KEMENTERIAN KESIHATAN MALAYSIA
HOSPITAL KUALA LUMPUR

# Improving Appropriate Use of Intravenous Immunoglobulin (IVIG) in Neurological Disorders at Hospital Kuala Lumpur


A collaboration between Neurology and Pharmacy Department, HKL

# ADVISORS

**Mdm Noraini Mohamad**
Deputy Director (Pharmacy)

**Dr Shanthi Viswanathan**
Head of
Neurology Department

# FACILITATOR

**Dr Farizan Abdul Ghaffar**
Senior Pharmacist

# GROUP MEMBERS

**Dr Dhayalen K**
Consultant
Neurologist

**Tan Ai Leen**
Senior
Pharmacist

**Yeak Chee Yan**
Pharmacist
Team Leader

**Hazrin**
Pharmacist
Presenter

**Mohd Izwan**
Neurology Registered
Nurse

**Ziran Nadiah**
Pharmacist

**Wan Hazimah**
Pharmacist

**Noradlina**
Pharmacist

# Selection of Opportunities For Improvement

# Problem Identification

| No | Problems | Verification | Domain Involved |
|---|---|---|---|
| 1. | High percentage of inappropriate use of IVIG in neurological disorders. | **61.2%** of inappropriate use of IVIG in neurological disorders. | Safety<br>Effectiveness |
| 2. | High percentage of expired medications returned by patients in wards. | **20%** of expired medications returned by patients in wards. | Safety |
| 3. | Delayed in discharge prescriptions sent to in-patient pharmacy. | **20%** of discharge prescriptions sent to pharmacy after 4pm. | Timeliness |
| 4. | Adherence to completion of ARF form when controlled antibiotic was initiated. | **31%** of ARF forms received at pharmacy are incomplete. | Safety |

ARF = Antibiotic Request Form

# Problem Prioritization

| No | Problems | S | M | A | R | T | Total |
|---|---|---|---|---|---|---|---|
| 1. | High percentage of inappropriate use of IVIG in neurological disorders. | 24 | 23 | 24 | 23 | 22 | **116** |
| 2. | High percentage of expired medications returned by patients in wards. | 22 | 21 | 21 | 20 | 21 | 105 |
| 3. | Delayed in discharge prescriptions sent to inpatient pharmacy. | 17 | 21 | 19 | 21 | 21 | 99 |
| 4. | Adherence to completion of ARF form when controlled antibiotic was initiated. | 19 | 22 | 20 | 21 | 22 | 104 |

**Group Members: 8**

| Score | 1 | 2 | 3 |
|---|---|---|---|
| Indication | Low | Fair | High |

# Intravenous Immunoglobulin (IVIG)[1]


- Fractionated **blood products** derived from pooled human plasma
- Given via **intravenous (IV) infusion**
- Act as **immunomodulators** in neurological disorders

| | | | | | |
|---|---|---|---|---|---|
| Guillain-Barré syndrome (GBS) | Chronic Inflammatory Demyelinating Polyneuropathy (CIDP) | Multifocal Motor Neuropathy (MMN) | Autoimmune Encephalitis (AE) | Acute disseminated encephalo-myelitis (ADEM) | Myasthenic crisis |

1. Lee JL, Mohd Saffian S, Makmor-Bakry M, Islahudin F, Alias H, Ali A, Mohamed Shah N. Prescribing Practices of Intravenous Immunoglobulin in Tertiary Care Hospitals in Malaysia: A Need for a National Guideline for Immunoglobulin Use. Front Pharmacol. 2022 Jun 9;13:879287.

# Reason for Selection

## Seriousness : Inappropriate use of IVIG

| | |
|---|---|
| IVIG used for **low evidence indication** | • **Worsening** of symptoms or **exacerbation** of underlying conditions[2]<br>• Increased morbidity and mortality[2] |
| Unnecessary prolonged **duration** and inappropriate **dose/frequency** | • 5–15% risk of **adverse effects** such as headache, fever/chills and anaphylaxis (1%)[3] |
| Improper **administration** of IVIG | • **Reactions** occurred with fast infusion rates due to different strengths and brands of IVIG[4] |


2. Dalakas MC. Update on Intravenous Immunoglobulin in Neurology: Modulating Neuro-autoimmunity, Evolving Factors on Efficacy and Dosing and Challenges on Stopping Chronic IVIg Therapy. Neurotherapeutics. 2021 Oct;18(4):2397-2418.
3. E.E. Perez *et al.* Update on the use of immunoglobulin in human disease: a review of evidence J Allergy Clin Immun (2017)
4. Palabrica FR, Kwong SL, Padua FR. Adverse events of intravenous immunoglobulin infusions: a ten-year retrospective study. Asia Pac Allergy. 2013 Oct;3(4):249-56. doi: 10.5415/apallergy.2013.3.4.249. Epub 2013 Oct 31.

# Reason for Selection

**M** Percentage of appropriate use of IVIG in neurological disorders.

**A** Improving appropriate use of IVIG in neurological disorders to ensure better clinical outcome and reduce treatment cost.

**R** Remediable by appropriate strategies of change and multidisciplinary approach.

**T** Can be completed in a timely manner.

# Literature Review

**Solís-Díez, G et al 2022[5]**

- The demand and **consumption for IVIG are growing**, leading to difficulties in obtaining supplies
- So, a rational plan with **evidence-based** is needed.

**Zahari, NH et al 2022[6]**

- A **national guideline** (in Malaysia) on the prescription of IVIG for patients is instantly needed to help clinicians in **prescribing IVIG appropriately**.


5. Solís-Díez G, Turu-Pedrola M, Roig-Izquierdo M, Zara C, Vallano A, Pontes C. Dealing With Immunoglobulin Shortages: A Rationalization Plan From Evidence-Based and Data Collection. Front Public Health. 2022 May 19;10:893770.
6. Zahari NH, Abd Hamid IJ, Tuan Din SA, Hashim IF, Zainudeen ZT, Mohd Shariff N, Ahmad NH, Tay CY. Practise of Immunoglobulin Replacement Therapy in Primary and Secondary Immunodeficiencies: A Single Centre Experience from Malaysia. Malays J Med Sci. 2023 Jun;30(3):112-121.

# Appropriate Use of IVIG

| | |
|---|---|
| **Correct Indication** | • Guillain-Barré syndrome (GBS)<br>• Chronic inflammatory demyelinating polyneuropathy (CIDP)<br>• Multifocal motor neuropathy (MMN)<br>• Myasthenic crisis<br>• Autoimmune encephalitis (AE)<br>• Acute disseminated encephalomyelitis (ADEM) |
| **Correct Dose** | • BMI ≤ 30 kg/$m^2$ – use actual body weight for dose calculation<br>• BMI > 30 kg/$m^2$ – use adjusted body weight for dose calculation |
| **Correct Frequency** | Once daily dosing |
| **Correct Duration** | a) Acute: One off and for 5 days<br>b) Chronic: Cyclical every 3 weeks for 6 cycles then slowly titrate according to patients' response |
| **Correct Administration** | a) Correct IVIG infusion rate<br>b) Monitoring & documentation of vital signs during infusion of IVIG<br>c) Monitoring & documentation of any adverse reactions |

# Terms & Definitions

**Indication of IVIG**

**Listed** in MOH Drug Formulary

- Guillain-Barré Syndrome (GBS)

**Not Listed** in MOH Drug Formulary

- *Chronic Inflammatory Demyelinating Polyneuropathy (CIDP)
- *Multifocal Motor Neuropathy (M[illegible])
- Acute Disseminated Encephalomyelitis (ADEM)
- Autoimmune Encepha[illegible]asthenic Crisis
- Myelin Oligodendrocyte G[illegible]Disease (MOGAD)
- Neuromyelitis Optica S[illegible]
- Myasthenia gravis
- CNS Vasculitis
- Infla[illegible]
- Multiple Sclerosis
- Chronic Relapsing Inflammatory optic Neuritis (CRION)
- New Onset Refractory Status Epilepticus (NORSE)
- Stiff Person Syndrome


* = Indication approved by Drug Control Authority (DCA)

# Introduction



Hospital Kuala Lumpur (HKL) is the largest hospital under the Ministry of Health (MOH).

HKL Neurology Department is a part of Institut Kajisaraf Tunku Abdul Rahman (IKTAR) which is the **first** and the **largest neuroscience center** in the country.

Serves as critical national referral center for **stroke, epilepsy, neuroimmunology and movement disorders.**

**Neurology Services**

- **Neurology Ward** (in-patient)
  - N5A
  - N5B
  - Total of 52 beds
- **Neurology Clinic** (out-patient)

# Problem Statement

**HKL IVIG Procurement**

IVIG is the **SECOND** most procured item in HKL, with a total of **RM 10,173,111.20** in 2021

**Highest IVIG User**

Cost of IVIG usage for **neurological disorders** was **RM8,335,249.80** in 2021

**Off-label Indication**

**97%** (n=67) of total IVIG is being used as **off-label indication** in 2021

KEMENTERIAN KESIHATAN MALAYSIA
*Ministry of Health Malaysia*
PUSAT DARAH NEGARA (PDN)
*National Blood Centre*
Jalan Tun Razak
50400 KUALA LUMPUR
MALAYSIA

Telefon : 603 – 2613 2688
Faksimili : 603 – 2698 0362
Laman Web : www.pdn.gov.my

Rujukan : PDN.400-5/4/5 (51)
Tarikh : 18 Ogos 2023

**SEPERTI SENARAI EDARAN**

YBhg. Datuk/Dato'/Dr./Tuan/Puan,

**STATUS BEKALAN *PLASMA DERIVED MEDICINAL PRODUCTS* (PDMP) DI PUSAT DARAH NEGARA**

Shortage of plasma has disrupted the supply of IVIG.

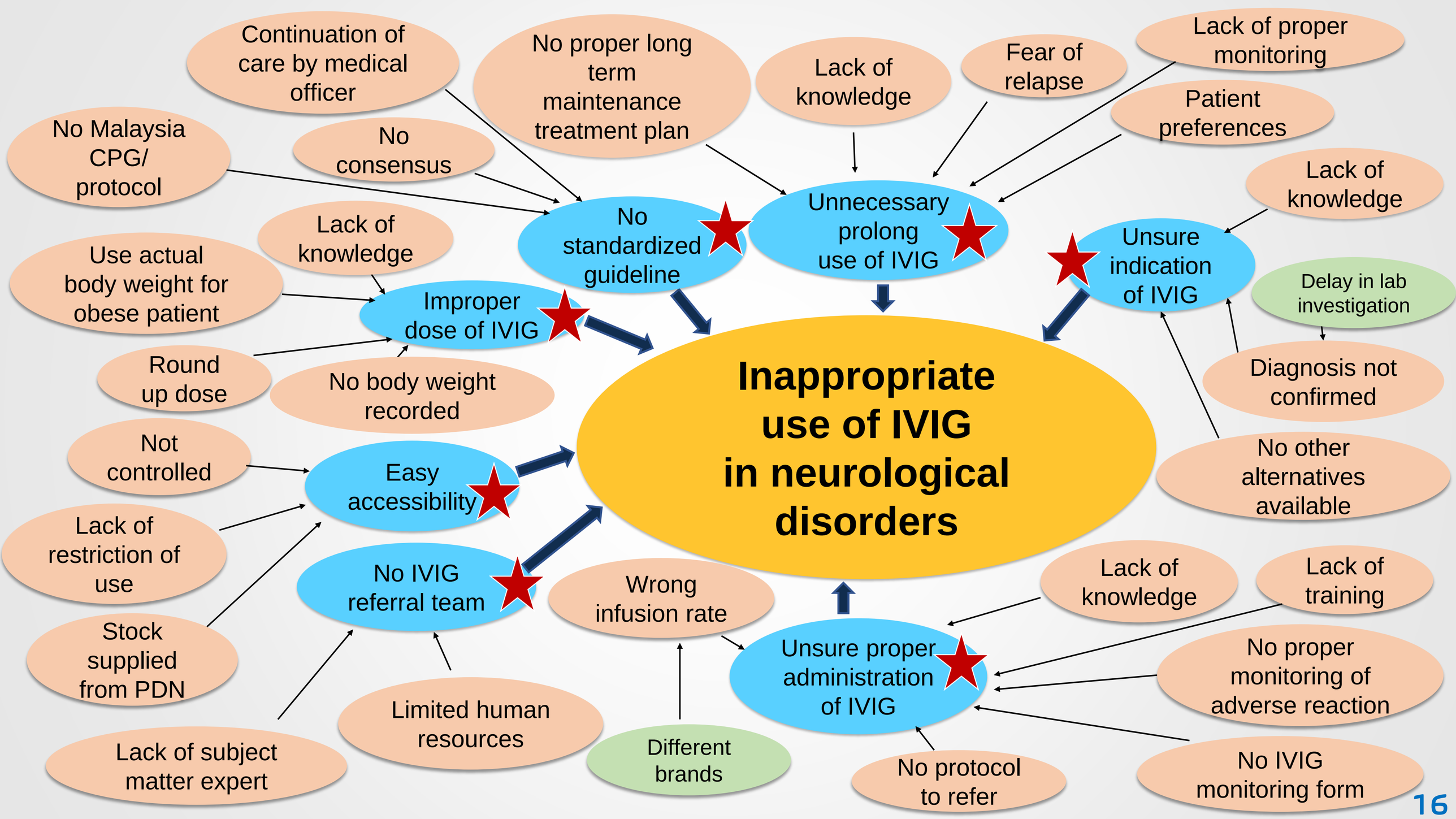
PDN has suggested to **limit use** of IVIG for **off-label indication.**

terjejas. PDN juga menyarankan agar penggunaan ubat-ubatan PDMP adalah berdasarkan indikasi klinikal dan bukan secara *off label use* memandangkan bekalan stok yang terbatas.

# Problem Statement

| | |
|---|---|
| **Effect** | Inappropriate use of IVIG in neurological disorders will lead to poor clinical outcomes, higher treatment costs and adverse event from improper administration of IVIG. |
| **Possible Cause** | Multiple factors including the absence of standardized protocols, easy accessibility of IVIG, and a lack of interdisciplinary teams for referral may contribute to this problem. |
| **Aim of Study** | Thus, this study aims to ensure the appropriate use of IVIG in neurological disorders. |

# Problem Analysis Chart


Inappropriate use of IVIG in neurological disorders
No standardized guideline
Unnecessary prolong use of IVIG
Improper dose of IVIG
Easy accessibility
No IVIG referral team
Unsure proper administration of IVIG
Unsure indication of IVIG
Continuation of care by medical officer
No proper long term maintenance treatment plan
Lack of knowledge
Fear of relapse
Lack of proper monitoring
Patient preferences
No Malaysia CPG/ protocol
No consensus
Lack of knowledge
Use actual body weight for obese patient
Round up dose
No body weight recorded
Not controlled
Lack of restriction of use
Stock supplied from PDN
Lack of subject matter expert
Limited human resources
Wrong infusion rate
Different brands
Lack of knowledge
Lack of training
No proper monitoring of adverse reaction
No protocol to refer
No IVIG monitoring form
Lack of knowledge
Delay in lab investigation
Diagnosis not confirmed
No other alternatives available

# Study Objectives

## General Objective

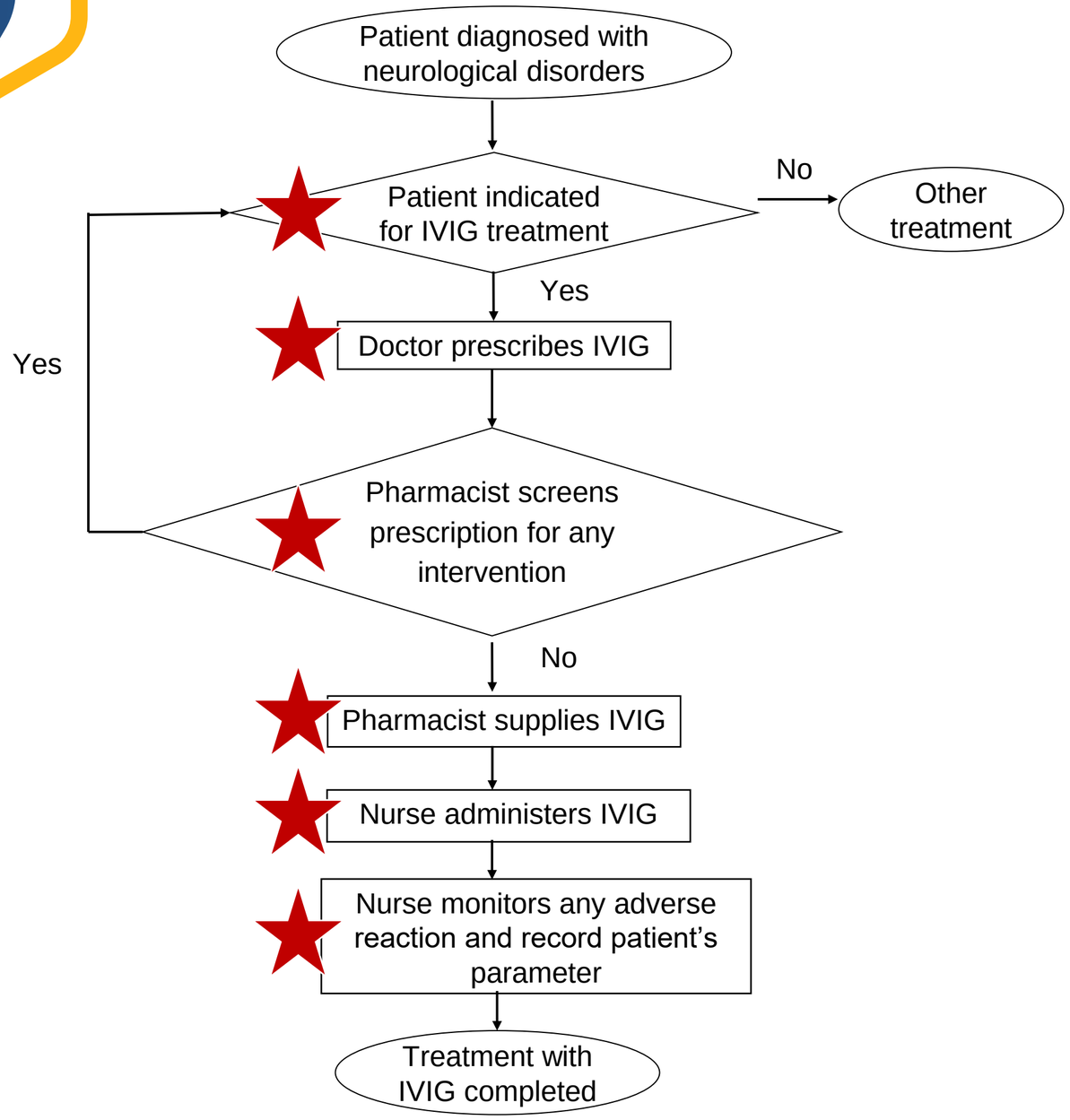
- To increase the percentage of appropriate use of IVIG in neurological disorders.

## Specific Objectives

1. To identify the prevalence of inappropriate use of IVIG in neurological disorders.
2. To identify the contributing factors which leads to inappropriateness use of IVIG in neurological disorders.
3. To formulate and implement the remedial measures.
4. To evaluate the effectiveness of the remedial measures taken.

# Key Measurement For Improvement

# Process of Care




**Role & Responsibility**

- Doctor
- Pharmacist
- Nurse

# Model of Good Care (1)

| No | Critical Steps | Criteria | Standard |
|---|---|---|---|
| 1. | **Patient indicated for IVIG treatment** | Doctor established a neurological diagnosis to be treated with IVIG. | 100% |
| 2. | **Doctor prescribes IVIG** | a. Doctor prescribes correct dose of IVIG. | 100% |
| | | b. Doctor prescribes correct frequency of IVIG. | 100% |
| | | c. Doctor prescribes correct duration of IVIG. | 100% |
| 3. | **Pharmacist screens prescription for any intervention** | a. Pharmacist screens prescription for correct indication of IVIG. | 100% |
| | | b. Pharmacist screens prescription for correct dose of IVIG. | 100% |
| | | c. Pharmacist screens prescription for correct frequency of IVIG. | 100% |
| | | d. Pharmacist screens prescription for correct duration of IVIG. | 100% |

# Model of Good Care (2)

| No | Critical Steps | Criteria | Standard |
|---|---|---|---|
| 4. | **Pharmacist supplies IVIG** | a. Pharmacist supplies correct drug and strength. | 100% |
| | | b. Pharmacist supplies correct dose of IVIG. | 100% |
| | | c. Pharmacist supplies correct frequency of IVIG. | 100% |
| | | d. Pharmacist supplies correct duration of IVIG. | 100% |
| 5. | **Nurse administers IVIG** | Nurse administers correct IVIG infusion rate. | 100% |
| 6. | **Nurse monitors any adverse reaction and record patient's parameter** | a. Nurse monitors & documents vital signs during infusion of IVIG. | 100% |
| | | b. Nurse monitors & documents for any adverse reactions. | 100% |

# Indicator & Standard

## Indicator

Percentage of appropriate use of IVIG in neurological disorders

## Formula

$$\frac{\text{Total no. of patients with appropriate use of IVIG in neurological disorders}}{\text{Total no. of patients treated with IVIG}} \times 100\%$$

## Standard

**95%**


7. Foster et al. Use of intravenous immune globulin in the ICU: a retrospective review of prescribing practices and patient outcomes. Transfus Med. 2010 Dec.
8. Zeinab et al. Predicting Factors for the Pattern of Intravenous Immunoglobulin Utilization in a Middle Eastern University Hospital. J Res Pharm Pract. 2018 Oct-Dec; 7(4): 188–194.

# Process of Gathering Information

# Methodology

## Study Design

Quasi experimental

## Sampling Technique

Universal sampling

## Study Location

Neurology Wards &
Neurology Clinic
in HKL

## Inclusion Criteria

All cases of IVIG treatment in neurological disorders

## Exclusion Criteria

Cases of IVIG treatment from other wards/clinic

## Source of Data

- Patients' medical record
- IVIG usage record
- Data collection form
- Questionnaire

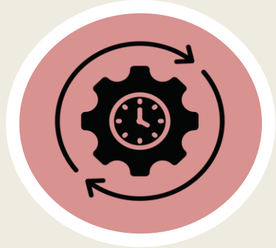
# Study Timeline

**Verification Study**

**Oct – Dec 2021**

**Cycle 1**

**Jan – Dec 2022**



**Cycle 2**

**Jan – Dec 2023**

**Cycle 3**

**Jan – July 2024**

# Data Collection Form

## Immunoglobulin (IVIG) Assessment Form

| | | | |
|---|---|---|---|
| Patient Name | | Dose regime as per guideline | |
| RN | | Actual body weight (ABW) | |
| Ward/ Clinic | | Height | |
| Indication | | BMI | |
| IgG level | | Allergies | |

| No | Criteria | Yes/ No | Comment (If any) |
|---|---|---|---|
| 1. | IgG level taken before start IVIG | ☐Yes ☐No | |
| 2. | Correct indication | ☐Yes ☐No | |
| 3. | Correct dose | ☐Yes ☐No | |
| 4. | Correct frequency | ☐Yes ☐No | |
| 5. | Correct duration | ☐Yes ☐No | |
| 6. | Correct infusion rate | ☐Yes ☐No | |
| 7. | Monitoring of patient's vital sign | ☐Yes ☐No | |
| 8. | Monitoring of infusion related reaction | ☐Yes ☐No | |

# Questionnaire

**Questionnaire: Appropriate Use of Intravenous Immunoglobulin (IVIG) in neurological disorders**

**This questionnaire consists of 14 questions to be answered by doctors, nurses, and pharmacist to assess on knowledge of IVIG. We thank you for your participation.**

Name :
Designation :
Email :
Current place of practice :
Year of service :

1. What is the dose of Immunoglobulin (IVIG) for CIDP?

   _____

2. What is administration rate for Intravenous Immunoglobulin (IVIG)?

   _____

3. Chills is one of the side effects of Intravenous Immunoglobulin (IVIG)?
   A. Yes B. No

4. What type of lab investigations needed prior to starting IVIG?

   _____

5. What are the neurological conditions commonly prescribed with IVIG in HKL?

   _____

6. Is there any IVIG protocol or guidelines available in HKL?

   _____

7. Does IVIG being used as first line treatment for Multiple Sclerosis?

   _____

8. How frequent does patient need to be on IVIG?

   _____

9. What tests usually done to assess how long patient need to be on IVIG?

   _____

10. Who do you refer to when there are any issues with IVIG prescription?

    _____

11. Does patient who experience allergic reaction towards IVIG with strength 10% will have allergic reaction towards IVIG with strength 6%?
    A. Yes B. No

12. What are the steps to be taken if patient do experience allergic reactions to IVIG?

    _____

13. Patient with BMI more than 30, need to adjust dose of IVIG by using adjusted body weight?
    A. Yes B. No

14. Any requirements needed to be sent together to pharmacy when. prescribing IVIG?

    _____

# Data Collection

| Data Collection Tools | Aim | Subject | Sample size (n) |
|---|---|---|---|
| Questionnaire to healthcare professionals | To determine the factors contributing to inappropriate use of IVIG in neurological disorders. | • Medical officers<br>• Pharmacists<br>• Nurses | **114** |
| IVIG assessment form | To assess the process of IVIG prescribing, supplying and administration | All patients who are initiated with IVIG | Verification cycle : 67<br>Cycle 1 : 241<br>Cycle 2 : 223<br>Cycle 3 : 115 |

# Data Analysis And Interpretation (Verification Study)

# Model of Good Care (1)

| No. | Critical Steps | Criteria | Standard | Verification Study (n=67) |
|---|---|---|---|---|
| 1. | **Patient indicated for IVIG treatment** | Doctor established a neurological diagnosis to be treated with IVIG. | 100% | ★**46.3%** |
| 2. | **Doctor prescribes IVIG** | a. Doctor prescribes correct dose of IVIG. | 100% | ★**70.1%** |
| | | b. Doctor prescribes correct frequency of IVIG. | 100% | 100% |
| | | c. Doctor prescribes correct duration of IVIG. | 100% | ★ **56.7%** |
| 3. | **Pharmacist screens prescription for any intervention** | a. Pharmacist screens prescription for correct indication of IVIG. | 100% | ★ **46.3%** |
| | | b. Pharmacist screens prescription for correct dose of IVIG. | 100% | ★**70.1%** |
| | | c. Pharmacist screens prescription for correct frequency of IVIG. | 100% | 100% |
| | | d. Pharmacist screens prescription for correct duration of IVIG. | 100% | ★ **56.7%** |

# Model of Good Care (2)

| No. | Critical Steps | Criteria | Standard | Verification Study (n=67) |
|---|---|---|---|---|
| 4. | **Pharmacist supplies IVIG** | a. Pharmacist supplies correct drug and strength. | 100% | 100% |
| | | b. Pharmacist supplies correct dose of IVIG. | 100% | 100% |
| | | c. Pharmacist supplies correct frequency of IVIG. | 100% | 100% |
| | | d. Pharmacist supplies correct duration of IVIG. | 100% | 100% |
| 5. | **Nurse administers IVIG** | Nurse administers correct IVIG infusion rate. | 100% | ★ **81%** |
| 6. | **Nurse monitors any adverse reaction and record patient's parameter** | a. Nurse monitors & documents vital signs during infusion of IVIG. | 100% | ★ **68%** |
| | | b. Nurse monitors & documents for any adverse reactions. | 100% | ★ **74%** |

# Verification Study

**Duration: Oct 2021 – Dec 2021**

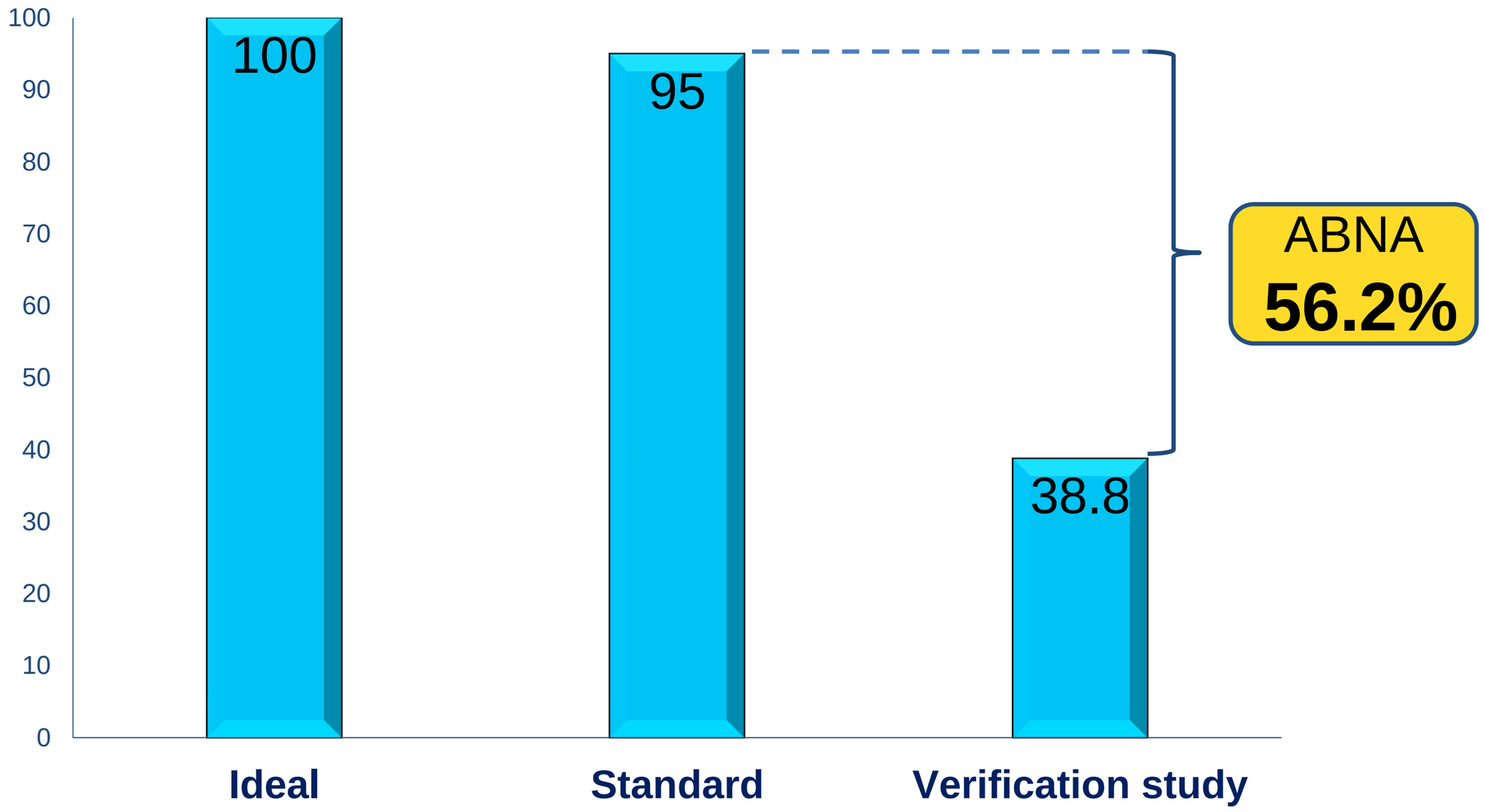
| Total number of patients with appropriate use of IVIG in neurological disorders (A) | Total number of patients treated with IVIG in neurological disorders (B) | Percentage of appropriate use of IVIG in neurological disorders [ (A/B) X100% ] |
|---|---|---|
| 26 | 67 | **38.8 %** |

## Goal for Improvement

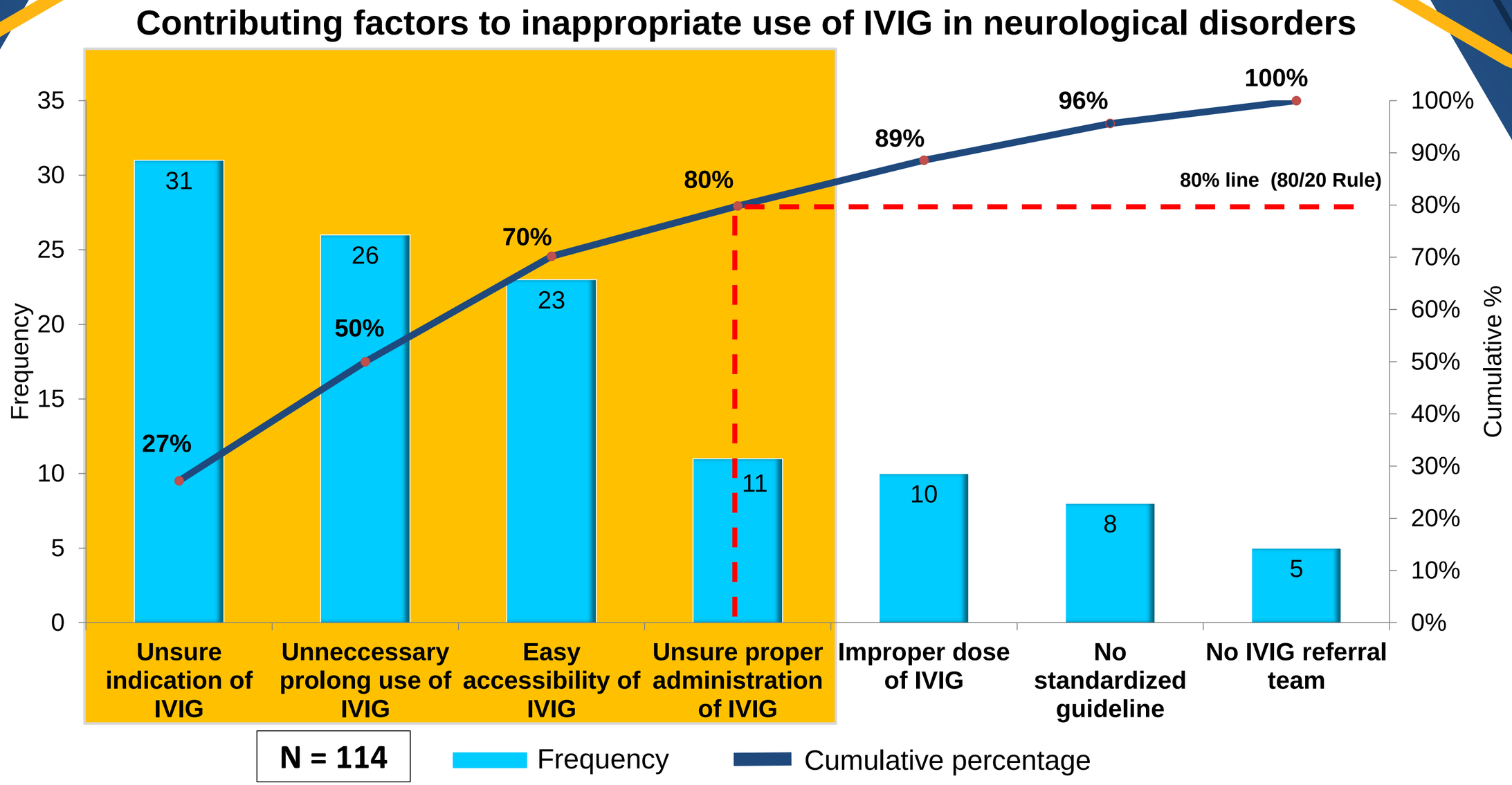
To increase the percentage of appropriate use of IVIG in neurological disorders **38.8%** to **95%**.

# Achievable Benefit Not Achieved (ABNA)

**Percentage of appropriate use of IVIG in neurological disorders**



# Main Findings From Verification Study



# Main Findings From Verification Study

## Doctors & Pharmacists

- Unsure indication of IVIG
- Easy accessibility of IVIG
- Unnecessary prolong use of IVIG
- Improper dose of IVIG

## Nurses

- Unsure proper administration of IVIG


## Hospital

- No standardized guideline
- No IVIG referral team

# Strategies For Change
# Cycle 1

# Main Findings From Verification Study

## Doctors & Pharmacists

- **Unsure indication of IVIG**
- Easy accessibility of IVIG
- Unnecessary prolong use of IVIG
- Improper dose of IVIG

## Nurses

- Unsure proper administration of IVIG

## Hospital

- No standardized guideline
- No IVIG referral team

# 1. Prioritization of IVIG Indication

**Before**

Lampiran 1

## FRACTIONATED PLASMA PRODUCT USAGE RECORD

(Human Normal Globulin Injection)

HOSPITAL NAME : **HOSPITAL KUALA LUMPUR**

PDN REFERENCE : _____

UNIT/DEPARTMENT : **FARMASI NEUROSAINS (IKTAR)**

PREPARED BY : Wan Hazimah

MONTH : **Nov 2021**

| NO | DATE | PATIENT'S NAME | IC NO. | INDICATIONS | REGIMENS | No. OF VIALS SUPPLIED |
|---|---|---|---|---|---|---|
| 1. | 3/11/21 | | | CNS Vasculitis | 42g OD x 3/7 | 42 |
| 2. | 3/11/21 | | | CIDP | 33g OD x 5/7 | 55 |
| 3. | 5/11/21 | | | Inflammatory Myositis | 33g OD x 5/7 | 55 |
| 4. | 8/11/21 | | | CIDP | 45g OD x 2/7 | 30 |
| 5. | 9/11/21 | | | CIDP | 33g OD x 3/7 | 33 |
| 6. | 3/11/21 | | | MS | 27g OD x 5/7 | 45 |
| 7. | 5/11/21 | | | Stiff Person Syndrome | 30g OD x 5/7 | 50 |
| 8. | 8/11/21 | | | MS | 24g OD x 5/7 | 40 |
| 9. | 8/11/21 | | | GBS | 21g OD x 5/7 | 35 |
| 10. | 17/11/21 | | | NMOSD | 24g OD x 5/7 | 40 |

IVIG therapy can be initiated for all indication as long as approved by MOH,

However, about **42%** of the neurological disorder cases are **not specified in established guidelines**[9]

9. Mehta, K. (2016). Intravenous Immunoglobulin (IVIg) prescribing guidance. NHS England.

# 1. Prioritization of IVIG Indication

**After**

MINIT MESYUARAT PERBINCANGAN PENGGUNAAN UBAT HUMAN NORMAL GLOBULIN INJECTION (IVIG) DI JABATAN NEUROLOGI

Tarikh 19 Januari 2022
Masa 2.00 - 3.00 petang
Tempat Bilik Mesyuarat Tingkat 3, Bangunan IKTAR

Senarai kehadiran:
Dr. Shanthi Viswanathan (Pengerusi)
Dr. Joyce Pauline Joseph
Dr. Mohd Sufian Adenan
Pn Tan Ai Leen
PJ Noraida Azizah Muhamad
KJ Halizan Hamidon

- Dalam proses untuk memperbaharui tender dan dijangka akan memperoleh stok semula selepas April 2022.
- Stok sedia ada akan disimpan untuk pesakit-pesakit yang alergik kepada IVIG 2.5g.

2. IVIG 2.5g:
   - Stok dibeli dari Pharmaniaga.
   - Mengalami masalah pembekalan global kerana kekurangan bahan mentah (plasma) untuk pemprosesan.
   - Stok sedia ada dianggarkan dapat bertahan sehingga akhir bulan Februari 2022.

Streamline IVIG indication :

1) Peripheral nervous system disorders
2) Life-saving indications

# 1. Prioritization of IVIG Indication

**Chronic Inflammatory Demyelinating Polyneuropathy (CIDP)**

**Multifocal Motor Neuropathy (MMN)**

**Acute Disseminated Encephalomyelitis (ADEM)**

**Autoimmune Encephalitis**

**Guillain-Barré Syndrome (GBS)**

**Myasthenic Crisis**

Myelin Oligodendrocyte Glycoprotein Antibody-associated Disease (MOGAD)

Neuromyelitis Optica Spectrum Disorder (NMOSD)

Myasthenia Gravis

CNS Vasculitis

Inflammatory Myopathy

Multiple Sclerosis

Chronic Relapsing Inflammatory Optic Neuritis (CRION)

New Onset Refractory Status Epilepticus (NORSE)

Stiff Person Syndrome

9. Mehta, K. (2016). Intravenous Immunoglobulin (IVIg) prescribing guidance. NHS England.

# Main Findings From Verification Study

## Doctors & Pharmacists

- Unsure indication of IVIG
- Easy accessibility of IVIG
- **Unnecessary prolong use of IVIG**
- Improper dose of IVIG

## Nurses

- Unsure proper administration of IVIG

## Hospital

- No standardized guideline
- No IVIG referral team

# 2. Prolong the Interval of Cyclical IVIG Treatment

**Duration of IVIG treatment[3]**

**Acute** → **ONE OFF**

- Guillain-Barré syndrome (GBS)
- Myasthenic crisis
- Autoimmune encephalitis (AE)
- Acute disseminated encephalomyelitis (ADEM)

**Chronic** → **CYCLICAL**

- **Chronic inflammatory demyelinating polyneuropathy (CIDP)**
- **Multifocal motor neuropathy (MMN)**

European Federation of Neurological Societies/Peripheral Nerve Society (EFNS/PNS) CPG 2010[10]

CIDP/MMN treatment – every 3 weeks for 6 cycles then slowly titrate **according to patients' response**.

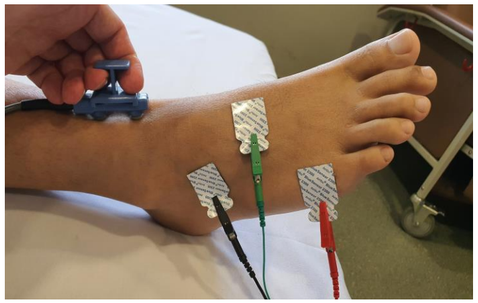
10. Van Den Bergh, P., Hadden, R. D. M., Bouché, P., Cornblath, D. R., Hahn, A. F., Illa, I., Koski, C. L., Léger, J., Nobile-Orazio, E., Pollard, J. D., Sommer, C., Van Doorn, P. A., & Van Schaik, I. N. (2010). European Federation of Neurological Societies/Peripheral Nerve Society Guideline on management of chronic inflammatory demyelinating polyradiculoneuropathy: Report of a joint task force of the European Federation of Neurological Societies and the Peripheral Nerve Society – First Revision. *Journal of the Peripheral Nervous System*, *15*(1), 1–9.

# 2. Prolong the Interval of Cyclical IVIG Treatment

39 out of 79 (**49%**) stable CIDP/MMN patients were **REDUCED** from

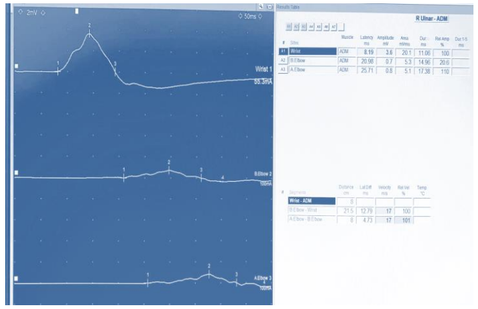
**12** Cycles/year → **6** Cycles/year

- Patient symptoms and progress were **closely monitored**
- **Nerve conduction study** done for each patient for every IVIG cycle change



Nerve conduction study (NCS)

NCS result



# Main Findings From Verification Study

## Doctors & Pharmacists

- Unsure indication of IVIG
- **Easy accessibility of IVIG**
- Unnecessary prolong use of IVIG
- Improper dose of IVIG

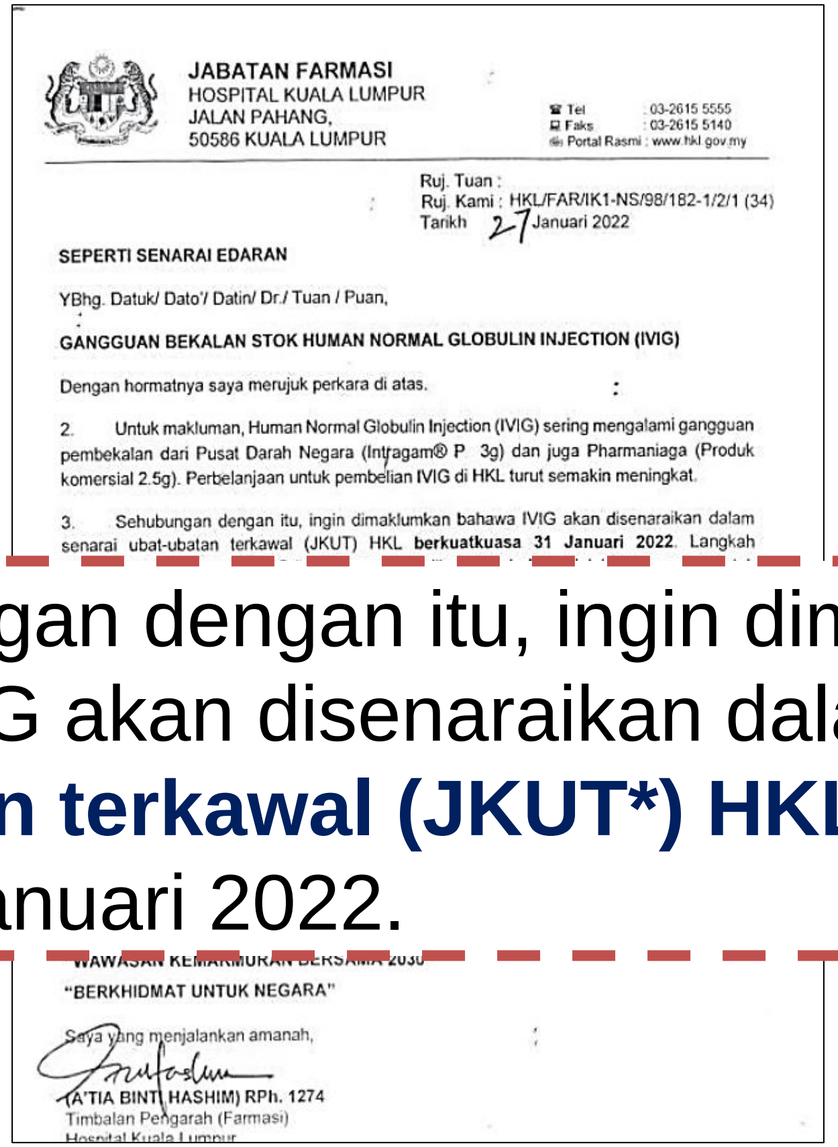
## Nurses

- Unsure proper administration of IVIG

## Hospital

- No standardized guideline
- No IVIG referral team

# 3. List IVIG as Control Drug Item in HKL



JABATAN FARMASI
HOSPITAL KUALA LUMPUR
JALAN PAHANG,
50586 KUALA LUMPUR

Tel : 03-2615 5555
Faks : 03-2615 5140
Portal Rasmi : www.hkl.gov.my

Ruj. Tuan :
Ruj. Kami : HKL/FAR/IK1-NS/98/182-1/2/1 (34)
Tarikh 27 Januari 2022

**SEPERTI SENARAI EDARAN**

YBhg. Datuk/ Dato'/ Datin/ Dr./ Tuan / Puan,

**GANGGUAN BEKALAN STOK HUMAN NORMAL GLOBULIN INJECTION (IVIG)**

Dengan hormatnya saya merujuk perkara di atas.

2. Untuk makluman, Human Normal Globulin Injection (IVIG) sering mengalami gangguan pembekalan dari Pusat Darah Negara (Intragam® P 3g) dan juga Pharmaniaga (Produk komersial 2.5g). Perbelanjaan untuk pembelian IVIG di HKL turut semakin meningkat.

3. Sehubungan dengan itu, ingin dimaklumkan bahawa IVIG akan disenaraikan dalam senarai ubat-ubatan terkawal (JKUT) HKL **berkuatkuasa 31 Januari 2022**. Langkah

WAWASAN KEMAKMURAN BERSAMA 2030

"BERKHIDMAT UNTUK NEGARA"

Saya yang menjalankan amanah,

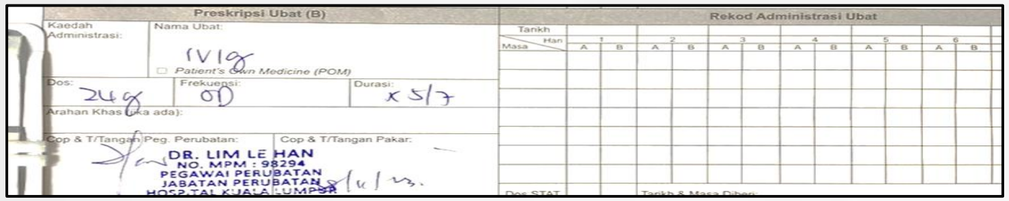
(A'TIA BINTI HASHIM) RPh. 1274
Timbalan Pengarah (Farmasi)
Hospital Kuala Lumpur

3. Sehubungan dengan itu, ingin dimaklumkan bahawa IVIG akan disenaraikan dalam **senarai ubat-ubatan terkawal (JKUT*) HKL** berkuat kuasa 31 Januari 2022.

*Jawatankuasa Ubat & Terapeutik

# 3. List IVIG as Control Drug Item in HKL

**After**




Doctor prescribes IVIG

**JAB. NEUROLOGI**

**Dr. Shanthi Viswanathan**

**Dr. Suganthi Chinnasami**

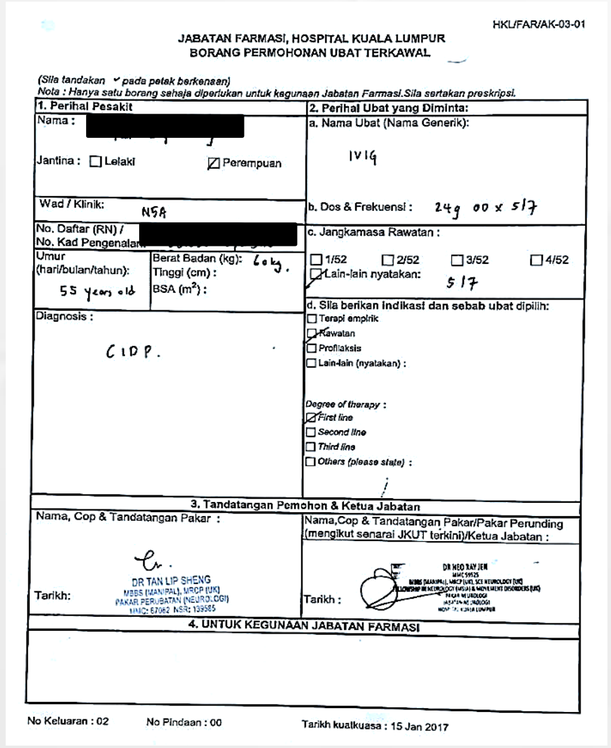
**Dr. Mohd Sufian Adenan**

**Dr. Ahmad Shahir Mawardi**

**Dr. Dhayalen Krishnan**

**Dr. Neo Ray Jen**

**Listed Consultants** must review and approve IVIG cases.



HKL/FAR/AK-03-01

JABATAN FARMASI, HOSPITAL KUALA LUMPUR
BORANG PERMOHONAN UBAT TERKAWAL

*(Sila tandakan ✓ pada petak berkenaan)*
*Nota : Hanya satu borang sahaja diperlukan untuk kegunaan Jabatan Farmasi.Sila sertakan preskripsi.*

**1. Perihal Pesakit**

Nama : [redacted]

Jantina : ☐ Lelaki ☑ Perempuan

Wad / Klinik: NSA

No. Daftar (RN) / No. Kad Pengenalan: [redacted]

Umur (hari/bulan/tahun): 55 years old

Berat Badan (kg): 60kg.

Tinggi (cm) :

BSA ($m^2$) :

Diagnosis : CIDP.

**2. Perihal Ubat yang Diminta:**

a. Nama Ubat (Nama Generik): IVIG

b. Dos & Frekuensi : 24g OD x 5/7

c. Jangkamasa Rawatan :

☐ 1/52 ☐ 2/52 ☐ 3/52 ☐ 4/52

☐ Lain-lain nyatakan: 5/7

d. Sila berikan indikasi dan sebab ubat dipilih:

☐ Terapi empirik
☐ Rawatan
☐ Profilaksis
☐ Lain-lain (nyatakan) :

*Degree of therapy :*
☑ *First line*
☐ *Second line*
☐ *Third line*
☐ *Others (please state)* :

**3. Tandatangan Pemohon & Ketua Jabatan**

Nama, Cop & Tandatangan Pakar :

DR TAN LIP SHENG
MBBS (MANIPAL), MRCP (UK)
PAKAR PERUBATAN (NEUROLOGI)
MMC: 67062 NRIC: 730505

Tarikh:

Nama,Cop & Tandatangan Pakar/Pakar Perunding (mengikut senarai JKUT terkini)/Ketua Jabatan :

DR NEO RAY JEN
MMC: 91572
MBBS (MANIPAL), MRCP (UK), SCE NEUROLOGY (UK)
CONSULTANT NEUROLOGIST (EPILEPSY & MOVEMENT DISORDERS) (UK)
HOSPITAL KUALA LUMPUR

Tarikh :

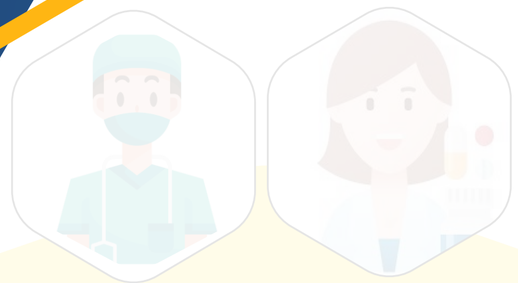
**4. UNTUK KEGUNAAN JABATAN FARMASI**

No Keluaran : 02 No Pindaan : 00 Tarikh kuatkuasa : 15 Jan 2017

Pharmacist screens prescription

Pharmacist supplies IVIG to nurse

# Main Findings From Verification Study



## Doctors & Pharmacists

- Unsure indication of IVIG
- Easy accessibility of IVIG
- Unnecessary prolong use of IVIG
- Improper dose of IVIG

## Nurses

- **Unsure proper administration of IVIG**




## Hospital

- No standardized guideline
- No IVIG referral team

# 4. Development of IVIG Administration Guide

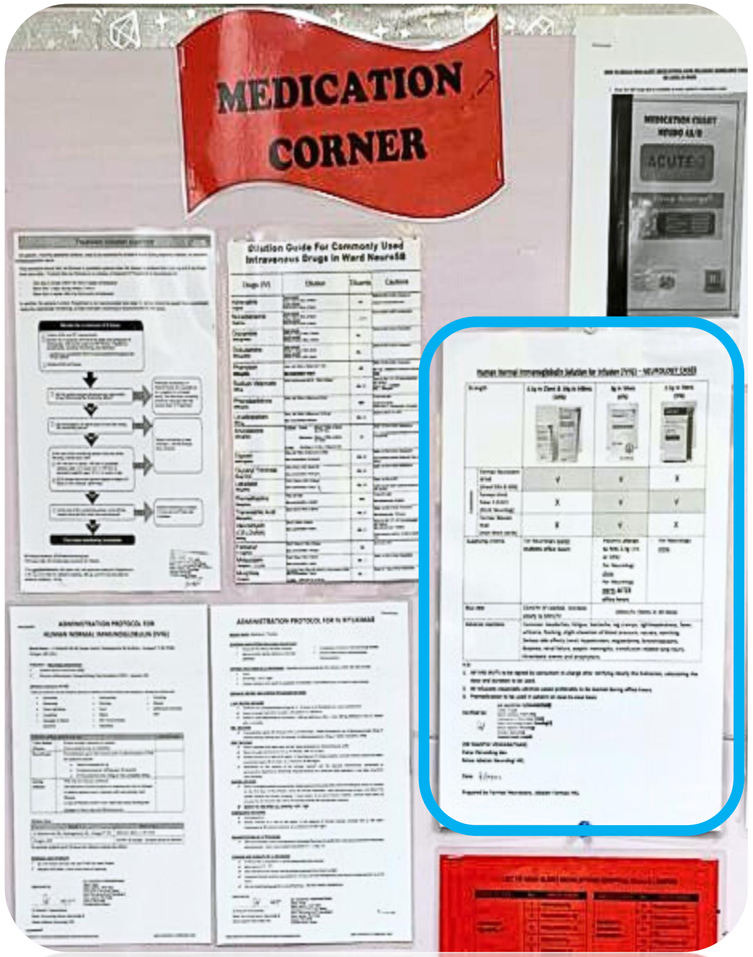
After

| | 2.5g in 25mL & 10g in 100mL (10%) | 3g in 50mL (6%) | 2.5g in 50mL (5%) |
|---|---|---|---|
| Strength & Brand |   |   |   |
| Infusion Rate | 25ml/hr (if needed, increase slowly to 50ml/hr | 100ml/hr (50mL in 30 mins) | |
| Adverse Effect | Common: headaches, fatigue, backache, leg cramps, light headedness, fever, urticaria, flushing, slight elevation of blood pressure, nausea, vomiting. Serious side effects (rare): hypotension, angioedema, bronchospasms, dyspnoea, renal failure, aseptic meningitis, transfusion-related lung injury, thrombotic events and anaphylaxis. | | |

# 4. Development of IVIG Administration Guide

**After**

**Hands on teaching session with nurses on IVIG administration guide in neurology wards and clinic by neurology pharmacists**




# Main Findings From Verification Study

## Doctors & Pharmacists

- **Unsure indication of IVIG**
- Easy accessibility of IVIG
- Unnecessary prolong use of IVIG
- **Improper dose of IVIG**

## Nurses

- **Unsure proper administration of IVIG**




## Hospital

- No standardized guideline
- No IVIG referral team

# 5. Continuous Medical Education (CME)


## 2 sessions

5 April 2022: 2.30 - 3.30pm
6 April 2022: 2.30 - 3.30pm

## Audience

**Specialists : 3**
**Doctors : 18**
**Pharmacists: 26**

## Pre & Post CME tests with awards

- Identify local champion
- Assess improvement in knowledge

*All participants scored more than 90% in post test.*

# 5. Continuous Nurse Education (CNE)

**2 sessions**
Nurses from neurology wards and clinic


**Pre & Post CNE tests with awards**

- Identify local champion
- Assess improvement in knowledge

*Out of 49 participants, 90% improved on IVIG knowledge*

**No. participants**
N5A – 20 nurses
N5B – 23 nurses
Neuro clinic – 6 nurses

# Effects of Change
# Cycle 1

# Effect of Change

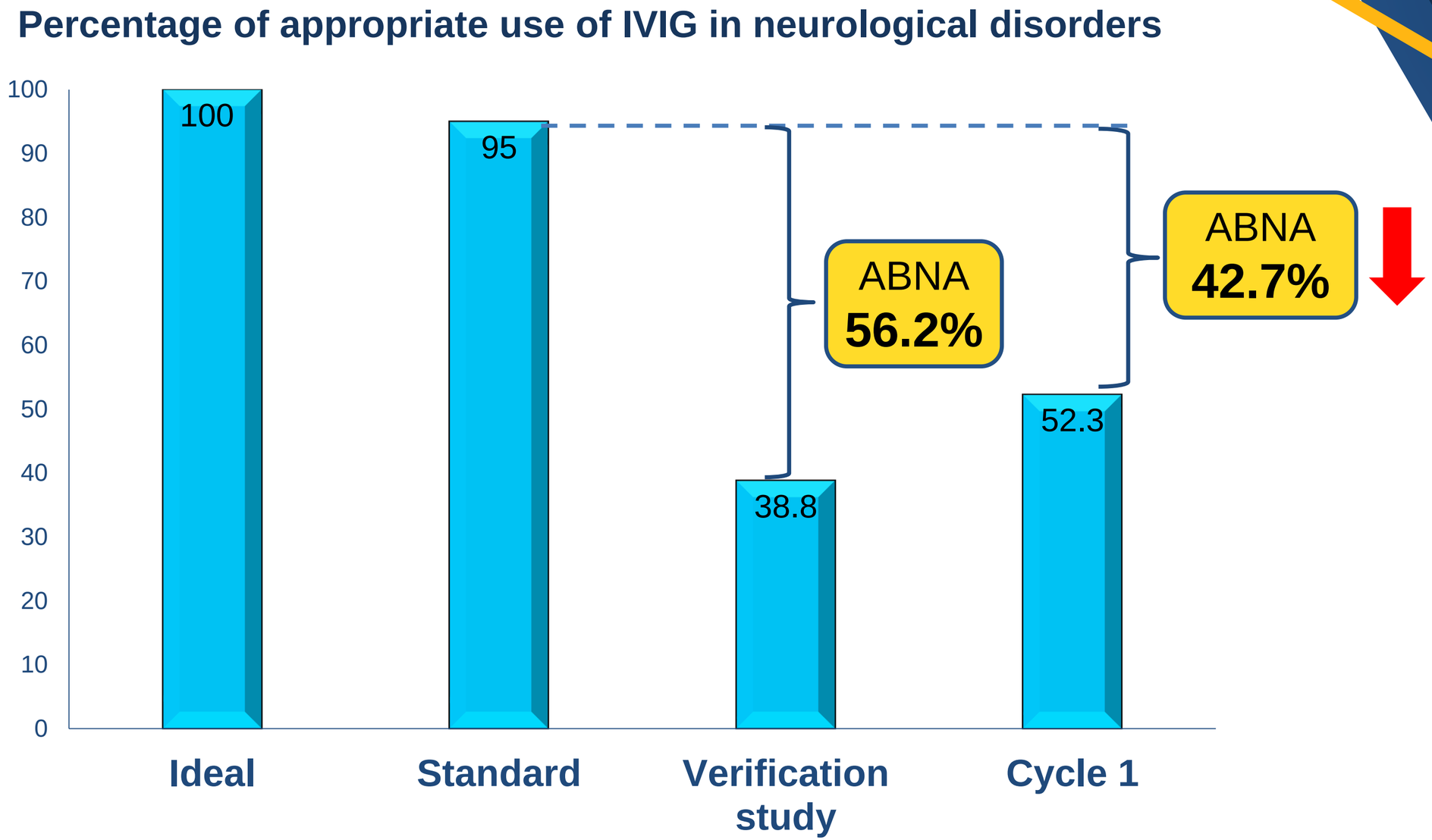
**Cycle 1: Jan 2022 – Dec 2022**

| Stage | Total number of patients with appropriate use of IVIG in neurological disorders (A) | Total number of patients treated with IVIG in neurological disorders (B) | Percentage of appropriate use of IVIG in neurological disorders [ (A/B) X100% ] |
|---|---|---|---|
| Verification | 26 | 67 | **38.8 %** |
| Cycle 1 | 126 | 241 | **52.3 %** |

## Goal for Improvement

To increase the percentage of appropriate use of IVIG in neurological disorders from **52.3%** to **95%**.

# Achievable Benefit Not Achieved (ABNA)



# Model of Good Care (1)

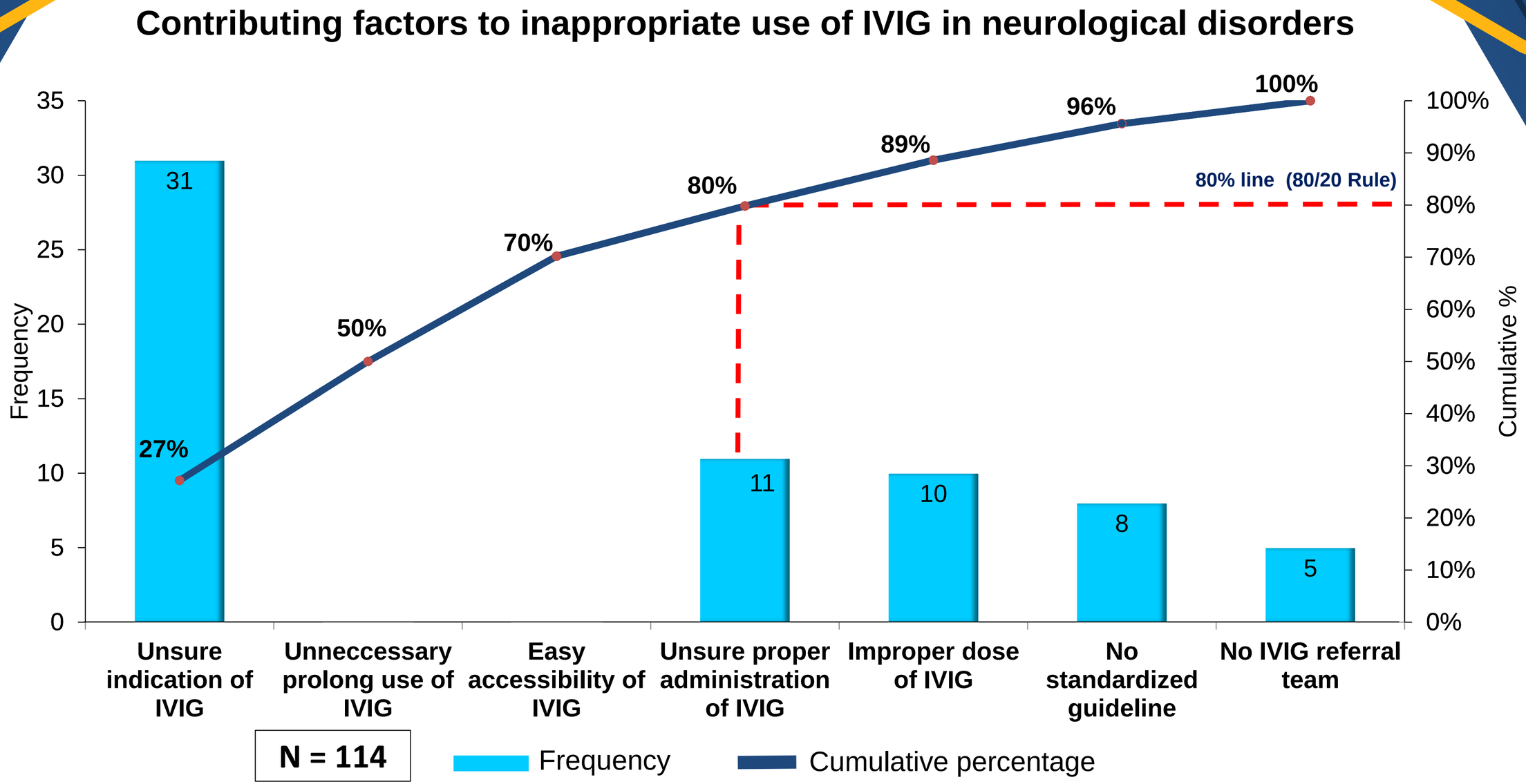
| No. | Critical Steps | Criteria | Standard | Verification Study (n=67) | Cycle 1 (n=241) |
|---|---|---|---|---|---|
| 1. | **Patient indicated for IVIG treatment** | Doctor established a neurological diagnosis to be treated with IVIG. | 100% | 46.3% | **63.1%** ↑ |
| 2. | **Doctor prescribes IVIG** | a. Doctor prescribes correct dose of IVIG. | 100% | 70.1% | **73.4%** ↑ |
| | | b. Doctor prescribes correct frequency of IVIG. | 100% | 100% | 100% |
| | | c. Doctor prescribes correct duration of IVIG. | 100% | 56.7% | **80.5%** ↑ |
| 3. | **Pharmacist screens prescription for any intervention** | a. Pharmacist screens prescription for correct indication of IVIG. | 100% | 46.3% | **73.4%** ↑ |
| | | b. Pharmacist screens prescription for correct dose of IVIG. | 100% | 70.1% | **88%** ↑ |
| | | c. Pharmacist screens prescription for correct frequency of IVIG. | 100% | 100% | 100% |
| | | d. Pharmacist screens prescription for correct duration of IVIG. | 100% | 56.7% | **85.1%** ↑ |

# Model of Good Care (2)

| No. | Critical Steps | Criteria | Standard | Verification Study (n=67) | Cycle 1 (n=241) |
|---|---|---|---|---|---|
| 4. | **Pharmacist supplies IVIG** | a. Pharmacist supplies correct drug and strength. | 100% | 100% | 100% |
| | | b. Pharmacist supplies correct dose of IVIG. | 100% | 100% | 100% |
| | | c. Pharmacist supplies correct frequency of IVIG. | 100% | 100% | 100% |
| | | d. Pharmacist supplies correct duration of IVIG. | 100% | 100% | 100% |
| 5. | **Nurse administers IVIG** | Nurse administers correct IVIG infusion rate. | 100% | 81% | **92.1%** ↑ |
| 6. | **Nurse monitors any adverse reaction and record patient's parameter** | a. Nurse monitors & documents vital signs during infusion of IVIG. | 100% | 68% | **78%** ↑ |
| | | b. Nurse monitors & documents for any adverse reactions. | 100% | 74% | **86%** ↑ |

# Strategies For Change Cycle 2

# Main Findings From Verification Study



# Main Findings From Verification Study

## Doctors & Pharmacists

- **Unsure indication of IVIG**
- Easy accessibility of IVIG
- Unnecessary prolong use of IVIG
- Improper dose of IVIG

## Nurses

- Unsure proper administration of IVIG

## Hospital

- No standardized guideline
- No IVIG referral team

Before

# 1. Establishment of IVIG Indication Priority Table

Chronic Inflammatory Demyelinating Polyneuropathy (CIDP)

Multifocal Motor Neuropathy (MMN)

Acute Disseminated Encephalomyelitis (ADEM)

Autoimmune Encephalitis

Guillain-Barré Syndrome (GBS)

Myasthenic Crisis

**Myelin Oligodendrocyte Glycoprotein Antibody-associated Disease (MOGAD)**

**Neuromyelitis Optica Spectrum Disorder (NMOSD)**

**Myasthenia Gravis**

**CNS Vasculitis**

**Inflammatory Myopathy**

**Multiple Sclerosis**

**Chronic Relapsing Inflammatory Optic Neuritis (CRION)**

**New Onset Refractory Status Epilepticus (NORSE)**

**Stiff Person Syndrome**

After

# 1. Establishment of IVIG Indication Priority Table

VIEWS & REVIEWS OPEN ACC

Internation
Managemer
2020 Update

Pushpa Narayanaswami, MBBS, D
Gabriel Cea, MD, Amelia Evoli, MD,
Arthur Melms, MD, Hiroyuki Murai
Jan Verschuuren, MD

*Neurology*® 2021;96:114-122. doi:

Abstract

Objective

To update the 2016 formal co
(MG) based on the latest evi

Methods

In October 2013, the Myasth
develop treatment guidance fo
RAND/UCLA appropriatene
pertaining to 7 treatment topi
the addition of one member t
reviewed for currency, and n
required inclusion or updates
e-mail votes were used to rea
rounds based on the panel inp
was used to approve minor cl

Results

The previous recommendatio
developed for the use of ritux
topics: early immunosuppress
inhibitor treatment.

Conclusion

This updated formal consens
provides recommendations to

Review

Autoimmune enc
recommendation
management

Hesham Abboud ,[1,2] Joh
David R Benavides,[6] Micha
Mireya Fernandez-Fournier,
Elena Grebenciucova,[15] Ad
Marcelo Matiello,[17,18] Anne
Ian Rossman,[22] Sarah Schm
Sean J Pittock ,[12] Maart
Clinicians Network

ABSTRACT

The objective of this paper is to evalu
evidence for each step in autoimmun
management and provide expert opi
evidence is lacking. The paper approa
encephalitis as a broad category rath
individual antibody syndromes. Core
Autoimmune Encephalitis Alliance Cl
reviewed literature and developed th
evidence was lacking or controversia
survey was distributed to all member
responses. Sixty-eight members from
answered the survey. Corticosteroids
with other agents (intravenous IG or
were selected as a first-line therapy b
responders for patients with a genera
74% for patients presenting with fac
seizures, 63% for NMDAR-IgG encep
for classical paraneoplastic encephali
responders indicated they would add
agent only if there was no response
first-line agent, 32% indicated addin
agent if there was no response to on
while only 15% indicated using a se
all patients. As for the preferred seco
of responders chose rituximab while
cyclophosphamide in a clinical scena
antibodies. Detailed survey results ar
the manuscript and a summary of th

*Review*

Acute Dissemi
Current Perspe

Renata Barbosa Paolilo [1],
Ming Lim [7,8,9,*]

1 Department of Neurology,
São Paulo 05508-060, Braz
2 Department of Pediatric N
University Hospitals Paris
Kumaran.deiva@aphp.fr
3 National Reference Centre
94270 Le Kremlin Bicêtre,
4 Inserm UMR 1184, Immu
94270 Le Kremlin Bicêtre,
5 Department of Neurology
r.neuteboom@erasmusmc
6 Department of Pediatric N
45711 Datteln, Germany;
7 Children's Neurosciences,
Foundation Trust, Londor
8 King's Health Partners Ac
9 Faculty of Life Sciences ar
* Correspondence: ming.lin

Received: 2 October 2020; Acc

**Abstract:** Acute dissemina
system (CNS) disorder, cha
resonance imaging (MRI) fi
CNS neuroimmune disorc
antibody (MOG-Ab) with b
into its definition, manager
current epidemiologic, clin
of ADEM.

Commissioning

Prepared by NHS E

Summary

The updated commissioning
commissioned and provides t
alongside possible alternative
the literature updated with a fi
developed by the Ig expert wo
respective Clinical Reference
other specialities. The CRG w
there is a significant change i
evidence and expert opinion.
often utilised as a commissior
commissioned routinely (NRC

Commissioning criteria

These commissioning criteria
the highest priority because o
the use of Ig but other treatme
little/no evidence) that have m

This guideline supersedes pre
those indications within the D
have not moved into routine c

A completed referral form is s
treatment can proceed withou

Received: 16 May 2021 | Revised: 27 May 2021 | Accepted: 28 May 2021

DOI: 10.1111/jns.12455

RESEARCH REPORT

WILEY

European Academy of Neurology/Peripheral Nerve Society guideline on diagnosis and treatment of chronic inflammatory demyelinating polyradiculoneuropathy: Report of a joint Task Force—Second revision

Peter Y. K. Van den Bergh[1] | Pieter A. van Doorn[2] | Robert D. M. Hadden[3] | Bert Avau[4] | Patrik Vankrunkelsven[5] | Jeffrey A. Allen[6] | Shahram Attarian[7] | Patricia H. Blomkwist-Markens[8] | David R. Cornblath[9] | Filip Eftimov[10] | H. Stephan Goedee[11] | Thomas Harbo[12] | Satoshi Kuwabara[13] | Richard A. Lewis[14] | Michael P. Lunn[15] | Eduardo Nobile-Orazio[16] | Luis Querol[17] | Yusuf A. Rajabally[18] | Claudia Sommer[19] | Haluk A. Topaloglu[20]

[1]Neuromuscular Reference Centre, Department of Neurology, University Hospital Saint-Luc, Brussels, Belgium
[2]Department of Neurology, Erasmus MC, University Medical Center, Rotterdam, The Netherlands
[3]Department of Neurology, King's College Hospital, London, UK
[4]Cochrane Belgium, CEBAM, Leuven, Belgium and CEBaP, Belgian Red Cross, Mechelen, Belgium
[5]Cochrane Belgium, CEBAM, Leuven, Belgium
[6]Department of Neurology, University of Minnesota, Minneapolis, Minnesota
[7]Centre de Référence des Maladies Neuromusculaires et de la SLA, APHM, CHU Timone, Marseille, France
[8]Patient Representative GBS/CIDP Foundation International, International Office, Philadelphia, Pennsylvania, USA
[9]Department of Neurology, Johns Hopkins University School of Medicine, Baltimore, Maryland, USA
[10]Department of Neurology, Amsterdam UMC, University of Amsterdam, Amsterdam, The Netherlands
[11]Department of Neuromuscular Disorders, University Medical Centre Utrecht, Utrecht, The Netherlands
[12]Department of Neurology, Århus University Hospital, Århus, Denmark
[13]Department of Neurology, Chiba University Hospital, Chiba, Japan
[14]Department of Neurology, Cedars-Sinai Medical Center, Los Angeles, California, USA
[15]Department of Neurology and MRC Centre for Neuromuscular Diseases, National Hospital for Neurology and Neurosurgery, London, UK
[16]Neuromuscular and Neuroimmunology Service, IRCCS Humanitas Clinical and Research Center, Department of Medical Biotechnology and Translational Medicine, University of Milan, Milan, Italy
[17]Neuromuscular Diseases Unit—Neurology Department, Hospital de la Santa Creu I Sant Pau, Barcelona, Spain

After

# 1. Establishment of IVIG Indication Priority Table

Colour coding priority table to reflect the **prioritization** and **approval** of IVIG use for different neurological disorders

| | | |
|---|---|---|
| **HIGH PRIORITY** | Indication listed in any product insert, listed in any local/international guideline | Automatic approval |
| **MEDIUM PRIORITY** | Based on studies from uncontrolled trial | To contact Neuroscience Pharmacist to obtain approval for use |
| **LOW PRIORITY** | Based on observational studies and expert consensus | To contact IVIG Neurology Panel to obtain approval for use |
| **LITTLE EVIDENCE** | Based on case reports and case series | |

**IVIG INDICATION PRIORITY TABLE**
**NEUROLOGY DEPARTMENT**
**HOSPITAL KUALA LUMPUR**

| Red (High Priority) | Blue (Medium Priority) | Grey (Low Priority) | Black (Little Evidence) |
|---|---|---|---|
| Guillain-Barre syndrome (GBS) | Paraneoplastic Neurological Syndrome | Cerebral infarction with antiphospholipid antibodies | Neuromyelitis optica spectrum disorder (NMOSD) |
| Chronic inflammatory demyelinating polyneuropathy (CIDP) | Inflammatory Myopathy | Chronic relapsing inflammatory optic neuritis (CRION) | New Onset Refractory Status Epilepticus (NORSE) |
| Multifocal motor neuropathy (MMN) | Myasthenia gravis (MG) | CNS vasculitis | Multiple sclerosis (MS) |
| Myasthenic crisis | Myelin oligodendrocyte glycoprotein antibody-associated disease (MOGAD) | Fulminant atypical demyelinating disease | Neuronopathy |
| Acute disseminated encephalomyelitis (ADEM) | Neuromyotonia | Stiff person syndrome | |
| Autoimmune encephalitis (AE) | | | |

Verified by,

(DR SHANTHI VISWANATHAN)
Head of Neurology Department
Hospital Kuala Lumpur

DR SHANTHI VISWANATHAN
(MMC 33569)
MBBS (INDIA), FRCP (IRE)
Fellowship in Neurologi (Msia)
Pakar Perunding Kanan Neurologi &
Ketua Jabatan Neurologi
Jabatan Neurologi
Hospital Kuala Lumpur

*Adapted and adopted from NHS Intravenous Immunoglobulin (IVIG) Prescribing Guidance 2016 and approved by Head of Neurology Department*

After

# 1. Establishment of IVIG Indication Priority Table

Chronic Inflammatory Demyelinating Polyneuropathy (CIDP)

Multifocal Motor Neuropathy (MMN)

Acute Disseminated Encephalomyelitis (ADEM)

Autoimmune Encephalitis

Guillain-Barré Syndrome (GBS)

Myasthenic Crisis

Myelin Oligodendrocyte Glycoprotein Antibody-associated Disease (MOGAD)

Neuromyelitis Optica Spectrum Disorder (NMOSD)

Myasthenia Gravis

CNS Vasculitis

Inflammatory Myopathy

Multiple Sclerosis

Chronic Relapsing Inflammatory Optic Neuritis (CRION)

New Onset Refractory Status Epilepticus (NORSE)

Stiff Person Syndrome

9. Mehta, K. (2016). Intravenous Immunoglobulin (IVIg) prescribing guidance. NHS England.

After

# 1. Establishment of IVIG Indication Priority Table

| Red (High Priority) | Blue (Medium Priority) | Grey (Low Priority) | Black (Little Evidence) |
|---|---|---|---|
| Guillain-Barré Syndrome (GBS) | Paraneoplastic Neurological Syndrome | Cerebral Infarction With Antiphospholipid Antibodies | Neuromyelitis Optica Spectrum Disorder (NMOSD) |
| Chronic Inflammatory Demyelinating Polyneuropathy (CIDP) | Inflammatory Myopathy | Chronic Relapsing Inflammatory Optic Neuritis (CRION) | New Onset Refractory Status Epilepticus (NORSE) |
| Multifocal Motor Neuropathy (MMN) | Myasthenia Gravis (MG) | CNS Vasculitis | Multiple Sclerosis (MS) |
| Myasthenic Crisis | Myelin Oligodendrocyte Glycoprotein Antibody-associated Disease (MOGAD) | Fulminant Atypical Demyelinating Disease | Neuronopathy |
| Acute Disseminated Encephalomyelitis (ADEM) | Neuromyotonia | Stiff Person Syndrome | |
| Autoimmune Encephalitis (AE) | | | |

# Main Findings From Verification Study

## Doctors & Pharmacists

- Unsure indication of IVIG
- Easy accessibility of IVIG
- Unnecessary prolong use of IVIG
- **Improper dose of IVIG**

## Nurses

- Unsure proper administration of IVIG

## Hospital

- No standardized guideline
- No IVIG referral team

# 2. Invention of Smart IVIG Dose Calculator

**Before**

Patient's body weight = 60 kg
Dose intended = 2g/kg over 5 days
= 0.4g/kg per day

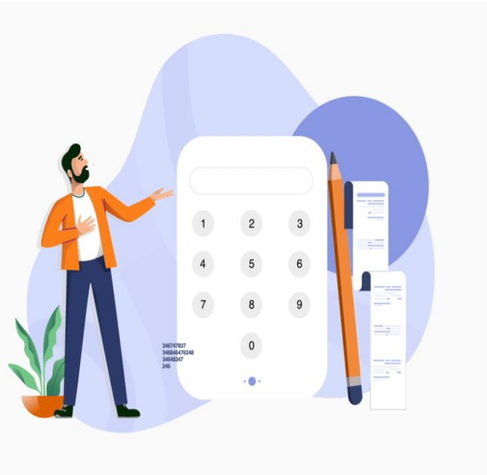
Dose given = 0.4g x 60 kg
= 24g → use 8 vials of 3g IVIG

Patient's body weight = 86 kg
Dose given = 34g → round up dose to 36g
use 12 vials of 3g IVIG

**No standardized calculator**

**Manually calculate dose of IVIG**

**Unsure use of actual or adjusted body weight for dose calculation**

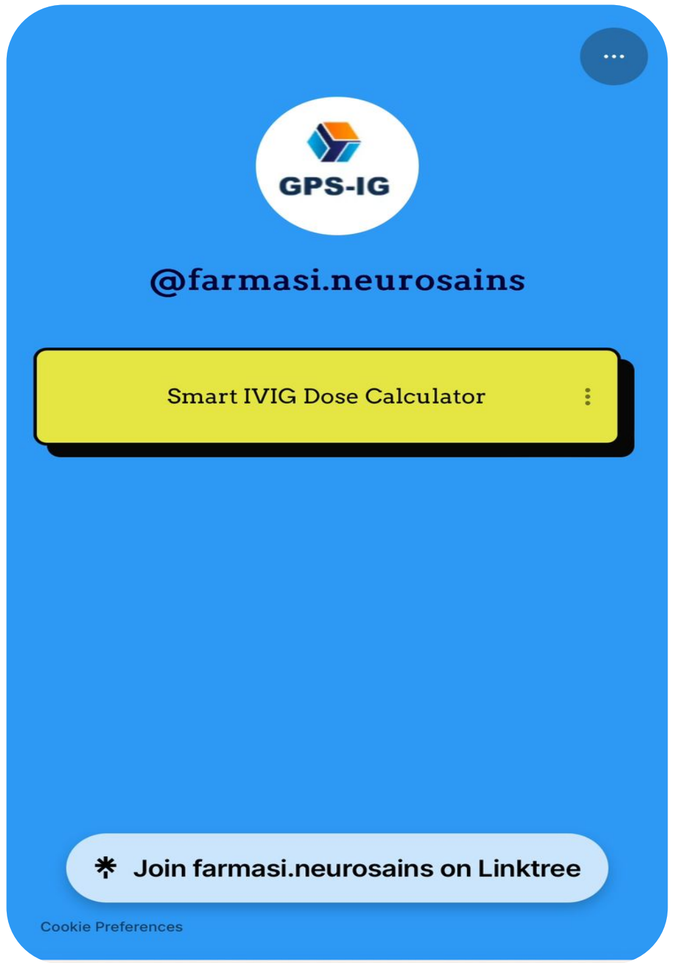


# 2. Invention of Smart IVIG Dose Calculator

**Linktree:**
https://linktr.ee/farmasi.neurosains

**QR Code**

After

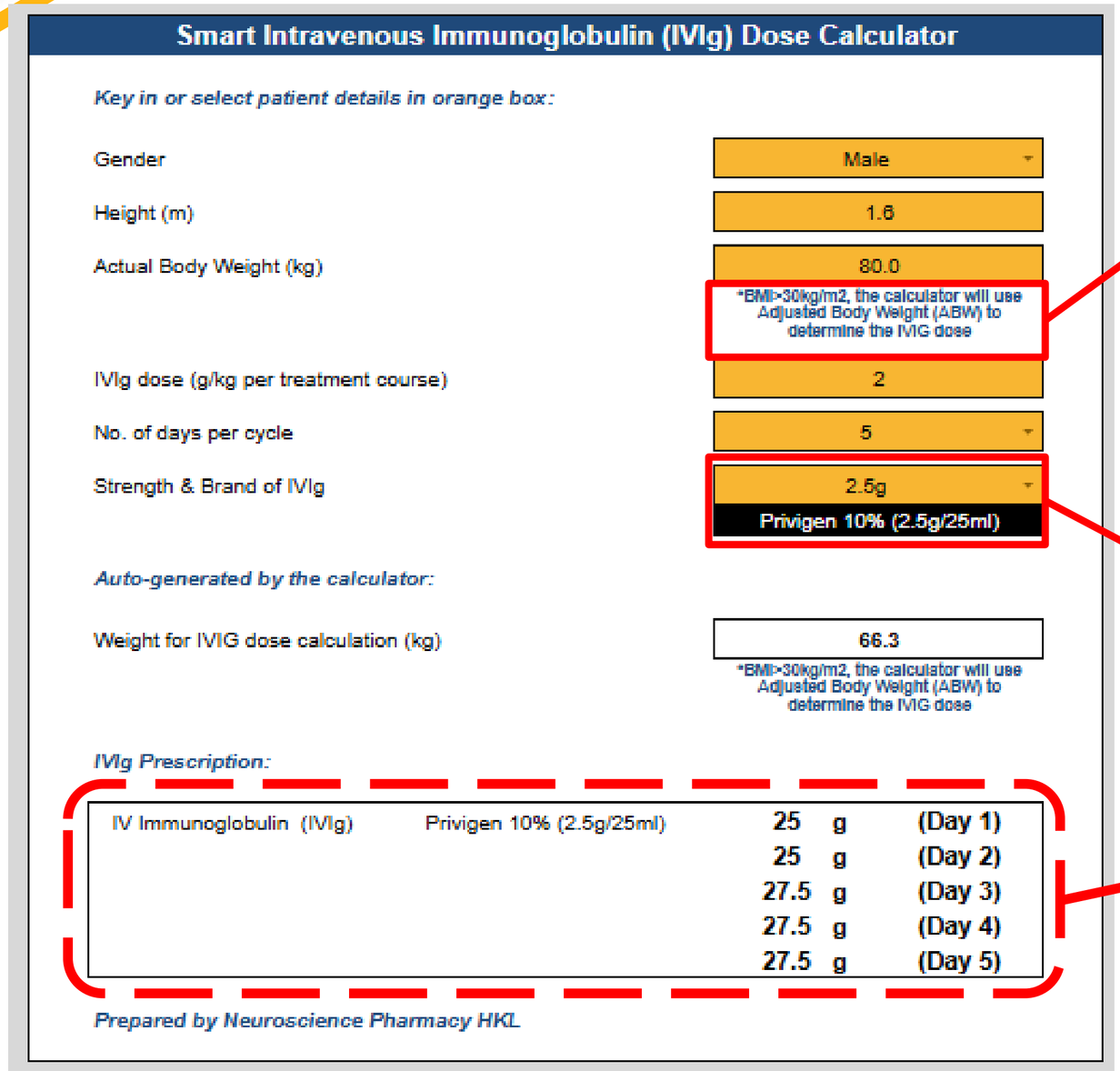



**Validated by 44 healthcare professionals:**
Including Neurology Consultants, MO and Pharmacists

Display at wards and clinic for easy access

After

# 2. Invention of Smart IVIG Dose Calculator



**Smart Intravenous Immunoglobulin (IVIg) Dose Calculator**

*Key in or select patient details in orange box:*

| | |
|---|---|
| Gender | Male |
| Height (m) | 1.6 |
| Actual Body Weight (kg) | 80.0 |
| | *BMI>30kg/m2, the calculator will use Adjusted Body Weight (ABW) to determine the IVIG dose |
| IVIg dose (g/kg per treatment course) | 2 |
| No. of days per cycle | 5 |
| Strength & Brand of IVIg | 2.5g<br>Privigen 10% (2.5g/25ml) |

*Auto-generated by the calculator:*

| | |
|---|---|
| Weight for IVIG dose calculation (kg) | 66.3 |
| | *BMI>30kg/m2, the calculator will use Adjusted Body Weight (ABW) to determine the IVIG dose |

*IVIg Prescription:*

| | | | | |
|---|---|---|---|---|
| IV Immunoglobulin (IVIg) | Privigen 10% (2.5g/25ml) | 25 | g | (Day 1) |
| | | 25 | g | (Day 2) |
| | | 27.5 | g | (Day 3) |
| | | 27.5 | g | (Day 4) |
| | | 27.5 | g | (Day 5) |

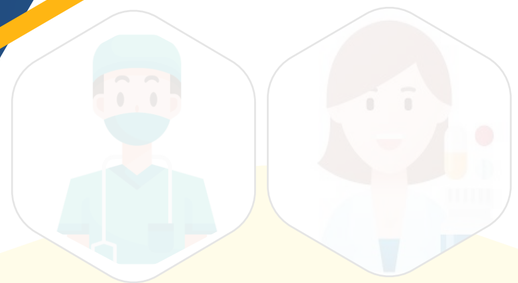
*Prepared by Neuroscience Pharmacy HKL*

**Auto calculate BMI**
by filling in height
and weight.
For BMI > 30kg/m²
- auto use **ABW**

Select **strength of IVIG** -
**Auto calculate dose**

**Auto round down**
to the nearest dose which
can be administered using
whole vials

# Main Findings From Verification Study



## Doctors & Pharmacists

- Unsure indication of IVIG
- Easy accessibility of IVIG
- Unnecessary prolong use of IVIG
- Improper dose of IVIG



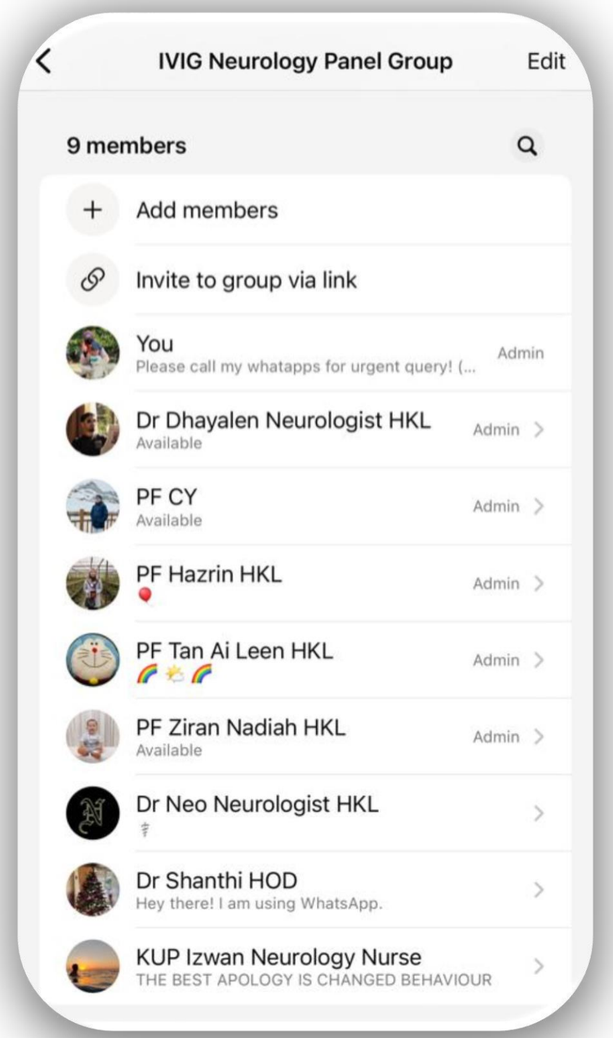
## Nurses

- Unsure proper administration of IVIG


## Hospital

- No standardized guideline
- **No IVIG referral team**

# 3. Formation of IVIG Neurology Panel Group



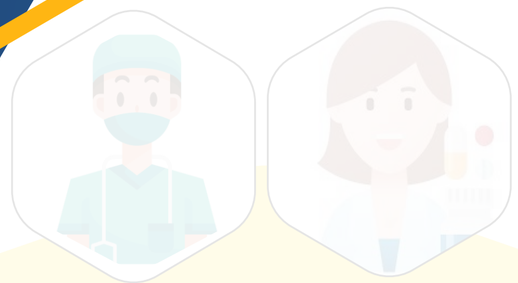

## 1. Members :

- HOD Neurology HKL
- Consultant Neurologists
- Pharmacists
- Neurology Registered Nurse

## 2. Platform for :

- Approval for low priority indication IVIG cases.
- Update on latest evidence-based information on IVIG use.
- Update on IVIG products availability and usage.

# Main Findings From Verification Study



## Doctors & Pharmacists

- Unsure indication of IVIG
- Easy accessibility of IVIG
- Unnecessary prolong use of IVIG
- Improper dose of IVIG

## Nurses

- **Unsure proper administration of IVIG**




## Hospital

- No standardized guideline
- No IVIG referral team

# 4. Development of IVIG Administration Chart

Appendix A(i)

## Intravenous Immunoglobulin (IVIg) Administration Chart (10%)
## Neurology Department, HKL

[Intragam® NexGen 5g/50ml (10%) / Privigen® 2.5g/25ml (10%) / Gamunex®-C 2.5g/25ml (10%) or 5g/50ml (10%)]

| | | | | | |
|---|---|---|---|---|---|
| **Patient Name** | | **Ward/Clinic** | | **Brand & Strength** | |
| **I.C No.** | | **Body Weight** | | **Batch number** | |

| Date | Dose (g) | Infusion Rate (ml/kg/hr) | Infusion Rate (ml/hr) | Start Time | End Time | Reactions (if any) | Staff Nurse Name |
|---|---|---|---|---|---|---|---|
| | | ☐ 0.3 ml/kg/hr | | | | | |
| | | ☐ 0.6 ml/kg/hr | | | | | |
| | | ☐ 0.9 ml/kg/hr | | | | | |
| | | ☐ _____ ml/kg/hr * | | | | | |
| | | ☐ 0.3 ml/kg/hr | | | | | |
| | | ☐ 0.6 ml/kg/hr | | | | | |
| | | ☐ 0.9 ml/kg/hr | | | | | |
| | | ☐ _____ ml/kg/hr * | | | | | |
| | | ☐ 0.3 ml/kg/hr | | | | | |
| | | ☐ 0.6 ml/kg/hr | | | | | |
| | | ☐ 0.9 ml/kg/hr | | | | | |
| | | ☐ _____ ml/kg/hr * | | | | | |
| | | ☐ 0.3 ml/kg/hr | | | | | |
| | | ☐ 0.6 ml/kg/hr | | | | | |
| | | ☐ 0.9 ml/kg/hr | | | | | |
| | | ☐ _____ ml/kg/hr * | | | | | |
| | | ☐ 0.3 ml/kg/hr | | | | | |
| | | ☐ 0.6 ml/kg/hr | | | | | |
| | | ☐ 0.9 ml/kg/hr | | | | | |
| | | ☐ _____ ml/kg/hr * | | | | | |

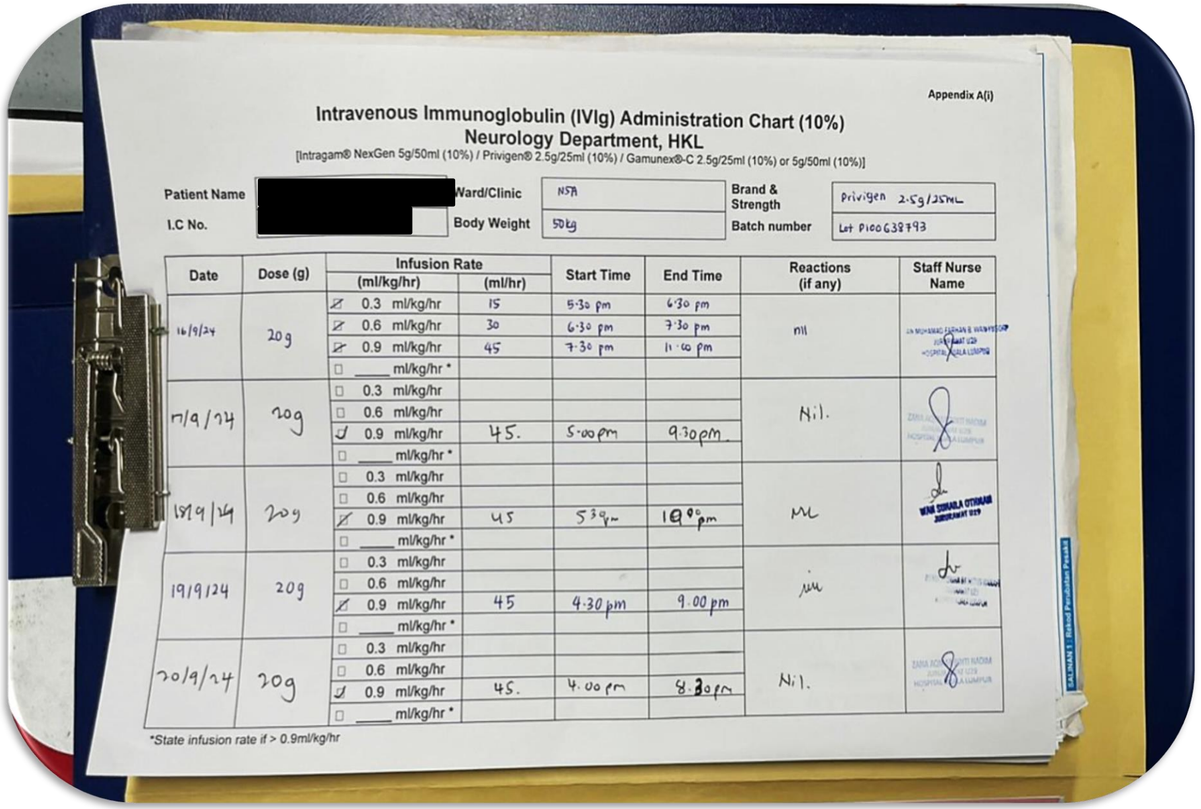
*State infusion rate if > 0.9ml/kg/hr

Identify allergies, brand and strength used

Monitor infusion rate, vital signs and any reactions during infusion

# 5. Distribution of IVIG Administration Chart

IVIG Administration Chart
is kept in patients' medical record



Appendix A(i)

**Intravenous Immunoglobulin (IVIg) Administration Chart (10%)**
**Neurology Department, HKL**
[Intragam® NexGen 5g/50ml (10%) / Privigen® 2.5g/25ml (10%) / Gamunex®-C 2.5g/25ml (10%) or 5g/50ml (10%)]

Patient Name: [redacted] Ward/Clinic: N5A Brand & Strength: Privigen 2.5g/25mL
I.C No.: Body Weight: 50kg Batch number: Lot P100638793

| Date | Dose (g) | Infusion Rate (ml/kg/hr) | Infusion Rate (ml/hr) | Start Time | End Time | Reactions (if any) | Staff Nurse Name |
|---|---|---|---|---|---|---|---|
| 16/9/24 | 20g | ☒ 0.3 ml/kg/hr | 15 | 5.30 pm | 6.30 pm | nil | |
| | | ☒ 0.6 ml/kg/hr | 30 | 6.30 pm | 7.30 pm | | |
| | | ☒ 0.9 ml/kg/hr | 45 | 7.30 pm | 11.00 pm | | |
| | | ☐ ____ ml/kg/hr * | | | | | |
| 17/9/24 | 20g | ☐ 0.3 ml/kg/hr | | | | Nil. | |
| | | ☐ 0.6 ml/kg/hr | | | | | |
| | | ☑ 0.9 ml/kg/hr | 45. | 5.00 pm | 9.30 pm | | |
| | | ☐ ____ ml/kg/hr * | | | | | |
| 18/9/24 | 20g | ☐ 0.3 ml/kg/hr | | | | Nil | |
| | | ☐ 0.6 ml/kg/hr | | | | | |
| | | ☒ 0.9 ml/kg/hr | 45 | 5.30 pm | 10.00 pm | | |
| | | ☐ ____ ml/kg/hr * | | | | | |
| 19/9/24 | 20g | ☐ 0.3 ml/kg/hr | | | | Nil | |
| | | ☐ 0.6 ml/kg/hr | | | | | |
| | | ☒ 0.9 ml/kg/hr | 45 | 4.30 pm | 9.00 pm | | |
| | | ☐ ____ ml/kg/hr * | | | | | |
| 20/9/24 | 20g | ☐ 0.3 ml/kg/hr | | | | Nil. | |
| | | ☐ 0.6 ml/kg/hr | | | | | |
| | | ☑ 0.9 ml/kg/hr | 45. | 4.00 pm | 8.30 pm | | |
| | | ☐ ____ ml/kg/hr * | | | | | |

*State infusion rate if > 0.9ml/kg/hr

# Survey Findings

**Doctors & Pharmacists**

**40%** (n= 73) did not attend CME sessions during Cycle 1.

# 6. Conduct more CME


## 2 sessions

15 March 2023
(2.30-3.30pm)

22 March 2023
(2.30-3.30pm)

## Audience

Specialists : 8
Doctors : 42
Pharmacists : 55
Nurses : 48

Total: **153**

# Effects of Change Cycle 2

# Effect of Change

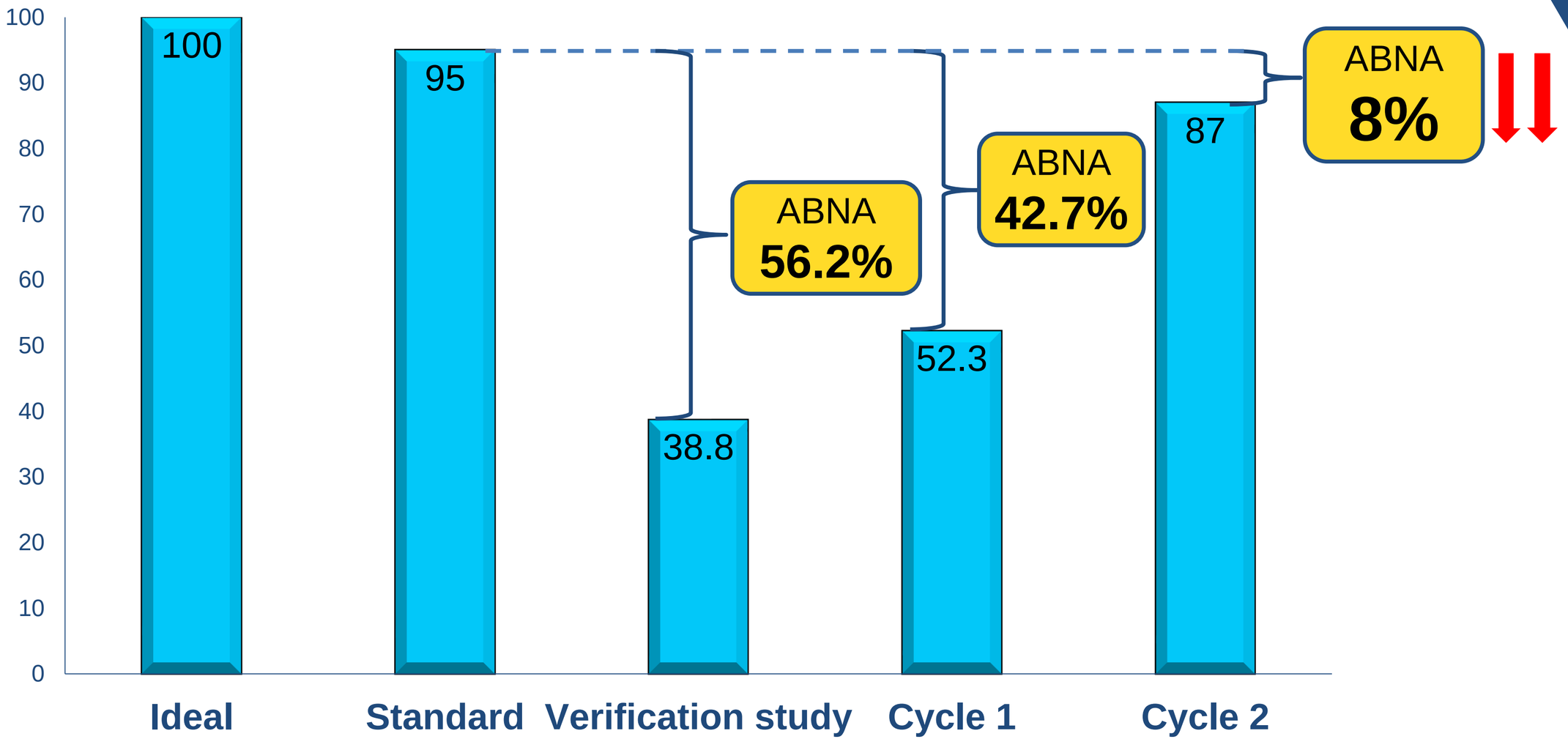
**Cycle 2: Jan 2023 – Dec 2023**

| Stage | Total number of patients with appropriate use of IVIG in neurological disorders (A) | Total number of patients treated with IVIG in neurological disorders (B) | Percentage of appropriate use of IVIG in neurological disorders [ (A/B) X100% ] |
|---|---|---|---|
| Verification | 26 | 67 | **38.8 %** |
| Cycle 1 | 126 | 241 | **52.3 %** |
| Cycle 2 | 194 | 223 | **87%** |

38.8 % → 52.3 % → 87 %

# Achievable Benefit Not Achieved (ABNA)

## Percentage of appropriate use of IVIG in neurological disorders



# Model of Good Care (1)

| No. | Critical Steps | Criteria | Standard | Verification Study (n=67) | Cycle 1 (n=241) | Cycle 2 (n=223) |
|---|---|---|---|---|---|---|
| 1. | **Patient indicated for IVIG treatment** | Doctor established a neurological diagnosis to be treated with IVIG. | 100% | 46.3% | 63.1% | ★ **88.3%** ↑ |
| 2. | **Doctor prescribes IVIG** | a. Doctor prescribes correct dose of IVIG. | 100% | 70.1% | 73.4% | **100%** ↑ |
| | | b. Doctor prescribes correct frequency of IVIG. | 100% | 100% | 100% | 100% |
| | | c. Doctor prescribes correct duration of IVIG. | 100% | 56.7% | 80.5% | ★ **92.8%** ↑ |
| 3. | **Pharmacist screens prescription for any intervention** | a. Pharmacist screens prescription for correct indication of IVIG. | 100% | 46.3% | 73.4 % | **96.4%** ↑ |
| | | b. Pharmacist screens prescription for correct dose of IVIG. | 100% | 70.1% | 88% | **100%** ↑ |
| | | c. Pharmacist screens prescription for correct frequency of IVIG. | 100% | 100% | 100% | 100% |
| | | d. Pharmacist screens prescription for correct duration of IVIG. | 100% | 56.7% | 85.1% | **98.7%** ↑ |

# Model of Good Care (2)

| No. | Critical Steps | Criteria | Standard | Verification Study (n=67) | Cycle 1 (n=241) | Cycle 2 (n=223) |
|---|---|---|---|---|---|---|
| 4. | **Pharmacist supplies IVIG** | a. Pharmacist supplies correct drug and strength. | 100% | 100% | 100% | 100% |
| | | b. Pharmacist supplies correct dose of IVIG. | 100% | 100% | 100% | 100% |
| | | c. Pharmacist supplies correct frequency of IVIG. | 100% | 100% | 100% | 100% |
| | | d. Pharmacist supplies correct duration of IVIG. | 100% | 100% | 100% | 100% |
| 5. | **Nurse administers IVIG** | Nurse administers correct IVIG infusion rate. | 100% | 81% | 92.1% | 100% |
| 6. | **Nurse monitors any adverse reaction and record patient's parameter** | a. Nurse monitors & documents vital signs during infusion of IVIG. | 100% | 68% | 78% | **100%** ↑ |
| | | b. Nurse monitors & documents for any adverse reactions. | 100% | 74% | 86% | **100%** ↑ |

# Strategies For Change Cycle 3

# 1. Additional Criteria for Other Indications of IVIG

The IVIG Neurology Panel Group reviewed and established the following **additional criteria for other indications not specified in priority table to be deemed as appropriate use** of IVIG:

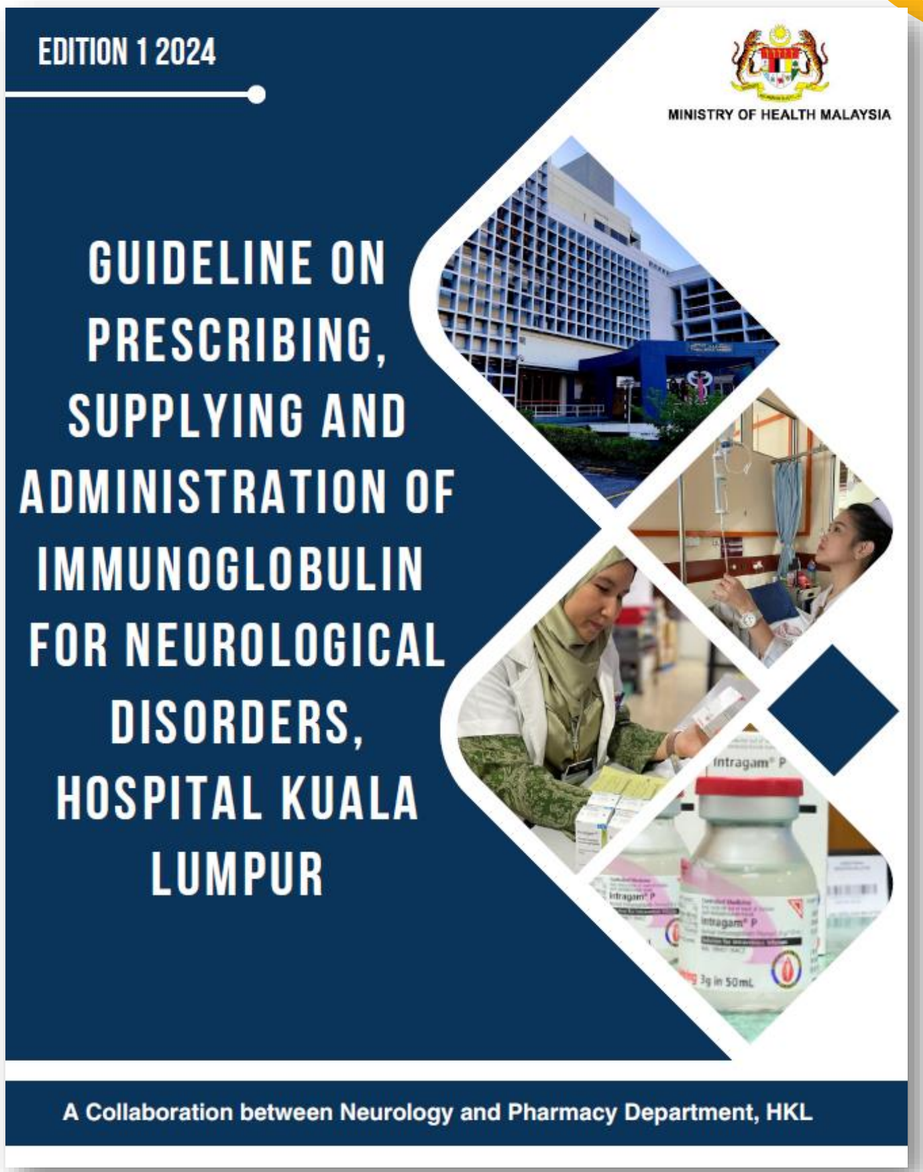
1. Patient failed / unable to tolerate first and second line treatment (plasma exchange / steroid / immunosuppressant)
2. Treatment duration – a fixed number of cycles must be decided upon initiation of treatment.

# 2. Publication of IVIG Guideline

**G**uideline on
**P**rescribing,
**S**upplying and Administration of
**I**mmuno**G**lobulin
for Neurological Disorders
in Hospital Kuala Lumpur

GPS-IG

**Navigate** your way towards
**Appropriate** IVIG use




QR Code for GPS-IG

# 3. Promotion of GPS-IG

GPS-IG was introduced in Neurology Workshop as a structured guideline of IVIG



# Effects of Change Cycle 3

# Effect of Change

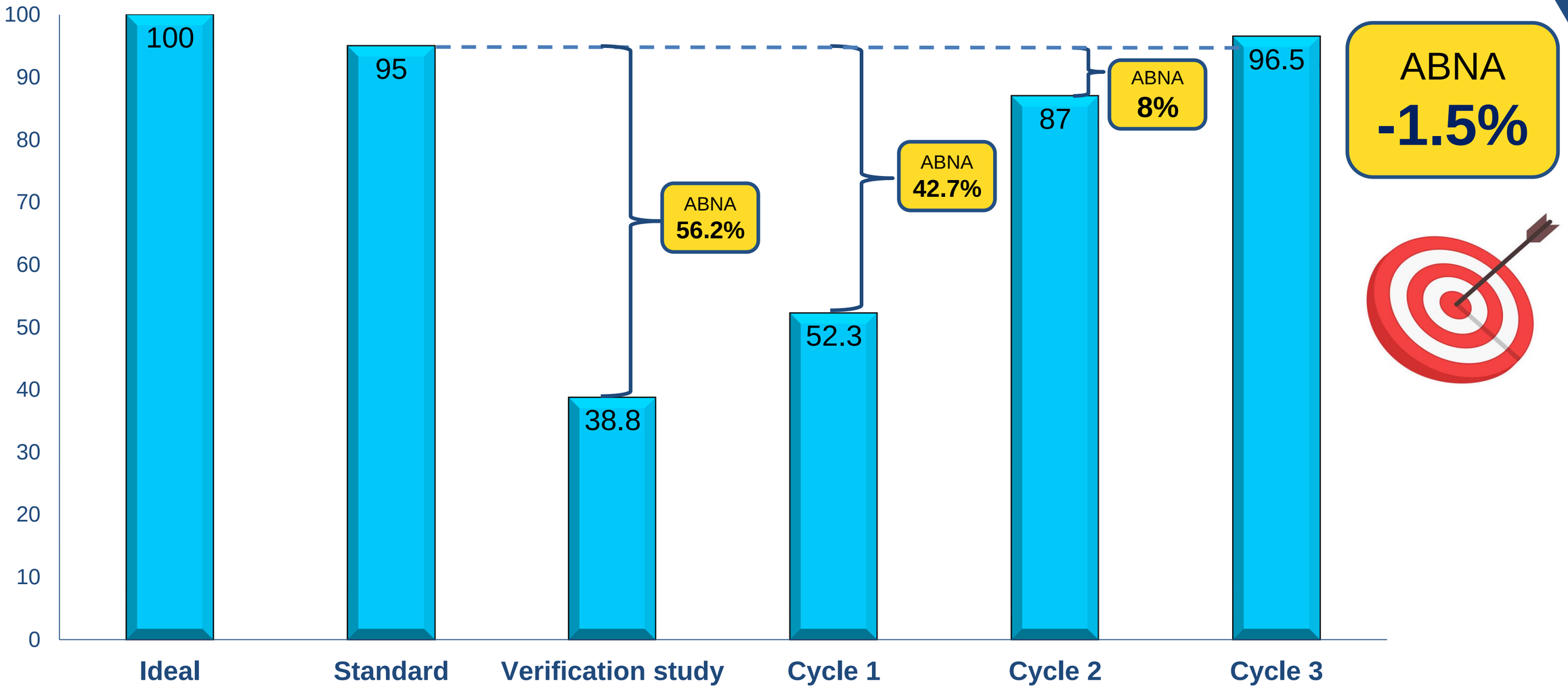
**Cycle 3: Jan 2024 – July 2024**

| Stage | Total number of patients with appropriate use of IVIG in neurological disorders (A) | Total number of patients treated with IVIG in neurological disorders (B) | Percentage of appropriate use of IVIG in neurological disorders [ (A/B) X100% ] |
|---|---|---|---|
| Verification | 26 | 67 | **38.8 %** |
| Cycle 1 | 126 | 241 | **52.3 %** |
| Cycle 2 | 194 | 223 | **87 %** |
| Cycle 3 | 111 | 115 | **96.5 %** |

38.8 % → 52.3 % → 87 % → **96.5 %**

# Achievable Benefit Not Achieved (ABNA)

## Percentage of appropriate use of IVIG in neurological disorders



# Model of Good Care (1)

| No. | Critical Steps | Criteria | Standard | Verification Study (n=67) | Cycle 1 (n=241) | Cycle 2 (n=223) | Cycle 3 (n=115) |
|---|---|---|---|---|---|---|---|
| 1. | **Patient indicated for IVIG treatment** | Doctor established a neurological diagnosis to be treated with IVIG. | 100% | 46.3% | 63.1% | 88.3% | **96.5%** ↑ |
| 2. | **Doctor prescribes IVIG** | a. Doctor prescribes correct dose of IVIG. | 100% | 70.1% | 73.4% | 100% | 100% |
| | | b. Doctor prescribes correct frequency of IVIG. | 100% | 100% | 100% | 100% | 100% |
| | | c. Doctor prescribes correct duration of IVIG. | 100% | 56.7% | 80.5% | 92.8% | **100%** ↑ |
| 3. | **Pharmacist screens prescription for any intervention** | a. Pharmacist screens prescription for correct indication of IVIG. | 100% | 46.3% | 73.4% | 96.4% | **96.5%** ↑ |
| | | b. Pharmacist screens prescription for correct dose of IVIG. | 100% | 70.1% | 88% | 100% | 100% |
| | | c. Pharmacist screens prescription for correct frequency of IVIG. | 100% | 100% | 100% | 100% | 100% |
| | | d. Pharmacist screens prescription for correct duration of IVIG. | 100% | 56.7% | 85.1% | 98.7% | **100%** ↑ |

# Model of Good Care (2)

| No. | Critical Steps | Criteria | Standard | Verification Study (n=67) | Cycle 1 (n=241) | Cycle 2 (n=223) | Cycle 3 (n=115) |
|---|---|---|---|---|---|---|---|
| 4. | **Pharmacist supplies IVIG** | a. Pharmacist supplies correct drug and strength. | 100% | 100% | 100% | 100% | 100% |
| | | b. Pharmacist supplies correct dose of IVIG. | 100% | 100% | 100% | 100% | 100% |
| | | c. Pharmacist supplies correct frequency of IVIG. | 100% | 100% | 100% | 100% | 100% |
| | | d. Pharmacist supplies correct duration of IVIG. | 100% | 100% | 100% | 100% | 100% |
| 5. | **Nurse administers IVIG** | Nurse administers correct IVIG infusion rate. | 100% | 81% | 92.1% | 100% | 100% |
| 6. | **Nurse monitors any adverse reaction and record patient's parameter** | a. Nurse monitors & documents vital signs during infusion of IVIG. | 100% | 68% | 78% | 100% | 100% |
| | | b. Nurse monitors & documents for any adverse reactions. | 100% | 74% | 86% | 100% | 100% |

# STRATEGIES FOR CHANGE

## 2024-CYCLE 3

- Additonal criteria for other indication of IVIG
- Publication of IVIG guideline
- Promotion of GPS-IG

## 2023-CYCLE 2

- Establishment of IVIG indication priority table
- Invention of smart IVIG calculator
- Formation of IVIG Neurology Panel
- Development of IVIG administration chart
- Distribution of IVIG administration and monitoring chart
- Conduct more CME


## 2022-CYCLE 1

- Prioritization of IVIG indication
- Prolong interval of cyclical IVIG treatment
- List IVIG as control drug item in HKL
- Development of IVIG administration guide
- Conduct CME & CNE

**OCT-DEC 2021**
**VERIFICATION STUDY**
Data collection

# Impact on Patients

# Improvement in Patient's Safety

**Close monitoring**

Vital signs and adverse effects monitored

**Early Detection**

48 infusion-related reactions detected (2022 – 2023)

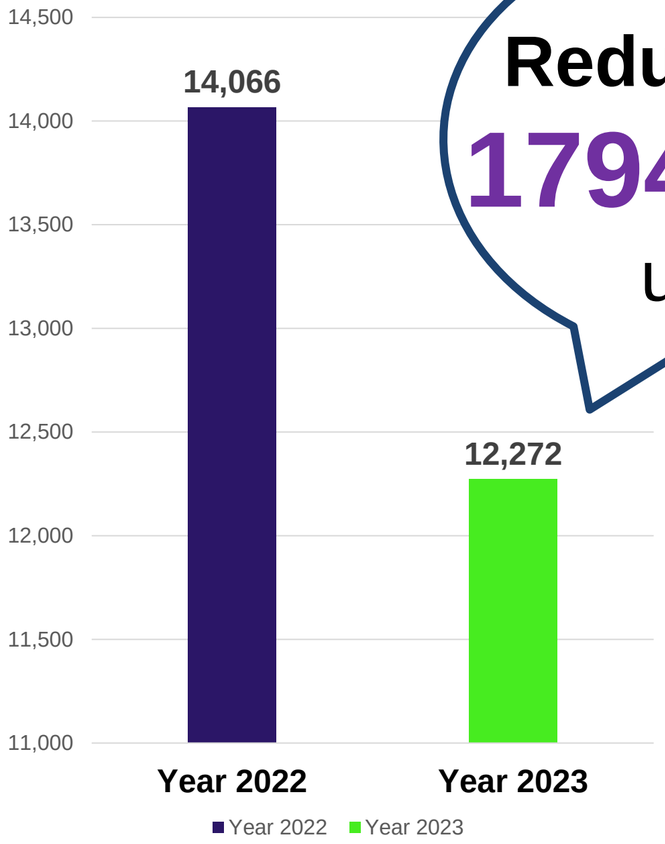
**Prompt Management**

All reactions resolved

# Total Cost Saving

SAVE COST

Number of IVIG vials used




**Reduction** of **1794 vials** used

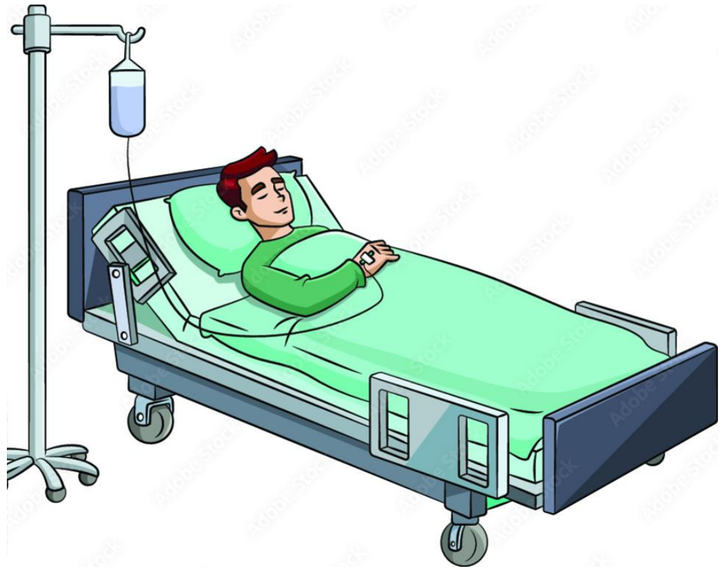
Total cost **saving** **RM 1.39 million**

Treat **38** **GBS / Myasthenic crisis patients**

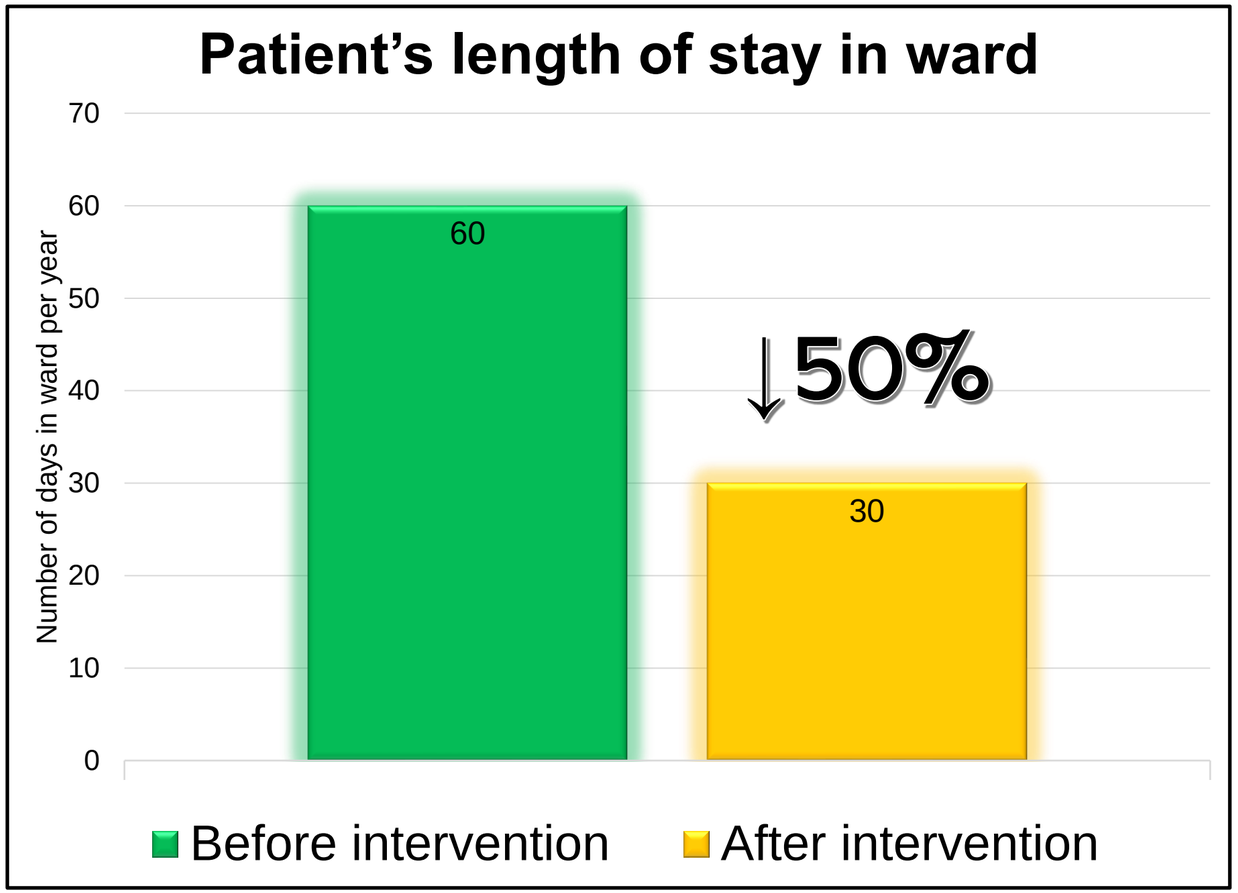
SAVE TIME

# Reduction in Patient's Length Of Stay

**For stable CIDP/MMN patients**



**Length of Stay in Ward**



# Reduction in Patient's Out-of-Pocket Expense

**Before**

**n = 39**

Admission cost: **RM 3/day x 60**
Travel cost: **RM 20/trip*** **x 24**
**= RM 25,740.00**

**After**

SAVE COST

Admission cost: **RM 3/day x 30**
Travel cost: **RM 20/trip*** **x 12**
**= RM 12,870.00**

Total saving:
**RM 12,870.00**

*Klang Valley

# Lesson Learnt

## Importance of a multidisciplinary approach

❑ Collaboration and proactive participation of doctors, nurses and pharmacist towards shared goals

## Importance of a standardized IVIG guidelines

❑ Advocate appropriate use of IVIG among all healthcare personnel


## Reduce health care cost

❑ Save cost for patients and also for institution

# Next step

2024

Expand GPS-IG to other departments in HKL

- Medical and Nephrology Department

**MINIT MESYUARAT PENGURUSAN JABATAN FARMASI**
**BIL. 03/2024**

**Tarikh** : 8 Ogos 2024
**Masa** : 9.00 pagi hingga 1.00 petang
**Tempat** : Hotel KSL Esplanade, Klang

[redacted]

**8. HAL-HAL BERBANGKIT**

**8.1** ***Guideline on Prescribing,Supplying and Administration of Intravenous Immunoglobulin (GPS-IG)***

Puan Ziran Nadiah memaklumkan kepada mesyuarat bahawa Farmasi Neurosains dengan kerjasama Jabatan Neurologi HKL dalam proses semakan terakhir untuk menerbitkan Guideline on Prescribing, Supplying and Administration of Intravenous Immunoglobulin (GPS-IG). Guideline ini akan meliputi penggunaan semua jenama dan kekuatan IVIg yang ada di HKL. Guideline ini diharapkan dapat digunakan sebagai rujukandi jabatan-jabatan lain di HKL khususnya jabatan-jabatan yang menggunakan IVIg sepertiJabatan Perubatan, Jabatan Nefrologi dan lain-lain.

**Makluman**

Request of GPS-IG As Reference Inbox ×

**NOUHA BINTI ADNAN (HSB)**
to me

Translate to English ×

Kedah

Good day,

I am Nouha bt Adnan, pharmacist from Hospital Sultanah Bahiyah, Alor Setar, Kedah. I am interested to get a copy of GPS-IG as reference onc

Regards,
*Nouha bt Adnan*
Pegawai Farmasi,
Hospital Sultanah Bahiyah, Alor Setar.

Request for GPS-IG as reference at Inbox ×

**NUR ADILAH BINTI A. RAHMAN (HSIP)**
to me

Greetings and Salam,

Kindly Requesting for GPS-IG as reference at Hospital Sultan Ismail Petra

Thank you

Kelantan

Sekian,
Saya yang menjalankan amanah,

*Adilah Rahman*
Pegawai Farmasi UF44 (Rph019530)
Hospital Sultan Ismail Petra,
Kuala Krai, Kelantan

**LEE MEI WAH (HKL)**
to me

Salam Sejahtera,

Dengan segala hormatnya perkara di atas adalah dirujuk.

2. Saya telah menghadiri Bengkel "NeuRx - Navigating Neurological Terrains" yang dianjurkan oleh Jabatan
Bengkel ini telah meningkatkan ilmu pengetahuan dalam bidang Neurologi dan diharap dapat diadakan deng

3. Saya ingin memohon "Guideline on Prescribing, Supplying and Administration of Immunoglobulin for Neu
Farmasi Hospital Kuala Lumpur. Garis panduan ini akan menjadi rujukan yang baik dalam penggunaan Immu

Sekian, terima kasih.

**"MALAYSIA MADANI"**

**"BERKHIDMAT UNTUK NEGARA"**

Saya yang menjalankan amanah,

Program Perkhidmatan Farmasi KKM

**LEE MEI WAH, RPh 5340**
Ketua Penolong Pengarah Kanan | S
Seksyen Farmasi Pesakit Dalam | Inpatient Pharmacy Section
Cawangan Penjagaan Farmaseutikal | *Pharmaceutical Care Branch*
Bahagian Amalan dan Perkembangan Farmasi | *Pharmacy Practice and Development Division*
Kementerian Kesihatan Malaysia | *Ministry of Health Malaysia*
No 36, Jalan Profesor Diraja Ungku Aziz
46200 Petaling Jaya
Selangor
Tel: 03-7841 3338 (talian terus)/ Faks: 03-7968 2222/ E-mel: meiwah@moh.gov.my

Request to have 1 copy of Guidelines on Prescribing, Supplying and Administration of IVIG for Neurological Disorder HKL
External Inbox ×

**muhamad amir Aluwi**
to me

Pulau Pinang

Thu, 5 Sept, 15:20 (17 hours ago)

Assalam and very good afternoon. I am Amir, previously a delegate of HKL Neurology Pharmacotherapy Workshop 2024. I would humbly like to request one copy of guidelines mentioned for future reference. Thank you.

Best regards
Muhamad Amir bin Aluwi
023636
Pegawai Farmasi UF44
Hospital Bukit Mertajam

Interested to get GPS -IG External Inbox ×

**Mei Chong**
to me

Selangor

Hi,

I'm a pharmacist from Hospital SIS, Serdang, interested to know about the guic

Requesting for IVIG guideline External

**Aina Nazira** <ainazira@ummc.edu.my>
to me

Hi, I'm Aina, pharmacist from PPUM, I'm interested in IVIG guidelines as it can be useful for us as a referenc

Your cooperation is highly appreciated.

Thank you.

PPUM (MOE)

Regards,
***Aina Nazira binti Abdul Halim***
***Pharmacist (RPh : 17022)***
***University of Malaya Medical Centre (UMMC)***

Permohonan salinan Guideline on Prescribing, Supplying an
Neurological Disorders, HKL Inbox ×

**SABARIAH BINTI PAKEER OOTHUMAN (NPRA)** <sabariah.p@npra.gov.my>
to me

Translate to English

NPRA

Request for A Copy of Guideline on Prescribing, Supplying and Administration of Immu
External Inbox ×

**Lai Hui Xian** <huixian.lai@pantai.com.my>
to nsig@moh.gov.my, me

Dear admin,

I would like to request for a copy of **Guideline on Prescribing, Supplying and Administration of Immunoglobulin for Neurological Disorders.**

Thank you and have a nice day!

Best Regards,

Private Hosp

**Lai Hui Xian**
Clinical Pharmacist (Non-Critical Care)
Pharmacy Department
Pantai Hospital Kuala Lumpur
IHH Malaysia
D +603 2296 0888 (Ext. 1405)

Requesting for HKL IVIG Guideline External Inbox ×

**Farah Waheeda Tajurudin .** <farahwaheeda@ppukm.ukm.edu.my>
to me

Salam

Dear Puan Hazimah and team,

HUKM (MOE)

Hope you find this email well.
I attended your presentation on IVIG during the recent Neuro Workshop and I'm really impressed with HKL teamwork on publishing the IVIG Guideline.

I would like to request if your team could share the guideline as this would be incredibly helpful to improve our own approach on IVIG usage in our institution.

Thank you

Regards
Farah Waheeda Tajurudin
*Clinical Pharmacist, Rph 6761*
*Head of Clinical Pharmacy Services*
*Pharmacy Department*
*Hospital Canselor Tuanku Muhriz, UKM.*

# References


1. Lee JL, Mohd Saffian S, Makmor-Bakry M, Islahudin F, Alias H, Ali A, Mohamed Shah N. Prescribing Practices of Intravenous Immunoglobulin in Tertiary Care Hospitals in Malaysia: A Need for a National Guideline for Immunoglobulin Use. Front Pharmacol. 2022 Jun 9;13:879287. doi: 10.3389/fphar.2022.879287. PMID: 35754485; PMCID: PMC9218597.
2. Dalakas MC. Update on Intravenous Immunoglobulin in Neurology: Modulating Neuro-autoimmunity, Evolving Factors on Efficacy and Dosing and Challenges on Stopping Chronic IVIg Therapy. Neurotherapeutics. 2021 Oct;18(4):2397-2418. doi: 10.1007/s13311-021-01108-4. Epub 2021 Nov 11. PMID: 34766257; PMCID: PMC8585501.
3. E.E. Perez *et al.* Update on the use of immunoglobulin in human disease: a review of evidence J Allergy Clin Immun (2017).
4. Palabrica FR, Kwong SL, Padua FR. Adverse events of intravenous immunoglobulin infusions: a ten-year retrospective study. Asia Pac Allergy. 2013 Oct;3(4):249-56. doi: 10.5415/apallergy.2013.3.4.249. Epub 2013 Oct 31. PMID: 24260730; PMCID: PMC3826603.
5. Solís-Díez G, Turu-Pedrola M, Roig-Izquierdo M, Zara C, Vallano A, Pontes C. Dealing With Immunoglobulin Shortages: A Rationalization Plan From Evidence-Based and Data Collection. Front Public Health. 2022 May 19;10:893770. doi: 10.3389/fpubh.2022.893770. PMID: 35664094; PMCID: PMC9160570.
6. Zahari NH, Abd Hamid IJ, Tuan Din SA, Hashim IF, Zainudeen ZT, Mohd Shariff N, Ahmad NH, Tay CY. Practise of Immunoglobulin Replacement Therapy in Primary and Secondary Immunodeficiencies: A Single Centre Experience from Malaysia. Malays J Med Sci. 2023 Jun;30(3):112-121. doi: 10.21315/mjms2023.30.3.10. Epub 2023 Jun 27. PMID: 37425378; PMCID: PMC10325126.
7. Foster et al. Use of intravenous immune globulin in the ICU: a retrospective review of prescribing practices and patient outcomes. Transfus Med. 2010 Dec.
8. Zeinab et al. Predicting Factors for the Pattern of Intravenous Immunoglobulin Utilization in a Middle Eastern University Hospital. J Res Pharm Pract. 2018 Oct-Dec; 7(4): 188–194.
9. Mehta, K. (2016). Intravenous Immunoglobulin (IVIg) prescribing guidance. NHS England.
10. Van Den Bergh, P., Hadden, R. D. M., Bouché, P., Cornblath, D. R., Hahn, A. F., Illa, I., Koski, C. L., Léger, J., Nobile-Orazio, E., Pollard, J. D., Sommer, C., Van Doorn, P. A., & Van Schaik, I. N. (2010). European Federation of Neurological Societies/Peripheral Nerve Society Guideline on management of chronic inflammatory demyelinating polyradiculoneuropathy: Report of a joint task force of the European Federation of Neurological Societies and the Peripheral Nerve Society – First Revision. *Journal of the Peripheral Nervous System*, *15*(1), 1–9.

# ACKNOWLEDGEMENT & SPECIAL THANKS


1. Dato’ Dr. Harikrishna K. R. Nair, Director of Hospital Kuala Lumpur (HKL)
2. Mr. (Dr.) Azmi Alias, Head of Department Neurosurgery, HKL
3. Dr. Sapiah Sapuan, Head of Service (Neurology), MOH
4. Mdm Tay Chan Yen, Pharmacy QA Coordinator, HKL
5. Dr. Siti Salmah Ghazali, Consultant Anesthesiologist, HKL
6. Dr. Mohammad Helmee Mohamad Noor, Forensic Radiology Specialist, HKL
7. En. Lai Poh Soon, Pegawai Sains Forensik, HKL
8. Quality Unit HKL

GPS-IG

# “Teamwork makes the dream work.”

*John C. Maxwell*


# *Thank you*

**A collaboration between Neurology and Pharmacy Department, HKL**