment (Cr>100) OR
  - Age older than 65yrs

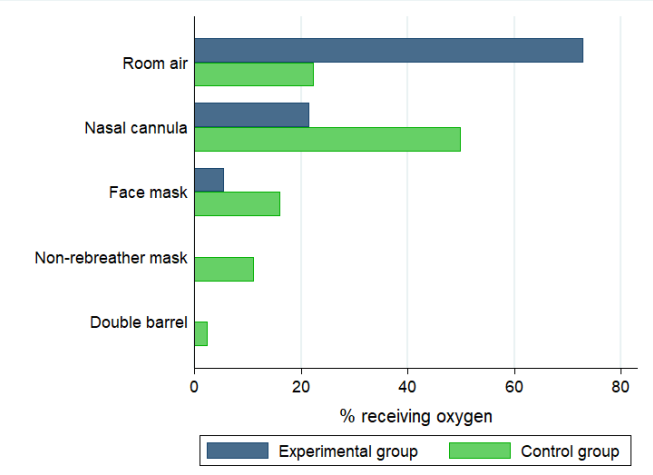
APPENDIX D: **Supplementary Table 1, Table 2 and 3 and Supplementary Figures 1,2,3,4 and 5**.

Supplementary Table 1 Demographic characteristics and clinical parameters, restricted to patients aged ≥65 years or with creatinine>100umol/l

Variable	Total sample	Experimental Group	Control Group	P-value	Missing data
Number of patients	123	41	82	-	-
Median [IQR] age	69 [65, 73]	69 [66, 74]	69 [65, 73]	-	-
Gender					
Female	77 (63%)	27 (66%)	50 (61%)		
Male	46 (37%)	14 (34%)	32 (39%)	-	-
Median [IQR] HbA1C	8.4 [7.1,	7.5 [6.7, 9.7]	9.1 [7.3,	0.006	n=5

	10.5]		11.4]		
Median [IQR] Cr	88 [67, 137]	87 [69, 119]	89 [67, 138]	-	-
Median [IQR] eGFR	60 [39, 81]	60 [45, 75]	60 [39, 84]	0.680	n=1
Median [IQR] Hb	12.6 [11.3, 14.2]	12.4 [11.4, 14.0]	12.7 [11.1, 14.2]	0.609	n=5
Median [IQR] Hgt at admission	10.5 [7.2, 13.9]	10.2 [6.6, 13.1]	10.6 [7.9, 14.3]	0.180	n=25
Median [IQR] average Hgt	9.6 [7.5, 12.2]	7.6 [6.9, 10.2]	10.3 [8.2, 12.5]	0.002	n=25
One or more hypoglycaemic episodes during admission	35 (32%)	12 (33%)	23 (31%)	0.812	n=13
One or more hyperglycaemic episodes during admission	78 (80%)	27 (82%)	51 (80%)	0.802	n=26
Median [IQR] Hgt at discharge	7.8 [6.1, 11.3]	7.4 [5.3, 9.9]	8.5 [6.7, 12.1]	0.033	n=20
Insulin at admission	43 (37%)	10 (28%)	33 (41%)	0.165	n=7
Insulin at discharge	57 (50%)	12 (34%)	45 (58%)	0.021	n=10
Dietician	33 (33%)	14 (41%)	19 (29%)	0.231	n=24
Oxygen[1]					
Room air	45 (38%)	27 (73%)	18 (23%)	<0.001	n=6
Nasal cannula	48 (41%)	8 (22%)	40 (50%)	0.004	n=6
Face mask 40%	14 (13%)	2 (6%)	12 (16%)	0.139	n=13
Non-rebreather mask	9 (8%)	0 (0%)	9 (11%)	0.056	n=6
Double barrel	2 (2%)	0 (0%)	2 (3%)	1.000	n=6
Median [IQR] days on oxygen	1 [0, 5]	0 [0, 1]	3 [1, 6]	<0.001	n=6
Antibiotic use	33 (29%)	5 (14%)	28 (36%)	0.015	n=8
Steroid use[1]					
Oral use	45 (39%)	9 (24%)	36 (46%)	0.025	n=8
Intravenous use	12 (10%)	0 (0%)	12 (15%)	0.009	n=8
[1] Individual patients may appear in more than one sub-group					

Supplementary Figure 1 Oxygen therapy among participants in the experimental and control groups, restricted to patients aged ≥65 years or with creatinine >100umol/l



Supplementary Table 1 and Figure 2 demonstrate data of the subjects adhering strictly to the inclusion criteria i.e. Age >65 years and/or Cr >100umol/L. This includes a sample of 123 patients, 41 of whom where community diabetics (experimental group) and 82 of whom were the matched control cohort.

This sample shows a similar gender profile with the majority of patients being female in both the Experimental and Control Groups (66% and 61%; respectively). The median Cr in the Experimental Group was 87umol/L and the median Cr in the Control Group was 89umol/L. The median HGT was 7.6mmol/L in the Experimental Group and 10.3mmol/L in the Control Group.

Once again, the participants in the Experimental Group had less oxygen requirements compared to those in the Control Group, 73% of participants in the Experimental Group were on room air while 23% of the participants in the Control Group were on room air. 30% of the participants in the Experimental Group required oxygen versus the Control Group where 80% required oxygen. See supplementary Figure 1.

Supplementary Table 2 Co-morbidities, restricted to patients aged ≥65 years or with creatinine>100umol/L (n=116)[1]

Variable	Total sample	Experimental Group	Control Group	P-value
Number of patients	116	37	79	
Hypertension	99 (85%)	30 (81%)	69 (87%)	0.374
Chronic obstructive pulmonary disease/smoking	14 (12%)	3 (8%)	11 (14%)	0.543
Raised BMI/overweight	17 (15%)	4 (11%)	13 (16%)	0.576
Ischaemic heart disease	6 (5%)	4 (11%)	2 (3%)	0.081
CKD	24 (21%)	9 (24%)	15 (19%)	0.508
	6 (5%)	1 (3%)	5 (6%)	0.663

HIV CCF Other[2]	10 (9%)	2 (5%)	8 (10%)	0.499

[1] Individual patients may have more than one co-morbidity

[2]"Other" group includes: Hyperlipidaemia; peripheral vascular disease; hypothyroidism; peptic ulcer disease; asthma; liver disease; myeloma; myeloproliferative disease; cerebrovascular accidents; atrial fibrillation and flutter; osteoarthritis; gout; benign prostatic hypertrophy; dementia; neurocognitive disorders; left ventricular hypertrophy; lymphoma; burns; urinary tract infection; pulmonary and disseminated tuberculosis; polio; colon cancer; physical disabilities

Supplementary Figure 2 Co-morbidities among participants in the Experimental and Control Groups, restricted to patients aged ≥65 years or with creatinine>100umol/L

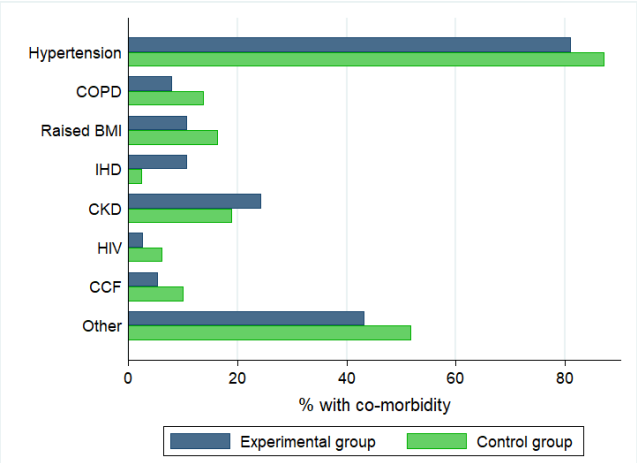


Table 5 and Figure 3 describe the co-morbidities of each group using the strict inclusion criteria. These show similar results with hypertension being the most common co-morbidity in both the Experimental and Control Groups (81% and 87%, respectively). Similarly, a high percentage of chronic kidney disease was present in the Experimental Group (24%), which was slightly higher than in the previous analysis. However, chronic kidney disease was much higher in the Control Group (19%) compared to the previous analysis.

Supplementary Table 3 Outcomes: Adverse events, adverse outcomes, and clinical interventions and outcomes, restricted to patients aged ≥65 years or with creatinine>100umol/L

Variable	Total sample	Experimental Group	Control Group	P-value	Missing data
Number of patients	123	41	82	-	-
Median [IQR] duration of stay	6 [3, 9]	5 [3, 8]	6 [3, 9]	0.210	n=7

Adverse events[1]					
AKI	26 (22%)	4 (11%)	22 (28%)	0.056	n=6
DKA	5 (4%)	0 (0%)	5 (6%)	0.178	n=6
Acute confusional state	5 (4%)	0 (0%)	5 (6%)	0.178	n=6
Hypoglycaemia	2 (2%)	1 (3%)	1 (1%)	0.534	n=6
Other	6 (5%)	2 (5%)	4 (5%)	1.000	n=6
Escalation to acute care	7 (6%)	1 (3%)	6 (8%)	0.429	n=6
Mortality	10 (9%)	2 (5%)	8 (10%)	0.501	n=6
Disposition/discharge					
Home	103 (90%)	33 (92%)	70 (89%)		
Acute care	2 (2%)	1 (3%)	1 (1%)		
Death	10 (9%)	2 (6%)	8 (10%)	0.543	n=8
[1] Individual patients may appear in more than one sub-group					

Supplementary Figure 3 Adverse events among participants in the Experimental and Control Groups, restricted to patients aged ≥65 years or with creatinine>100umol/L

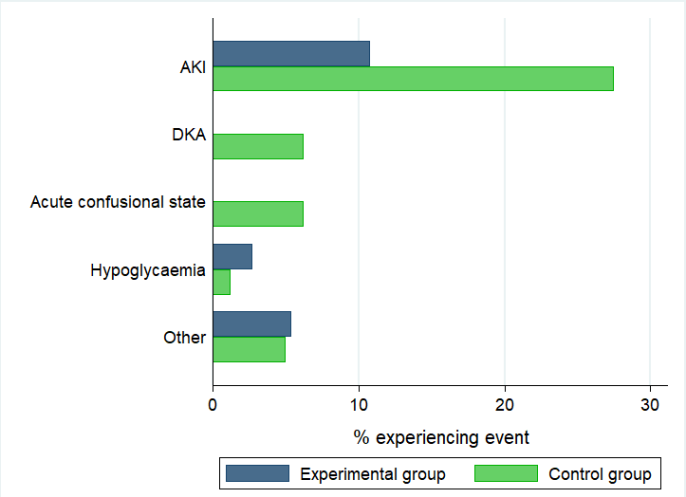
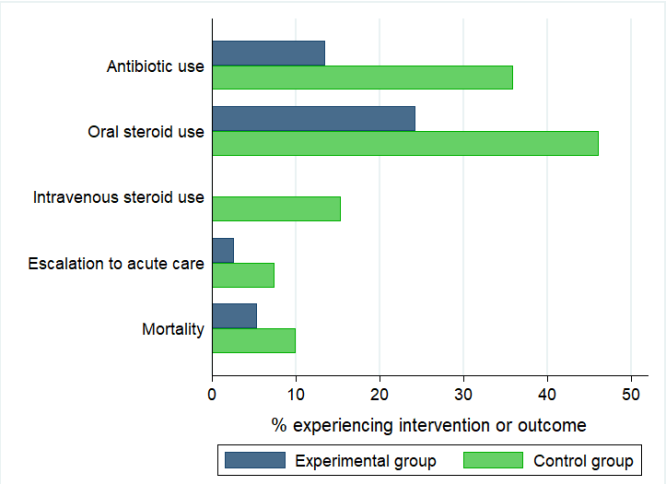


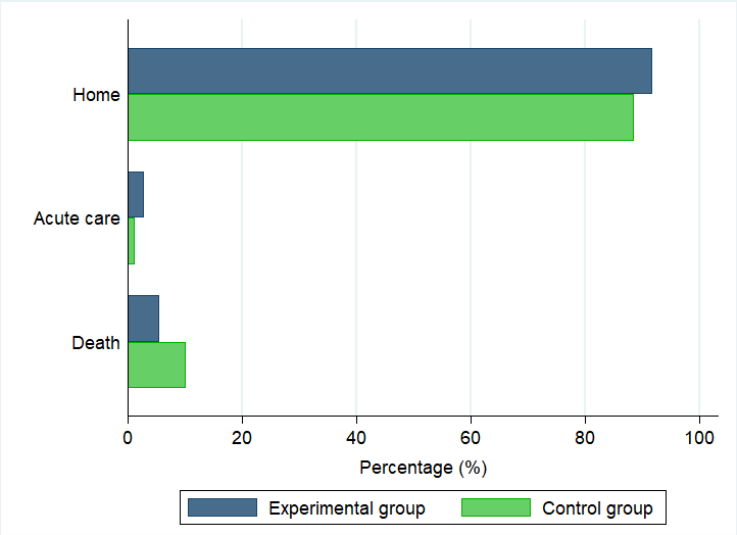
Table 6 and Figure 4 once again demonstrate the high prevalence of Acute Kidney injury (AKI) in both groups (11% in the Experimental Group and 28% in the Control Group). This is not statistically significant with a p value of 0.056. It was once again noted that the participants in the Experimental Group had a lower prevalence of AKI compared to those in the Control Group. Diabetic ketoacidosis (DKA) was more prevalent in the Control Group (6%) as well as acute confusional state (6%).

Supplementary Figure 4 Clinical interventions and outcomes among participants in the Experimental and Control Groups,restricted to patients aged ≥65 years or with creatinine>100umol/L



Figures 5 and 6 once again demonstrate the increased use of antibiotics (36%) in the Control Group. It shows that 89% of participants in the Experimental Group were discharged home and 87% of the participants in the Control Group were discharged home. Mortality amongst the participants in the Experimental Group was 5% (2) and 10% (8) amongst those in the Control Group.

Supplementary Figure 5 Disposition among participants in the Experimental and Control Groups, restricted to patients aged ≥65 years or with creatinine>100umol/L



Appendix F: RIFLE Criteria

Risk, Injury, Failure, Loss of kidney function and End-stage kidney disease (RIFLE) classification[a]

Class	GFR	UO
Risk	↑ SCr × 1.5 or ↓ GFR >25%	<0.5 mL/kg/h × 6 h
Injury	↑ SCr × 2 or ↓ GFR >50%	<0.5 mL/kg/h × 12 h
Failure	↑ SCr × 3 or ↓ GFR >75% or if baseline SCr ≥353.6 µmol/L(≥4 mg/dL) ↑ SCr >44.2 µmol/L(>0.5 mg/dL)	<0.3 mL/kg/h × 24 h or anuria × 12 h
Loss of kidney function	Complete loss of kidney function >4 weeks	
End-stage kidney disease	Complete loss of kidney function >3 months	

[a]GFR, glomerular filtration rate; UO, urine output; SCr, serum creatinine

FHS016: Annual Progress Report / Renewal

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This serves as notification of annual approval, including any documentation described below.			
☑ Approved	Annual progress report	Approved until/next renewal date	30.01.2023
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Comments to PI from the HREC

Principal Investigator to complete the following:

1. Protocol Information

Date (when submitting this form)	05 January 2022		
HREC REF Number	737/2020	Current Ethics Approval was granted until	30/11/2021
Protocol title	Diabetic care in an intermediate health care facility during a pandemic		
Protocol number (if applicable)			
Are there any sub-studies linked to this study?		☐ Yes	√☐ No
If yes, could you please provide the HREC Reference number for all sub-studies? Note: A separate FHS016 must be submitted for each sub-study.			
Principal Investigator	Dr Tasleem Ras		

(Note: Please complete the Closure form (FHS010) if the study is completed within the approval period)

Department / Office Internal Mail Address	Tasleem.ras@uct.ac.za

1.1 Does this protocol receive US Federal funding?	☐ Yes	√☐ No
1.2 If the study receives US Federal Funding, does the annual report require full committee approval? **Note:** Any annual approvals for **Full Committee** review MUST be submitted on the monthly HREC submission dates. (Please send electronic copy for full committee review to hrec-submission@uct.ac.za)	☐ Yes	☐ No

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3. Protocol status (tick ✓)

☐	Open Enrolment
☐	Closed to enrolment (tick ✓)
√☐	Research-related activities are ongoing
☐	Research-related activities are complete, long-term follow-up only
☐	Research-related activities are complete, data analysis only
☐	Main study is complete but sub-study research-related activities are ongoing
☐	Study is closed → Please submit a Study Closure Form (FHS010)

4. Enrolment

Number of participants enrolled to date	183
Number of participants enrolled, since last HREC Progress report (continuing review)	nil
Additional number of participants still required	nil

5. Refusals

Total number of refusals (participants invited to join the study, but refused to take part)	nil

(Note: Please complete the Closure form (FHS010) if the study is completed within the approval period)

6. Cumulative summary of participants

Total number of participants who provided consent	**Not applicable**
Number of participants determined to be ineligible (i.e. after screening)	nil
Number of participants currently active on the study	nil
Number of participants completed study (without events leading to withdrawal)	nil
Number of participants withdrawn at participants' request (i.e. changed their mind)	nil
Number of participants withdrawn by PI due to toxicity or adverse events	nil
Number of participants withdrawn by PI for other reasons (e.g. pregnancy, poor compliance)	nil
Number of participants lost to follow-up. Please comment below on reasons for loss of follow-up.	nil
Folder reviews used for this study.	
Number of participants no longer taking part for reasons not listed above. Please provide reasons below:	Not applicable

7. Progress of study

Please provide a brief summary of the research to date including the overall progress and the progress since the last annual report as well as any relevant comments/issues you would like to report to the HREC:
Folder reviews were performed of all folders. Study is complete and ready for submission for postgraduate Mmed Family Medicine degree for Dr Tatum Aronson. The HREC approval has expired in November 2021 and needs to be renewed in order for Dr Aronson to submit her research.

8. Protocol violations and exceptions (tick ✓ all that apply)

√☐	No prior violations or exceptions have occurred since the original approval
☐	Prior violations or exceptions have been reported since the last review and have already been acknowledged or approved
☐	Unreported minor violations that have occurred since the last review, as well as significant deviations not yet reported, are attached for review

9. Amendments (tick ✓ all that apply)

√☐	No Prior amendments have been made since the original approval

(Note: Please complete the Closure form (FHS010) if the study is completed within the approval period)

☐	Prior amendments have been reported since the last review and have already been approved
☐	New protocol changes/ amendments are requested as part of this continuing review (See note below)

Note: If new protocol changes are being requested in this review, please complete an amendment form (FHS006).
Specific changes in the amended protocol and consent/assent forms must be **bolded**, *italicised* or tracked and all changes must include a rationale.

10. Adverse events

10.1 Please provide below or attach a narrative summary of serious adverse events and/ or unanticipated problems since the last progress report. Please indicate changes made to the protocol and informed consent document(s) as a result (if not already reported to the HREC). Please comment on whether causality to any study procedure or intervention could be established.
No adverse events

10.2 Have participants received appropriate treatment/ follow-up/ referral when indicated (e.g. in the case of abnormal or incidental clinical findings, distress or anxiety)?		
☐ Yes	☐ No	√☐ Not applicable
If yes, please describe:		

11. Summary of Monitoring and Audit Activities (tick ✓)

11.1 Was this study monitored or audited by an external agency (e.g. SAHPRA, FDA)?		
☐ Yes	☐ No	√☐ Not applicable

11.2 Did a Data and Safety Monitoring Board publish a report?		
☐ Yes	☐ No	√☐ Not applicable

11.3 If yes, please identify the agency and attach a summary of the findings. NOT APPLICABLE					
Agency Name		Report attached	☐ Yes	☐ No	☐ Not applicable
		DSMB report attached	☐ Yes	☐ No	☐ Not applicable

11.4 Has there been any agency, institutional or other inquiry into non-compliance in this study, or any finding of non-compliance concerning a member of the research team?	
☐ Yes	√☐ No
If yes, please explain:	

(Note: Please complete the Closure form (FHS010) if the study is completed within the approval period)

12. Level of risk (tick ✓)

12.1 In light of your experience of this research, please indicate whether the level of risk to participants has:	
☐	Increased
☐	Decreased
√☐	Shown no change
If there has been a change, please explain:	
No risk to participants because this study comprised of folder reviews only.	

12.2 Please provide a narrative summary of recent relevant literature that may have a bearing on the level of risk.
Not applicable

13. Insurance

Please confirm that valid no fault insurance is still in place? (tick ✓)			
☐ Yes		√☐ No	
If yes, please complete the following:			
Insurer's name:			
Policy no.		*Coverage Period:	
For UCT sponsored studies please liaise the insurance office via fhs.sponsorship@uct.ac.za regarding the required documentation and information required obtain a renewed UCT No-fault Insurance Certificate.			

14. Statement of conflict of interest

Has there been any change in the conflict of interest status of this protocol since the original approval? (tick ✓)	
☐ Yes	√☐ No
If yes, please explain and if necessary, attach a revised conflict of interest statement (Section #7 in the New Protocol Application Form FHS013):	

15. Signature

My signature certifies that the above is complete and correct.			
Signature of PI		Date	10 Jan 2021

INITIAL in-hospital management of Diabetes and COVID-19

COVID-19 severity

Mild

RR < 30/min

O_2 sats ≥ 94%

Moderate

Severe

RR > 30/min

O_2 sats ≤ 94%

HbA1c or glucose

HbA1c ≤ 9%

or

glucose ≤ 12 mmol/L

HbA1c > 9%

or

glucose > 12 mmol/L

Diabetes management

- Continue pre-admission diabetes treatment
- Monitor fingerprick glucose
  - Fasting and before supper if on oral medication
  - Before each meal and 22h00 if on insulin
- Adjust treatment if glucose readings > 10 mmol/L
  - If on oral meds - stop oral meds and start insulin if average glucose is > 10 mmol/L
  - If on insulin - increase preceding insulin dose by 2 units every 24 hours if the glucose reading is above 10mmol/L
- Use insulin correction doses as below in **B**
- Use the simplest regimen possible to achieve glucose targets (see # below)
- Review diabetes control daily

- Stop pre-admission oral diabetes treatment
- Continue or start insulin
- #Insulin regimen to be determined by expertise and staff availability
  - Long-acting insulin bd (patients NOT eating/transient diabetes due to steroids)
    - Total daily dose (TDD) of insulin to give=0.3 units per kg of body weight
    - Give 2/3 TDD before breakfast and 1/3 TDD before supper
    - Use rapid-acting insulin correction doses ONLY at meal times and ONLY for blood glucose > 10 mmol/L (as below in **A**)
  - Pre-mix insulin before breakfast and supper
    - Total daily dose (TDD) of insulin to give=0.3 units per kg of body weight
    - Give 2/3 TDD before breakfast and 1/3 TDD before supper
    - Use correction doses as below in **B**
  - Basal bolus
    - Total daily dose (TDD) of insulin to give=0.3 units per kg of body weight
    - Amount basal long-acting insulin (units)=50% of TDD, given as a single injection at 22h00
    - Amount short-acting insulin (units)=50% of TDD given as 3 divided doses before each meal
    - Use correction doses as below in **B**
- Monitor fingerprick glucose before each meal and 22h00
- Increase preceding insulin dose by 2 units every 24 hours if the glucose reading is above 10mmol/L
- Review diabetes control daily

A Rapid-acting insulin correction doses for a patient NOT EATING or on bd long-acting insulin

Previously on insulin use TOTAL daily dose		Less than 25 units	25 to 50 units	Greater than 50 units
Not previously on insulin use weight		Less than 50 kg	50 kg to 75 kg	Greater than 75 kg
Blood glucose level (mmol/L)	10.1-12.0	2 units	4 units	6 units
	12.1-14.0	3 units	6 units	9 units
	14.1-16.0	4 units	8 units	12 units
	More than 16.1	5 units	10 units	15 units

B Meal-time insulin correction doses for a patient EATING

Blood glucose level (mmol/L)	Less than 4.0	**See Block B**
	4.1 to 4.9	Decrease the prescribed dose of insulin by 4 units
	5.0 to 8.5	Give the prescribed dose of insulin
	8.6 -12.0	Increase the prescribed dose of insulin by 2 units
	Greater than 12.1	Increase the prescribed dose of insulin by 4 units

Division of Endocrinology, Groote Schuur Hospital, July 2020

INITIAL in-hospital management of NEW Diabetes and COVID-19

COVID-19 severity

Mild

RR < 30/min

O_2 sats ≥ 94%

Moderate

Severe

RR > 30/min

O_2 sats ≤ 94%

HbA1c or glucose

HbA1c ≤ 9%

or

glucose ≤ 12 mmol/L

HbA1c > 9%

or

glucose > 12 mmol/L

Diabetes management

- Monitor fingerprick glucose
  - Before each meal and 22h00
- Add glimepiride if average glucose reading is 10-12 mmol/L
- Increase dose of glimepiride by 1 mg every 24 hours if the average glucose reading is 10-12 mmol/l
- Start insulin if average glucose level is still 10-12 mmol/L despite glimepiride 4 mg daily OR at any time if the average glucose is > 12 mmol/L
- Use the simplest insulin regimen possible to achieve glucose targets (see # below)
- Review diabetes control daily

- Continue or start insulin
- #Insulin regimen to be determined by expertise and staff availability
  - Long-acting insulin bd (NOT eating or on dexamethasone/prednisone)
    - Total daily dose (TDD) of insulin to give=0.3 units per kg of body weight
    - Give 2/3 TDD before breakfast and 1/3 TDD before supper
    - Use rapid-acting insulin correction doses ONLY at meal times and ONLY for blood glucose > 10 mmol/L (as below in **A**)
  - Pre-mix insulin before breakfast and supper
    - Total daily dose (TDD) of insulin to give=0.3 units per kg of body weight
    - Give 2/3 TDD before breakfast and 1/3 TDD before supper
    - Use correction doses as below in **B**
  - Basal bolus
    - Total daily dose (TDD) of insulin to give=0.3 units per kg of body weight
    - Amount basal long-acting insulin (units)=50% of TDD, given as a single injection at 22h00
    - Amount short-acting insulin (units)=50% of TDD given as 3 divided doses before each meal
    - Use correction doses as below in **B**
- Monitor fingerprick glucose before each meal and 22h00
- Increase preceding insulin dose by 2 units every 24 hours if the glucose reading is above 10mmol/L
- Review diabetes control daily

A Rapid-acting insulin correction doses for a patient NOT EATING or on bd long-acting insulin

Previously on insulin use TOTAL daily dose		Less than 25 units	25 to 50 units	Greater than 50 units
Not previously on insulin use weight		Less than 50 kg	50 kg to 75 kg	Greater than 75 kg
Blood glucose level (mmol/L)	10.1-12.0	2 units	4 units	6 units
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	8.6 -12.0	Increase the prescribed dose of insulin by 2 units
	Greater than 12.1	Increase the prescribed dose of insulin by 4 units

Division of Endocrinology, Groote Schuur Hospital, July 2020

COMMUNITY DIABETIC PATIENTS ADMITTED TO THE CAPE TOWN

PATIENT	AGE	GENDER	HbAIC	Cr	eGFR	Hb	Hgt on admission
1.							
2.							
3.							
4.							
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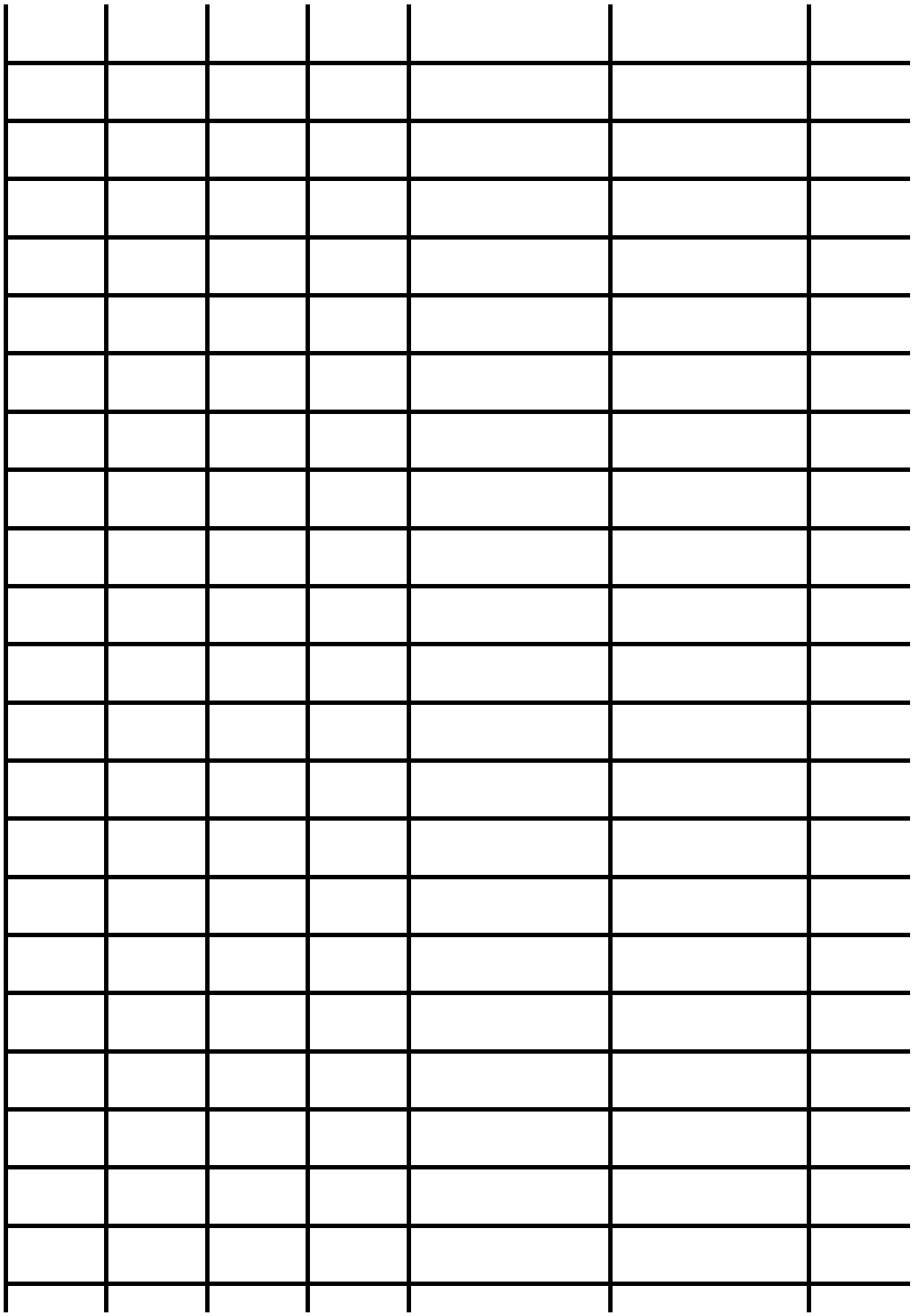
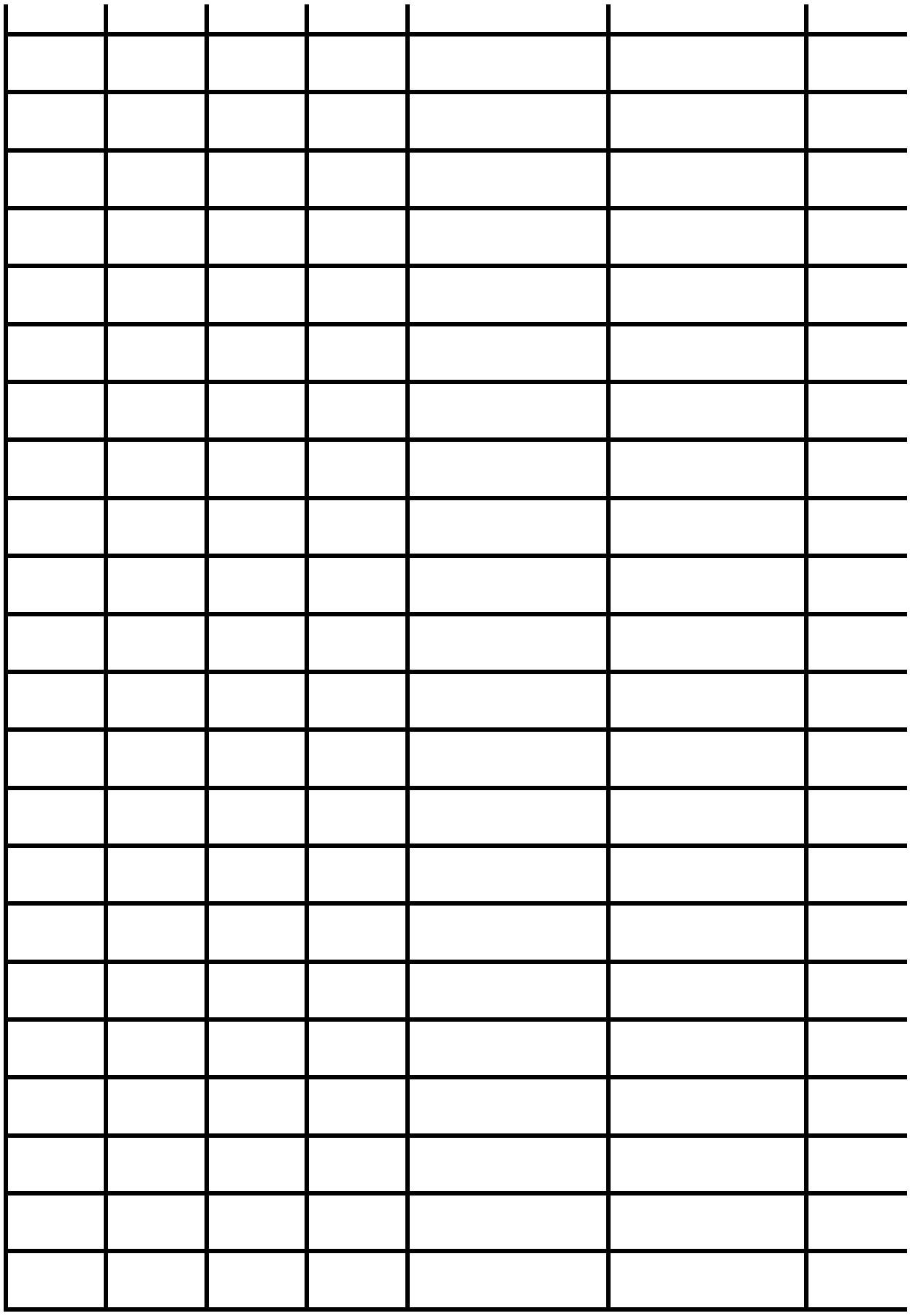
65.							

HOSPITAL OF HOPE (EXAMPLE)

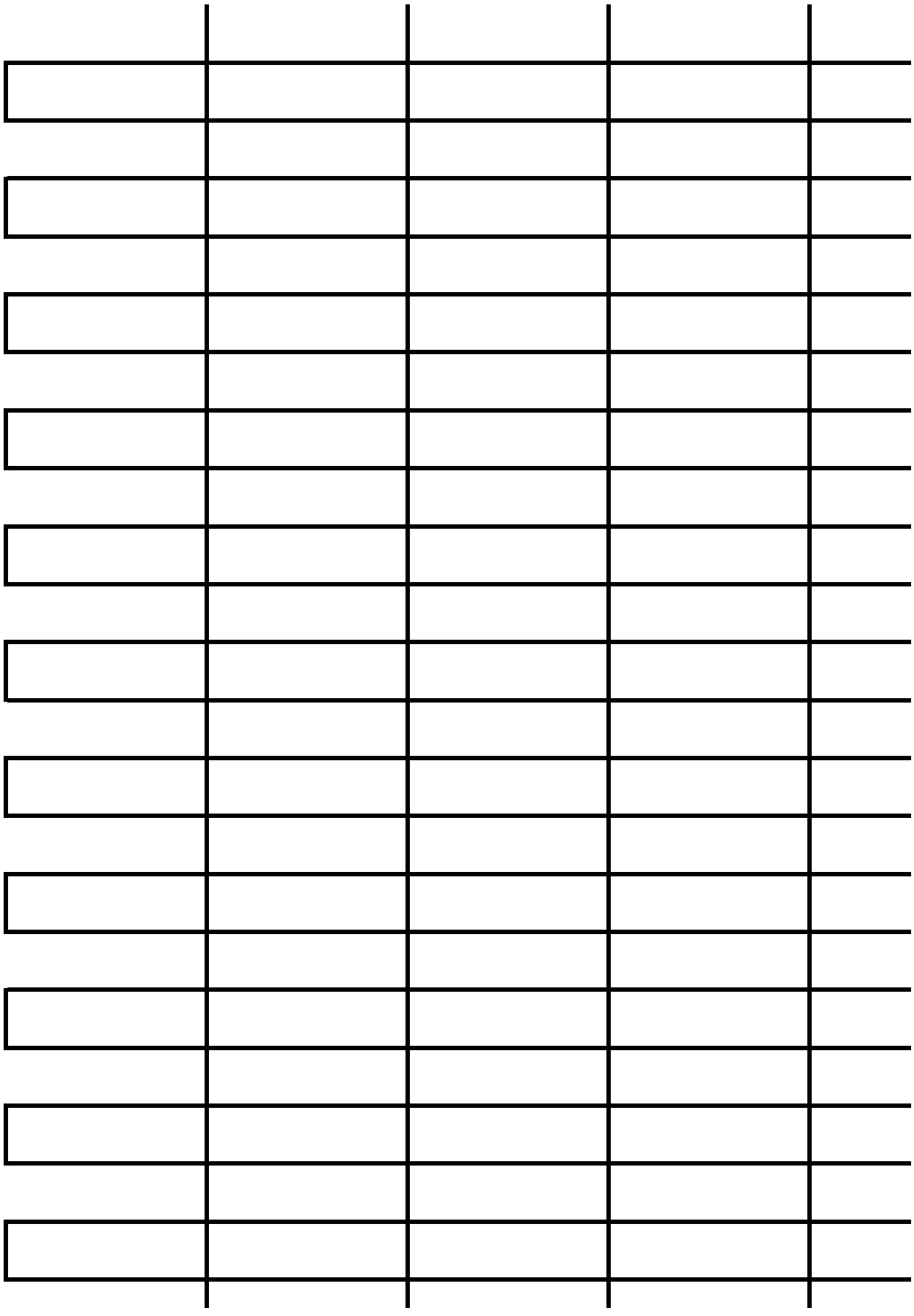
Mean hgt	HGt<4	hgt>10	Hgt on DC	DM meds prior to admission		DM medica
				oral	insulin	ORAL



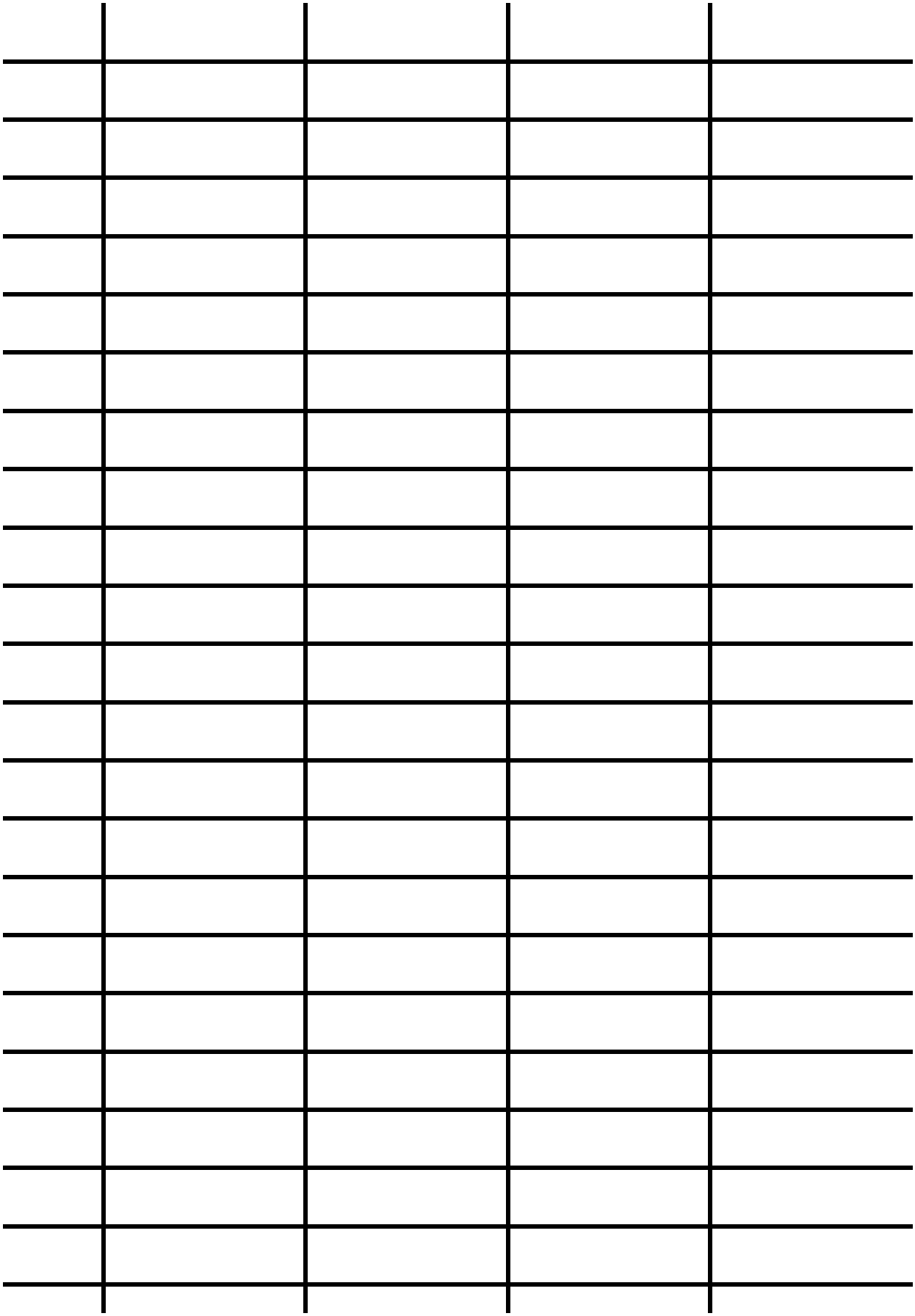


ıtion on Discharge from CTICC		DIETICIAN CONSULTATION	LENGTH OF STAY
	INSULIN		

OUTCOMES			OXYGEN USE	
ADVERSE EVENTS	ESCALATION	MORTALITY	ROOM AIR	NASAL CAN



				DAYS ON OXYGEN
	FACEMASK	NON-REBREATHER	DOUBLE BARREL	



ANTIBIOTIC USE	STEROID USE	
	ORAL	INTRAVENOUS

+		