



DEPARTMENT OF EMERGENCY AND CRITICAL CARE MEDICINE

**OUTCOME AND ASSOCIATED FACTORS OF GUILLAIN-BARRE
SYNDROME IN SELECTED ADDIS ABABA HOSPITALS, ETHIOPIA**

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medicine resident)**

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Addis Ababa, Ethiopia

ST. PAUL'S HOSPITAL MILLENNIUM MEDICAL COLLEGE
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Contents

Acknowledgement	3
LIST OF ABBREVIATIONS	6
LIST OF TABLES	8
LIST OF FIGURES	8
ABSTRACT	9
1. INTRODUCTION	11
1.1. Background	11
1.2. Statement of the problem	12
1.3. Significance of the study	13
2. LITERATURE REVIEW	15
2.1. Magnitude of Guillain Barre Syndrome	15
2.2. Treatment outcome of Guillain Barre Syndrome	16
2.3. Factors associated with treatment outcome of Guillain Barre Syndrome	17
3. OBJECTIVES	20
3.1. General objectives	20
3.2. Specific objectives	20
4. METHODS AND MATERIALS	20
4.1. Study setting and period	20
4.2. Study design	20
4.3. Source population	20
4.4. Study population	21
4.5. Eligibility criteria	21
4.7. Sampling technique and procedure	21
4.8. Study variables	22
4.8.1. Dependent variables	22
4.8.2. Independent variables	22
4.9. Operational definitions	22
4.10. Measurement	23
4.11. Data collection methods and tools	23
4.12. Data quality control	23

4.13.	Data processing and analysis	23
4.14.	Ethical consideration	24
5.	RESULTS	25
5.1.	Socio-demographic status	25
5.2.	Disease related variables	25
5.3.	Treatment related variables	28
5.4.	Treatment outcome.....	29
5.5.	Factors associated with treatment outcome of GBS.....	32
6.	DISCUSSION	36
7.	CONCLUSION.....	39
	Recommendations.....	39
	REFERENCES	40
	ANNEXES	43
	Assurance of Principal Investigator	43
	Waiver of consent	44
	Questionnaire	45

LIST OF ABBREVIATIONS

AaBETH: Addis Ababa Burn Emergency and Trauma Hospital

AIDP: Acute Inflammatory Demyelinating Polyneuropathy

ALERT: All Africa Leprosy Rehabilitation and Training Center

AMAN: Acute Motor Axonal Neuropathy

AMSAN: Acute Motor Sensory Axonal Neuropathy

BLH: Black Lion Hospital

CMV: Cytomegalovirus

CSF: Cerebrospinal Fluid

GBS: Guillain Barre Syndrome

HIC: High Income Countries

ICU: Intensive Care Unit

IRB: Institutional Review Board

IVIG: Intravenous Immunoglobulin

LMIC: Low and Middle Income Countries

MFS: Miller Fisher Syndrome

NCS: Nerve Conduction Test

NINDS: National Institute of Neurological Disorders and Stroke

SPHMMC: St. Paul's Hospital Millennium Medical College

YLD: Years Lived with Disability

LIST OF TABLES

Table 1 Summary of sample size calculation for associated factors with outcome of GBS . **Error! Bookmark not defined.**

Table 2 socio-demographic characteristics of GBS patients in selected hospitals in Addis Ababa Ethiopia..... 25

Table 3 Disease related variables of GBS patients in selected hospitals in Addis Ababa Ethiopia 26

Table 4 Treatment related factors in GBS patients in selected hospitals of Addis Ababa Ethiopia 28

Table 5 Treatment outcomes in GBS patients in selected hospitals of Addis Ababa Ethiopia 29

Table 6 Treatment out come in GBS patients for different variables 31

Table 7 Bivariate and multivariable analysis of factors associated with treatment outcome in GBS patients (n=124) in selected hospitals in Addis Ababa Ethiopia, 2020 - 2022 33

LIST OF FIGURES

Figure 1 Conceptual frame work 19

Figure 3 preceding events in GBS patients in selected hospitals of Addis Ababa Ethiopia.. **Error! Bookmark not defined.**

Figure 4 NCS findings in GBS patients in selected hospitals of Addis Ababa Ethiopia..... 28

Figure 5GBS disability grading in GBS patients in selected hospitals of Addis Ababa Ethiopia 30

Figure 6 Treatment outcomes in GBS patients in selected hospitals of Addis Ababa Ethiopia... 31

ABSTRACT

Background: Guillain-Barré syndrome (GBS) represents an aberrant autoimmune response to a preceding infection or other immune stimulation, which leads to ascending symmetric weakness or paralysis which may ascend to the diaphragm, compromising respiratory function and requiring mechanical ventilation in one third of patients. Data on GBS from Ethiopia studies is limited. And given the poor hygiene and sanitation along with frequent exposure to pathogens that render populations in low-income and middle-income countries like Ethiopia prone to outbreaks of infectious diseases that can trigger GBS, it is important to assess the burden of the problem and treatment outcome and factors that are associated

Objective: The objective of this study is to assess the outcome and associated factors of GBS in selected hospitals of Addis Ababa.

Methodology: A retrospective chart review of GBS patients admitted from January 2020 – December 2022 in selected Addis Ababa hospitals was conducted. Whole take sampling was used for selecting the study participants and a structured questionnaire was used for data collection. Data was entered in Epi Info version 7.1 and analysed using SPSS by binary logistic regression and multiple logistic regression models.

Result: A total of 124 participants were included in the study. Among the total participants most 84 (67.7%) were males. The age of participants ranged from 2-75 years and the mean age was 29.8 years (SD: 20.6). The most common preceding event was respiratory tract infection, accounting for 29.8% followed by gastroenteritis in 29%; whereas 29% of the patients had no any preceding event. The most common clinical presentation was ascending paralysis 119 (95.6%) and the most common finding on NCS was AMAN 18 (14.5%) followed by normal, AIDP and AMSAN, 9.7%, 5.6% and 3.2% respectively. 68.5% of the cases had bad outcome based on the Hughes motor scale of the GBS disability grading. The odds of having good outcome was found to be 0.24 times less in those participants who have gastroenteritis as a preceding event (AOR: 0.24, 95% CI: 0.069-0.823) than those who had no preceding event. Those participants who needed mechanical ventilation were found to be 0.12 times less likely to have good outcome than those who don't (AOR: 0.12, 95% CI: 0.023-0.604).

Conclusion and recommendations: This study showed that bad outcome in GBS patients is high. And since respiratory tract infections and gastroenteritis were the main preceding events,

with gastroenteritis being associated with bad outcomes, hospitals and health care providers should work on infection control strategies including gastroenteritis among the public.

Key words: Guillain–Barré Syndrome, Treatment outcome

1. INTRODUCTION

1.1. Background

Guillain-Barré syndrome (GBS) is an acute, frequently severe, and fulminant polyradiculoneuropathy that is autoimmune in nature. It represents an aberrant autoimmune response to a preceding infection or other immune stimulation, which leads the immune system to attack the myelin sheaths or axons of the peripheral nerves and their spinal roots, due to molecular mimicry (1,2).

The most common infectious organisms associated with GBS is *Campylobacter jejuni*, with Cytomegalovirus, Epstein-Barr virus, and *Mycoplasma pneumonia* also associated with subsequent development of GBS (3)

Classically, GBS is preceded by a viral illness, followed by ascending symmetric weakness or paralysis and areflexia or hyporeflexia. Paralysis may ascend to the diaphragm, compromising respiratory function and requiring mechanical ventilation in one third of patients. Autonomic dysfunction may be present as well (4)

The National Institute of Neurological Disorders and Stroke (NINDS) diagnostic criteria is widely used to diagnose GBS. It consists of two required features, progressive weakness of more than one limb due to neuropathy and areflexia or hyporeflexia, and supportive features including duration of progress less than 4 weeks, the absence of a sharp sensory level on the trunk, absence of other causes of acute neuropathy and less than 50 mononuclear leukocytes per mm³ in cerebral spinal fluid (5)

Several subtypes of GBS are recognized, the most common variant is acute inflammatory demyelinating polyneuropathy (AIDP). Additionally, there are two axonal variants, which are often clinically severe—the acute motor axonal neuropathy (AMAN) and acute motor sensory axonal neuropathy (AMSAN) subtypes. In addition, a range of limited or regional GBS syndromes are also encountered which include the Miller Fisher syndrome (MFS); pure sensory forms; ophthalmoplegia with anti-GQ1b antibodies as part of severe motor-sensory GBS; GBS with severe bulbar and facial paralysis, sometimes associated with antecedent cytomegalovirus (CMV) infection and anti-GM2 antibodies; and acute pan-dysautonomia (1,3,4).

GBS occurs worldwide with an overall incidence rate of 1–2 cases per 100,000 people per year, affecting all age groups, but is slightly more common in males than in females. Mortality, or severe disability due to GBS, occurs in around 20% of patients (2)

Both IV immunoglobulin and plasma exchange shorten the time to recovery. Neither has been shown to be superior to the other, nor are they more efficacious when used together. There are adverse effects seen with both modalities of treatment. IV immunoglobulin has been associated with thromboembolism and aseptic meningitis; plasma exchange is associated with hemodynamic instability and a small increase in the rate of relapse, though full recovery is still more likely (4) The mortality rate is <5% in optimal settings and death usually results from secondary pulmonary complications (1). Patients with symmetrical weakness of acute onset have a greater risk for respiratory compromise, which develops in 20% to 30% of patients. Conversely, patients with predominantly sensory signs and symptoms are less likely to develop acute respiratory distress and have a more favorable prognosis (3).

1.2. Statement of the problem

In the post-polio era, GBS is the most common cause of acute flaccid paralysis in healthy infants and children and it occurs world-wide with an annual incidence of 0.34 to 1.34 cases per 100,000 persons aged 18 years or less. While all age groups are affected, the incidence is lower in children than in adults. The incidence increases by approximately 20 percent with every 10-year increase in age beyond the first decade of life(5)

Complications in GBS can cause severe morbidity and death (6). Advances in general care facilities and the availability of specific treatments have improved the outcome of patients with GBS. Nonetheless, about 20% of patients die from the complications of GBS or remain severely disabled (7). A detailed analysis of the prevalence and disability burden of GBS from 1990 to 2019 by cause, age, sex, and Socio-demographic Index in 204 countries found a large burden, in terms of the worldwide prevalence and disability, especially among young children and the elderly (2). In 2019, there were 150,095 total cases of GBS worldwide, which resulted in 44,407 Years lived with disability (YLDs). Globally, there was a 6.4% (95% UI 3.6 to 9.5) increase in the age-standardized prevalence of GBS per 100,000 population between 1990 and 2019 (2)

The epidemiology, clinical characteristics, management and outcome of GBS differ between low-income and middle-income countries (LMIC) and high income countries (HIC). At present, limited data are available on GBS in LMIC and the true incidence of GBS in many LMIC remains unknown. Increased understanding of GBS in LMIC is needed because poor hygiene and high exposure to infections render populations in LMIC vulnerable to GBS outbreaks (8).

In Ethiopia, a retrospective cross-sectional review of the electro-diagnostic referral and diagnostic patterns in patients with suspected neuromuscular conditions in Black Lion Hospital showed that polyneuropathy was the most frequent electro-diagnosis, where diffuse axonal and demyelinating subtypes accounted for 54% and 18.8%, respectively. Guillain-Barre syndrome was suspected in 18 patients and 15 had electro-diagnosis confirmed motor axon polyneuropathy while three patients had demyelinating variant (9)

Data on GBS from Ethiopia studies is limited. And given the poor hygiene and sanitation along with frequent exposure to pathogens that render populations in low-income and middle-income countries like Ethiopia prone to outbreaks of infectious diseases that can trigger GBS, it is important to assess the burden of the problem and treatment outcome and factors that are associated. This research will achieve possible intervention and strategies needed to be developed to achieve better outcomes in GBS patients.

1.3. Significance of the study

In low-income and middle-income countries like Ethiopia where there is insufficient health-care infrastructure leading to diagnostic delays and lack of available and affordable treatment, rates of adverse outcomes and mortality from GBS will impose a higher burden on the society.

To develop and implement specific strategies aimed at improving the health outcomes for people with GBS, it is important to systematically evaluate the burden of this condition. This study will present analysis of the disability burden of GBS by cause, socio-demographic characteristics, disease related conditions and treatment related factors.

The results of this study will recommend the ways to improve the overall patient care and disease outcome. This will help to develop different methods of intervention to solve problems related to non-adherence by healthcare professionals, policy makers and concerned bodies.

The study will also provide useful baseline information for further studies on treatment outcome of GBS and related issues.

2. LITERATURE REVIEW

2.1. Magnitude of Guillain Barre Syndrome

GBS is a heterogeneous condition with several variant forms. Most often, GBS presents as an acute, monophasic paralyzing illness provoked by a preceding infection. Weakness can vary from mild difficulty with walking to nearly complete paralysis of all extremity, facial, respiratory, and bulbar muscles (5)

In 2019, there were 150,095 cases of GBS globally, with an age-standardized point prevalence of 1.9 per 100,000 populations, which represents a 6.4% increase since 1990. GBS accounted for 44,407 YLDs in 2019, with an age-standardized rate of 0.6, which has increased 6.5% since 1990.

A retrospective observational study done in China among hospital admissions from 2016 – 2019 showed that the age- and sex adjusted incidence per 100,000 person-years is 0.698 in children and 0.829 in adults. It also showed that 426 adults and 13 children died in this study pool, with a hospital mortality rate of 11.2 per 1,000 person-years (10)

A study done in Saudi Arabia which assessed a total of 156 patients with GBS showed that the most commonly reported antecedent illnesses were upper respiratory tract infection (39.1%) and diarrhea (27.8%). And patients presented with weakness 98.7%, had sensory symptoms 64.1%, had facial diplegia 43.1%, 33.8% had oropharyngeal weakness, 12.4% had ophthalmoplegia, and 26.3% needed mechanical ventilation. Similarly, another study in the pediatric patients in Saudi Arabia, prevalence of GBS among pediatrics admitted with acute paralysis was 49% (11,12)

In most studies worldwide, the mortality rate for GBS is 2–10% although disparities are evident between regions. For example, reported mortality rates are 2–7% in Europe and North America 13% in Hong Kong, 14–17% in Bangladesh and 16% in Egypt (8) showing increased prevalence rates in LMICs.

In an Ethiopian study done among patients referred for the first time to the Electrodiagnostic laboratory at Black Lion Hospital between 2016 and 2019, GBS accounted for 5.8% of the referrals among which 83.3% were acute motor axonal polyneuropathy (AMAN) variant, while

only 1% showed acute inflammatory demyelinating polyneuropathy (AIDP) features on their Nerve Conduction Study (9)

2.2. Treatment outcome of Guillain Barre Syndrome

In the vast majority of patients with GBS, treatment should be initiated as soon after diagnosis as possible (1). Despite the generally positive prospects for patients with GBS, death occurs in 3–10% of cases, most commonly owing to cardiovascular and respiratory complications, which can occur in both the acute and the recovery phase (6).

In a retrospective study conducted in Nepal, from January 2013 to December, among 31 patients with GBS, 90% of the patients survived and the in-hospital mortality rate of patients with GBS in this study was 6.45%. Among the patients who survived, the majority (92.8%) of patients were able to walk unaided for 5 meters (13)

In a study done in Saudi Arabia which assessed a total of 156 patients with GBS, among which 88.1% had intravenous immunoglobulin (IVIg), and 11.9% had plasmapheresis, the ability to walk was reported at follow-up in 62.2% patients. Approximately half of these patients were able to walk independently within 9 months after discharge, and a third regained the ability to walk independently thereafter. Death of one patient was caused by septicemia (11). Similarly, in another study in the pediatric patients in Saudi Arabia, at 60 days post emergency department visit, 46.9% patients still had residual paralysis. Three patients suffered from recurrent GBS and one case from a relapse. No deaths were reported (12)

Italian retrospective study done from 1 January 2011 to 31 December 2021 found that at hospital discharge, 26.2% of patients had mild symptoms, mainly sensory in nature, and was able to perform daily activities and to run, whereas 14.3% were unable to walk even with the bilateral support. No patients died. There were no significant differences in clinical status between demyelinating and axonal forms (14).

Across the globe, ~20% of patients with GBS are unable to walk unaided 6 months after disease onset, and this rate is higher (30–40%) in countries such as Bangladesh where AMAN predominates and most patients do not receive immunotherapy. No data have been reported on rates of these complications in LMIC. However, as most patients with GBS in LMIC only

receive supportive care, these sequelae are also likely to vary between countries and to be worse in patients in LMIC than in those in High Income Countries (HIC) (8)

In a cross-sectional study done in Burkinafaso from September 1, 2003 to July 31, 2020, five cases of death were recorded (14.3%) - 2.8% recorded during the extension phase and 8.6% during the plateau phase. 2.6% were transferred to intensive care for respiratory decompensation. On discharge, complete functional recovery was noted in 2.6% patient and partial in 48.6% patients (15).

A six years retrospective descriptive study conducted in the pediatric and child health department of Black Lion Hospital Addis Ababa Ethiopia reported that 22.39% patients required ICU care out of which 6 didn't get the service. There were 11 (16.4%) deaths. Respiratory failure was considered as a cause of death in 6, Respiratory failure and infection were cause of death in 5 of them (3 had pneumonia, 1 urosepsis) (16).

A study conducted in St. Paul's and Zewditu Hospitals Addis Ababa Ethiopia from August 2014 to August 2021 showed that 60% of patients had good outcome and 40% of bad outcome. At discharge, 60% of patients were able to walk without support but incapable of manual work/running. Among 40% who had bad outcome, 31% died, 8.79% Patients were bedridden, and 60% had significant disabilities requiring support for ambulation. The common imminent cause of death among the study population were mentioned as GBS related respiratory failure, autonomic dysfunction, and ventilator associated pneumonia (17).

2.3. Factors associated with treatment outcome of Guillain Barre Syndrome

Factors associated with a poor prognosis for recovery from GBS include older age, rapid onset (less than seven days) prior to presentation, severe muscle weakness on admission, need for ventilator support, an average distal motor response amplitude reduction to <20 percent of normal and preceding diarrheal illness (5)

In addition, the Saudi Arabian study conducted among pediatric patients showed that being male and having a complaint of respiratory problems at admission were associated with progression to maximum paralysis within ≤ 2 weeks. And residual paralysis at 60 days post onset of disease

was associated with facial weakness, ocular abnormalities and age 8-14 compared to younger groups (12).

HIV as a preceding infection, Diabetes Mellitus, need for mechanical ventilation, longer duration of ICU stay, increased protein level in the CSF were found to be associated with poor outcome in the Ethiopian study conducted in st. paul's and Zewditu hospitals (17)

As per the type of treatment provided, an Indian study conducted from May 2008 to September 2012 showed that Hughes grade of 0 was noted in 23.8% of plasmapheresis and 21% of IVIg groups at 30 days follow up, which improved to 66.6% of plasmapheresis and 76.4% of IVIg at 180 day follow up. There was no significant difference in outcome at discharge or at follow up at 30, 60, 180 days and 1 year between both groups (18). And no significant clinical benefit of a second intravenous immunoglobulin course administered shortly after the first standard intravenous immunoglobulin dose was seen in patients with GBS with poor prognosis (19)

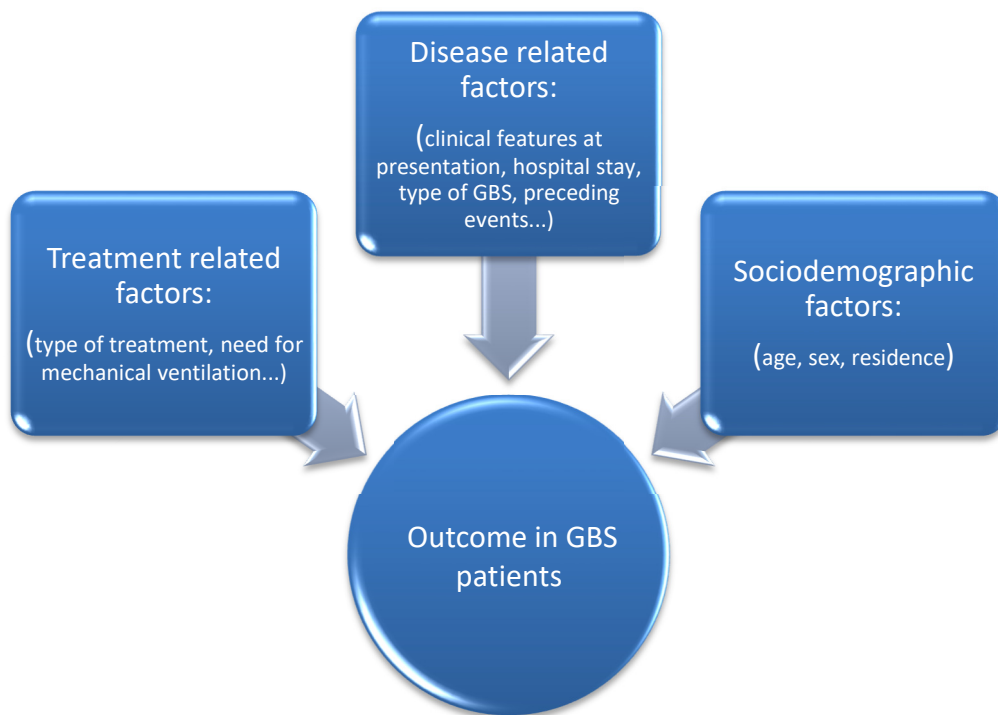


Figure 1 Conceptual frame work

3. OBJECTIVES

3.1. General objectives

To assess the outcome and associated factors of GBS in selected hospitals of Addis Ababa (AaBET Hospital, St. Paul's Hospital Millennium Medical College (SPHMMC), and ALERT Hospital) from January 2020 – December 2022

3.2. Specific objectives

To assess the outcome of GBS in selected hospitals of Addis Ababa (AaBET Hospital, St. Paul's Hospital Millennium Medical College (SPHMMC), and ALERT Hospital) from January 2020 – December 2022

To identify the factors associated with the outcome of GBS patients in selected hospitals of Addis Ababa from January 2020 – December 2022

4. METHODS AND MATERIALS

4.1. Study setting and period

The study was conducted in Addis Ababa which is the capital and largest city of Ethiopia. There are a total of 13 hospitals in Addis Ababa among which six are operated by Addis Ababa City Administrative Health Bureau and seven by the Federal Ministry of Health.

This study was conducted in three selected hospitals located in Addis Ababa namely, AaBET Hospital, St. Paul's Hospital Millennium Medical College (SPHMMC), ALERT Hospital by reviewing charts of ICU admissions and Emergency visits from January 2020 – December 2022.

4.2. Study design

A hospital-based retrospective chart review was conducted among admissions in selected hospitals of Addis Ababa, Ethiopia from January 2020 – December 2022

4.3. Source population

All patients diagnosed with GBS admitted to AaBET Hospital, St. Paul's Hospital Millennium Medical College (SPHMMC) and ALERT Hospital from January 2020 – December 2022.

4.4. Study population

All GBS patients who were admitted to AaBET Hospital, St. Paul's Hospital Millennium Medical College (SPHMMC) and ALERT Hospital from January 2020 – December 2022 who fulfill the inclusion criteria

4.5. Eligibility criteria

INCLUSION CRITERIA

All GBS patients of any age group who were admitted to AaBET Hospital, St. Paul's Hospital Millennium Medical College (SPHMMC) and ALERT Hospital from January 2020 – December 2022 fulfilling the diagnostic criteria for GBS of the National Institute of Neurological Disorders and Stroke (NINDS)

EXCLUSION CRITERIA

- Patients whose charts are incomplete
- Patients who had relapse case of GBS

4.6. Sampling technique and procedure

Among a total of 13 hospitals in Addis Ababa, 12 hospitals give ICU service. From these 12 hospitals three hospitals was selected, namely, AaBET Hospital, St. Paul's Hospital Millennium Medical College (SPHMMC) and ALERT Hospital. Then, whole take sampling method was used to select the sample since the total number of GBS patients in all three hospitals from January 2020 – December 2022 was 124 which is less than the calculated sample size.

4.7. Study variables

4.7.1. Dependent variables

- Functional outcome of GBS patients at discharge

4.7.2. Independent variables

1. Socio demographic variables; age, sex and place of residence
2. Disease related variables;
 - Type of GBS on Nerve Conduction Tests (NCS)
 - Time to maximal weakness
 - Clinical features at presentation (Clinical profile, Ascending paralysis, Sensory disturbance, Respiratory failure, Dysphagia, Autonomic dysfunction, Bladder involvement, Cranial nerve involvement)
 - Duration of Hospital Stay
 - Duration of ICU stay
 - Comorbid illness
 - CSF protein
3. Preceding event; HIV seropositive, respiratory tract infections, Gastroenteritis, Rabies vaccine, surgery and other febrile illness
4. Treatment related variables;
 - Treatment given
 - Need for Mechanical Ventilation
 - Tracheostomy

4.8. Operational definitions

Bad outcome: those patients with grades more than 2 on Hughes motor scale at the time of discharge

Good outcome: those patients with grades 0-2 on Hughes motor scale at the time of discharge (17,20)

4.9. Measurement

Functional outcome of the patients will be assessed by Hughes motor scale at the time of discharge. Hughes motor scale ranges from 0 to 6 where 0 is asymptomatic, 1 is having mild signs or symptoms but able to run, 2 is able to walk unaided for 10 meters but unable to run, 3 is able to walk 10 meters with support, 4 is bedridden or chair bound, 5 is requiring ventilator assistance, and 6 is death of the patient (7)

4.10. Data collection methods and tools

Data was collected using a structured questionnaire, which is developed after thoroughly reviewing previous relevant literatures (10–14,16–18,20,21). The questionnaire was designed to include socio-demographic variables such as age, sex, and residence; disease related factors like type of GBS on Nerve Conduction Tests (NCS), time to maximal weakness, Clinical features at presentation, Duration Of Hospital Stay and Comorbid illness; the preceding event; medication related variables and Hughes motor scale at the time of discharge.

Three BSc nurses were recruited to participate throughout the data collection and were trained for one day by the principal investigator on the study, instrument and data collection procedures.

4.11. Data quality control

A structured Questionnaire, which fits with the context, was prepared. Training was given to data collectors. To ensure the validity and reliability of the data collection tool, pre-test was done on 5% of the total sample size 1 week before the actual data collection and the questionnaire was checked for its clarity, understand ability and simplicity and it was modified as needed. The filled questionnaire was checked for its completeness by the investigator to assure the quality of data. The investigator was responsible for supportive supervision on the spot and on reviewing all filled questionnaires on daily basis.

4.12. Data processing and analysis

After data is collected it was entered into the Epi Info version 7.1 and analysed using SPSS using binary logistic regression and multiple logistic regression models. The data analysis included descriptive statistics, including frequency and percentage. Crude and adjusted odds

ratios (AOR) were analysed with a 95% confidence level. Binary logistic regression was used to see association between dependent and independent variables. Those variables with p-value of ≤ 0.25 on binary logistic regression were considered for multivariate logistic regression to determine associations of each variable. Significance of association was declared at p-value of ≤ 0.05 . Multicollinearity was assessed using linear regression and there was no multicollinearity between the above variables using tolerance cut off point of 0.1.

4.13. Ethical consideration

The proposal was submitted to SPHMMC, department of Emergency Medicine and Critical care. Ethical clearance was obtained from the institutional review board (IRB) of SPHMMC. A waiver of consent was requested from the IRB. Permission was obtained from the respective institutions - AaBET Hospital, SPHMMC and ALERT hospital. The personal information of study participants was kept entirely anonymous, and confidentiality was assured throughout the study period.

5. RESULTS

5.1. Socio-demographic status

A total of 124 participants were included in the study. Among the total respondents most, 84 (67.7%), of the respondents were males. The mean age of participants was 29.8 (SD: 20.6) with minimum age of 2 years and maximum 75 years. In addition, 85 (68.5%) respondents came from urban areas.

Table 1 socio-demographic characteristics of GBS patients in selected hospitals in Addis Ababa Ethiopia

Variable	Category	Frequency	Percentage
Sex	Female	40	32.3
	Male	84	67.7
Residence	Rural	39	31.5
	Urban	85	68.5

5.2. Disease related variables

The most common preceding event was respiratory tract infection, accounting for 29.8% followed by gastroenteritis in 29%; whereas 29% of the patients had no any preceding event. In addition, 46 (31.1%) had comorbidities. Most of the participants, 105 (84.7%), have maximal weakness of 2 weeks or less. The most common clinical presentation was ascending paralysis 119 (95.6%).

NCS was not done for most patients 83 (66.9%) and the most common finding on NCS was AMAN 18 (14.5%) followed by normal, AIDP and AMSAN, 9.7%, 5.6% and 3.2% respectively. CSF protein was elevated in 62 (50%) of patients; normal in 24 (19.4%) and not done for 38 (30.6%). The median length of hospital stay was 16.5 (IQR:0.1-0.29).

Table 2 Disease related variables of GBS patients in selected hospitals in Addis Ababa Ethiopia

Variable	Category	Frequency	Percentage
NCS	Not done	83	66.9
	AIDP	7	5.6
	AMAN	18	14.5
	AMSAN	4	3.2
	Normal	12	9.7
Time to maximal weakness	≤ 2 wks	105	84.7
	> 2 wks	19	15.3
CSF protein	Not done	38	30.6
	Elevated	62	50
	Normal	24	19.4
Preceding event	Respiratory tract infection	37	29.8
	Gastroenteritis	36	29
	Recent vaccination	3	2.4
	Surgery	8	6.5
	No preceding event	36	29
Comorbidity	DM	11	8.9

	HTN	14	11.3
	Renal disease	10	8.1
	HIV	4	3.2
	Cardiovascular disease	12	9.7
	Other	6	4.8
	More than one comorbidity	9	7.3
	No comorbid illness	78	62.9
Clinical presentation	Ascending paralysis	119	95.9
	Sensory disturbance	40	32.3
	Autonomic dysfunction	23	18.5
	Bladder involvement	6	4.8
	Cranial nerve involvement	38	30.6
	Respiratory failure	32	25.8

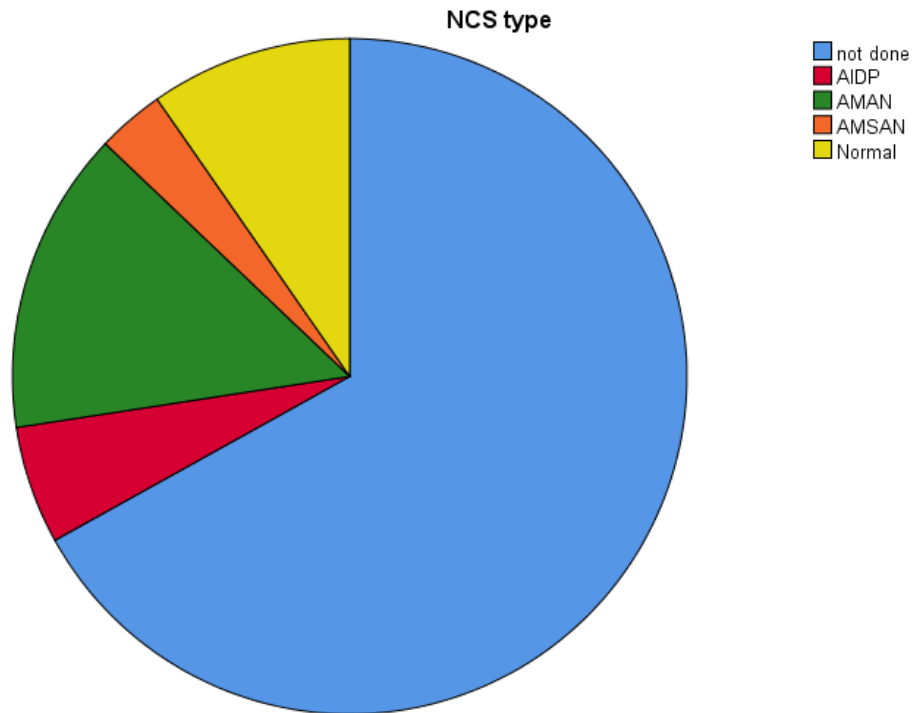


Figure 3 NCS findings in GBS patients in selected hospitals of Addis Ababa Ethiopia

5.3. Treatment related variables

Most (79.8%) patients were not given immune-modulatory therapy. 24 (19.4%) were given IVIg while plasmapheresis was given to one patient (0.8%). In addition, 46 patients (37.1%) needed mechanical ventilation and tracheotomy was done for 18 (14.5%) patients.

Table 3 Treatment related factors in GBS patients in selected hospitals of Addis Ababa Ethiopia

Variable	Category	Frequency	Percentage
Type of treatment given	IVIg	24	19.4
	Plasmapheresis	1	0.8
	Not given	99	79.8
Mechanical ventilator	Yes	46	37.1

	No	78	62.9
Tracheotomy	Yes	18	14.5
	No	106	85.5

5.4. Functional Outcome

Most patients (37.9%) were able to walk for 10m with support (Hughes motor scale of 3); 27.4% were able to walk for 10m or more without support but unable to run (Hughes motor scale of 2); 18.5% were confined to bed (Hughes motor scale of 4) at the time of discharge. In addition, 15 patients (12.1%) died (Hughes motor scale of 6). There were no patients who were asymptomatic (Hughes motor scale of 0) or who required assisted ventilation (Hughes motor scale of 5) at the time of discharge. 85 patients (68.5%) had bad outcome (Hughes motor scale of >2).

Table 4 Outcomes in GBS patients in selected hospitals of Addis Ababa Ethiopia

Variable	Category	Frequency	Percentage
GBS disability grading	0 A healthy state	0	0
	1 Minor signs and symptoms but able to run	5	4
	2 Able to walk for 10 m or more without support but unable to run	34	27.4
	3 Able to walk 10 m with support	47	37.9
	4 Confined to bed	23	18.5

	5 Required assisted ventilation	0	0
	6 Dead	15	12.1
Treatment outcome	Bad outcome	85	68.5
	Good outcome	39	31.5

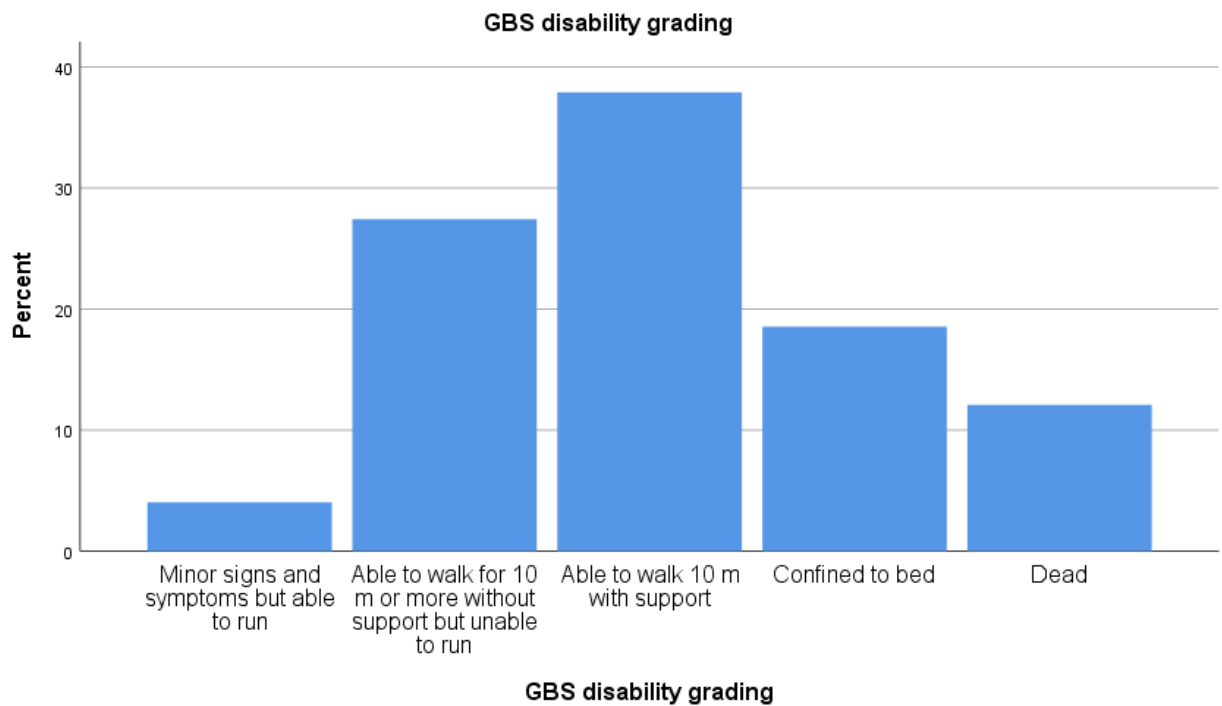


Figure 2GBS disability grading in GBS patients in selected hospitals of Addis Ababa Ethiopia

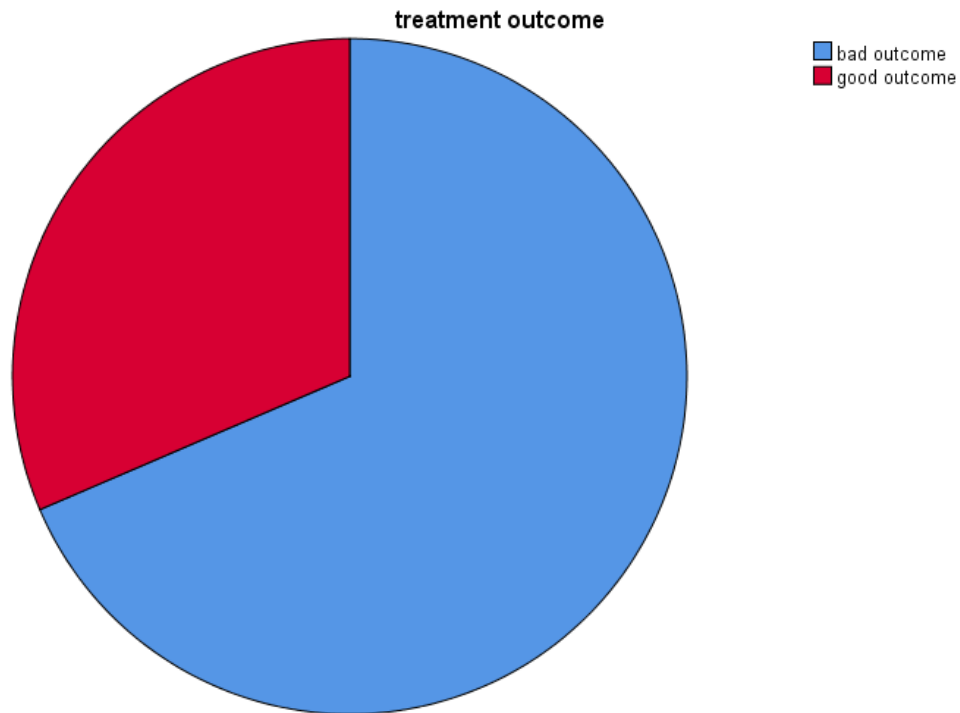


Figure 3 Outcomes in GBS patients in selected hospitals of Addis Ababa Ethiopia

Table 5 Out come in GBS patients for different variables

Variables		Bad outcome	Good outcome
Sex	Female	29	11
	Male	56	28
Maximal weakness	≤ 2 wks	75	30
	> 2 wks	10	9
Preceding event	Respiratory tract infection	25	12
	Gastroenteritis	28	8
	Recent vaccination	3	0
	Surgery	6	2
	No preceding event	19	17
Clinical presentation	Ascending paralysis	83	36
	Sensory disturbance	25	15
	Autonomic dysfunction	23	0
	Bladder involvement	6	0
	Cranial nerve	31	7

	involvement		
	Respiratory failure	30	2
NCS	Not done	57	26
	AIDP	6	1
	AMAN	12	6
	AMSAN	1	3
	Normal	9	3
CSF protein	Not done	22	16
	Elevated	45	17
	Normal	18	6
Type of treatment	IVIg	18	6
	Plasmapheresis	1	0
	Not given	66	33
Mechanical ventilation	Yes	42	4
	No	43	35
Tracheotomy	Yes	17	1
	No	68	38

5.5. Factors associated with outcome of GBS

In this study, variables which have p-value less than 0.25 in bivariate analysis were considered as candidate for multivariate analysis. Hence, age, NCS finding, time to maximal weakness, hospital stay, ICU stay, preceding event, CSF protein, need for mechanical ventilation and need for tracheostomy were variables candidate for multivariate logistic regression model.

After multivariate analysis was done, gastroenteritis as a preceding event and the need for mechanical ventilation were found to be significantly associated with bad outcomes. The odds of having good outcome was found to be 0.24 times less in those participants who have gastroenteritis as a preceding event (AOR: 0.24, 95% CI: 0.069-0.823) than those who had no preceding event. Those participants who needed mechanical ventilation were found to be 0.12 times less likely to have good outcome than those who didn't (AOR: 0.12, 95% CI: 0.023-0.604). In other words, those patients who had gastroenteritis as a preceding event were found to have 4.2 times higher odds of having bad outcome compared to those who had no preceding event.

And the odds of having bad outcomes were 8.3 times higher in patients who needed MV compared to those who didn't.

Table 6 Bivariate and multivariable analysis of factors associated with outcome in GBS patients (n=124) in selected hospitals in Addis Ababa Ethiopia, 2020 - 2022

variables	category	Treatment outcome		Bivariate	Multivariate	p-value
		Bad outcome n (%)	Good outcome n (%)	Crude OR (95% CI)	Adjusted OR (95% CI)	
Age				1.01(0.99-1.03)	1(0.98-1.03)	0.74
NCS finding	Not done	57	26	1.37(0.34-5.48)	1.88(0.39-8.85)	0.43
	AIDP	6	1	0.5(0.04-6.02)	1.50(0.74-30.64)	0.79
	AMAN	12	6	1.5(0.29-7.68)	2.10(0.33-13.6)	0.44
	AMSAN	1	3	9(0.66-122.8)	59(0.00-)	0.99
	Normal	9	3	0	0	
Maximal weakness	</=2wks	75	30	2.25(0.83-6.08)	0.74(0.19-2.79)	0.66
	>2wks	10	9	0	0	
Hospital stay				0.96(0.92-0.99)	0.97(0.91-1.04)	4.3
ICU stay				0.93(0.89-	1.03(0.94-	0.55

				0.98)	1.13)	
Preceding events	Respiratory tract infection	25	12	0.54(0.21-1.39)	0.65(0.21-2.01)	0.45
	Gastroenteritis	28	8	0.32(0.12-0.89)	0.24(0.069-0.82)*	0.023
	Recent vaccination	3	0	0.00(0.00-)	0.00(0.00-)	0.99
	Surgery	6	2	0.37(0.66-2.1)	0.29(0.36-2.47)	0.26
	No preceding event	19	17	0	0	
CSF protein	Not done	22	16	2.18(0.71-6.73)	3.36(0.78-14.5)	0.11
	Elevated	45	17	1.13(0.34-3.34)	3.07(0.71-13.2)	0.13
	Normal	18	6	0	0	
Need for MV	Yes	42	4	0.12(0.04-0.36)	0.12(0.02-0.6)*	0.01
	No	43	35	0	0	
Need for tracheotomy	Yes	17	1	0.11(0.01-0.82)	0.75(0.04-14.04)	0.85
	No	68	38	0	0	
	Occasionally	26	115	1.05(.36-3.05)	1.24(.368-.18)	.727

	Weekly	5	21	0	0	
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1

¹ OR: Odds Ratio; CI: Confidence interval
*variables of significant association (p value <0.05) in multivariable logistic regression

6. DISCUSSION

This study assessed treatment outcome and its associated factors among of GBS patients in selected hospitals in Addis Ababa, Ethiopia: AaBET Hospital, SPHMMC and ALERT Hospital from January 2020 – December 2022. The study examined selected factors from socio-demographic characteristics, disease related factors and treatment related factors.

Male predominance was seen in this study with male to female ratio of 2.1. This was comparable with both regional and global data (10–12,17,20–22). The most common preceding event was respiratory tract infection followed by gastroenteritis in 29% these results were in agreement with the studies done in china, Nepal, Saudi Arabia but different from the study done in st. paul and Zewditu hospitals which showed gastroenteritis to be the most common preceding event followed by respiratory tract infection (10,11,13,17).

The most common clinical presentation was ascending paralysis 119 (95.6%) which was a similar finding with the results from Nepal, Nigeria, Burkinafaso as well as Ethiopia (13,15,17,21). And the most common finding on NCS was AMAN 18 (14.5%). This goes in line with the Ethiopian study done among patients referred for the first time to the Electrodiagnostic laboratory at Black Lion Hospital between 2016 and 2019 which showed AMAN to be the most common variant (9). On the other hand the most common NCS finding in India, Nepal, Saudi Arabia was reported to be AIDP. This difference can be attributed to...

Having gastroenteritis as a preceding event and need for mechanical ventilation were found to be factors associated with bad outcome in GBS patients.

In this study, the GBS disability grading used to assess the treatment outcome was the Hughes motor scale. Death (Hughes motor scale of 6) was recorded in 12.1% of the cases. This was comparable with the study done in Burkina Faso from 2003-2020 which showed the death rate to be 14.3% (15). On the other hand, this figure is much higher compared to the studies done in Nepal where the in-hospital mortality rate was 6.45% and those done in Saudi Arabia and Italy where this rate was found to be approximately 0% (12–14). This discrepancy may be explained by various environmental and economic factors like lack of ICU services which result in delayed management which is expected in low-income countries like Ethiopia. And this was lower than

the mortality rate in the study done at Black lion Hospital, which was 16.4% (16). The discrepancy is possibly because of the difference in the study population, since the later was done only in the pediatric population.

Most patients (37.9%) were able to walk for 10m with support (Hughes motor scale of 3); 27.4% were able to walk for 10m or more without support but unable to run (Hughes motor scale of 2); 18.5% were confined to bed (Hughes motor scale of 4) and 4% had minor signs and symptoms and were able to run (Hughes motor scale of 1) at the time of discharge. This finding collaborates with the review of LMIC which found that 30-40% of the cases were unable to walk unaided (8). But better outcomes were reported in the Italian study where 26.2% of patients had mild symptoms, mainly sensory in nature, and were able to perform daily activities and to run, whereas 14.3% were unable to walk even with the bilateral support at the time of discharge (14). The Saudi Arabian study has also showed a better prognosis with 50% being able to walk independently (12), but this difference may be due to methodological difference since the outcome was assessed nine months after discharge.

Generally, 85 patients (68.5%) had bad outcome (Hughes motor scale of >2). This finding is in line with the Indian study published in 2022 which showed bad outcome in 68% of the patients at discharge (20).

Patients who needed mechanical ventilation were found to be 0.12 times less likely to have good outcomes. This finding is in line with the study conducted in SPHMMC and Zewditu hospitals where those who needed MV were 1.13 times more likely to have poor outcome (17). In addition, gastroenteritis as a preceding event was associated with higher odds of bad outcome. 36 (29%) of the patients had gastroenteritis as a preceding event. Gastroenteritis contributes a great deal to occurrence of GBS, especially in low income countries like Ethiopia where poor hygiene and sanitation, unsafe drinking water and frequent exposure to pathogens are likely to be abundant. Those patients with gastroenteritis as a preceding event were found to be 0.24 times less likely to have good outcome compared to those who had no preceding event. This finding collaborates with the Egyptian study published in 2023 which showed the odds to be 0.21 times less in these patients (23).

The strength of this study is that it enrolled the patients from three hospitals and hence is more representative.

The limitation of this study is, since it was a cross sectional study; no causal relationships were explored.

7. CONCLUSION

This study showed that poor treatment outcome in GBS patients is high and AMAN was found to be the most common variant of GBS. Respiratory tract infections and gastroenteritis were the main preceding events, with gastroenteritis being associated with bad outcomes. Mechanical ventilation was also found to have a statistically significant association with bad outcomes.

Recommendations

Organizations (hospitals)

- Hospitals and related organizations should arrange platforms for awareness creation and trainings on GBS and its predisposing factors for patients.
- There should be a system by which healthcare providers are continuously updated on the early signs of GBS so that appropriate referrals can be made to better ICU setups at early stages of the disease.
- Infection prevention strategies including gastroenteritis should be strengthened for better disease outcomes as shown in this study

Healthcare providers

- Health care providers should give more focus to giving proper health education/information on GBS, proper hygiene and sanitation.

Researchers

- Researchers should conduct researches to assess the cause effect relationship using strong study designs by large sample size by using this study as a base line.

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ANNEXES

Assurance of Principal Investigator

I the undersigned agree to accept all responsibilities for the scientific and ethical conduct of the research project. I will provide timely progress report to my advisor and seek the necessary advice and approval from my primary advisors in the course of the research. I will communicate timely to my advisors all stakeholders involved in the study including any source of funding for this research.

Name of the student: _____

Signature: _____

Date: _____

Approval of the Primary Advisor

Name of the primary advisor: _____

Signature: _____

Date: _____

Approval of the Co-Advisor

Name of the primary advisor: _____

Signature: _____

Date: _____

Waiver of consent

Title: Treatment outcome and associated factors of GBS patients in selected Addis Ababa Hospitals from January 2020 – December 2022

Investigator: Gelila Negusie, M.D. year 2 Emergency and critical care resident

Phone: 0913791520

Review of medical records of all patients who were admitted in AaBET Hospital, SPHMMC and ALERT Hospital from January 2020 – December 2022. There will not be any risk to the subjects, and it will not adversely affect the rights and welfare of the subjects. Researchers will be collecting limited data that will be assigned a random code and the link is known only to the researchers. The study will be anonymous, findings will be strictly confidential, and patients' identification will not be mentioned. All information will be kept in a password protected computer. Results of the research will not affect clinical care of the individuals, since they will already have left the hospital.

Reviewer: -----

Date:-----

Questionnaire

PART 1: Sociodemographic characteristics	
1.1. Age in years	
1.2. Sex	a) Female b) Male
1.3. Place of residence	a) Rural b) Urban
PART 2: Disease related variables	
2.1. Type of GBS on NCS	a) AIDP b) AMAN c) AMSAN d) Normal e) Not done
2.2. Time to maximal weakness	a) ≤ 2 weeks b) > 2 weeks
2.3. Clinical features at presentation	a) Ascending paralysis b) Sensory disturbance c) Respiratory failure d) Dysphagia e) Autonomic dysfunction f) Bladder involvement g) Cranial nerve involvement
2.4. Duration of Hospital Stay in days	
2.5. Duration of ICU stay in days	
2.6. Comorbid illness	a) Diabetes mellitus b) HIV c) Hypertension d) Cardiovascular disease e) Renal disease

	f) Other
2.7. Preceding event	a) Respiratory tract infections b) Gastroenteritis c) Rabies Vaccine d) Surgery e) Other f) No preceding event
2.8. CSF protein	a) Elevated b) Normal c) Not done
PART 3: Treatment related variables	
1.1. Treatment provided	a) IVIg b) Plasmapheresis
1.2. Mechanical ventilation	a) Yes b) No
1.3. Tracheostomy	a) Yes b) No
PART 4: Guillain Barré Syndrome disability scale, adapted from Hughes et al	
0 A healthy state 1 Minor signs and symptoms but able to run 2 Able to walk for 10 m or more without support but unable to run 3 Able to walk 10 m with support 4 Confined to bed 5 Required assisted ventilation 6 Dead	