The Sustainable Medicine Cabinet: Redesigning Pharma's Impact

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Director, Centre for Allied Health and Pharmacy Excellence (CAPE)

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Fig. 4.1. Conceptual framework for low carbon health systems and health facilities (linking health system areas, Scopes, and approaches, with selected examples)

Carbon footprint of the Health System: *Top-down assessments and interventions*

Scope 1 (Direct, controlled)	Scope 2 (Indirect, purchased energy)	Scope 3 (Indirect, supply chain)
Health workforce active travel; Virtual meetings; Telehealth	Reduced energy use by health workforce actions	Health workforce commuting; Business travel
Waste reduction and recycling	Water heating and cooling	Waste disposal; Water use
Fossil fuel use; Reduced unnecessary travel	Electricity needs; Space heating and cooling	Energy used in other areas of the supply chain
Anesthetic products Reusable medical devices	Reduced energy from energy efficient technologies and products; Electrification of transport fleet	Metered dose inhalers; Medicines; Medical devices; Food procurement; Construction

Carbon footprint of Health Facilities: *Bottom-up assessments and interventions*

GHG emissions by Scope

- Scope 1: 17%
- Scope 2: 12%
- Scope 3: 71%

Within scope 3, **Pharmaceuticals and chemicals** are the largest contributors of carbon emissions, accounting for 18% of total healthcare sector carbon emissions.

WHO Guidance 2023. Operational Framework for building carbon resilient and low carbon health systems

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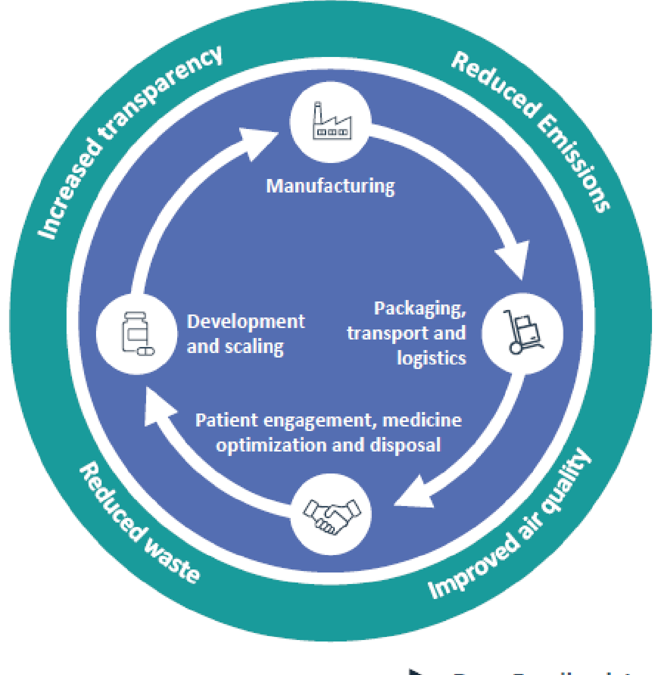
Circular Life Cycle Management of Medicines

A circular model, in contrast to the 'take-make-waste' linear model, aims to help pharmaceutical companies achieve their environmental and carbon reduction targets in order to increase efficiency and lower costs of production and disposal



Key Finding: Pharma companies should consider taking a comprehensive, data driven end-to-end view of the clinical development process, including waste generation, pollutants, energy use and renewable materials, to identify opportunities for reducing emissions and waste

THE PHARMACEUTICAL INDUSTRY'S CARBON FOOTPRINT AND CURRENT MITIGATION STRATEGIES: A LITERATURE REVIEW ISPOR Annual 2023
Sumudu Dehipawala, MPH1, Ellie Goldman, MPH1, Emily Hwang, MPH1, Prem Shah1, Ayushi Shroff1, Matthew O'Hara, MBA1
1Trinity Life Sciences, Waltham, MA, USA

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Impact Stories

The Sustainable Medicine Cabinet: Redesigning Pharma's Impact

Top contributor to healthcare carbon = Pharmaceuticals[1]

Overprescription

Antibiotic resistance

Routine / lifestyle prescriptions

Non-adherence

Drug dependency

Treatment needed due to lack of preventive healthcare … *etc.*

1. Richie C. Journal of Medical Ethics 2022;48:334-7.

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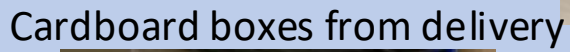
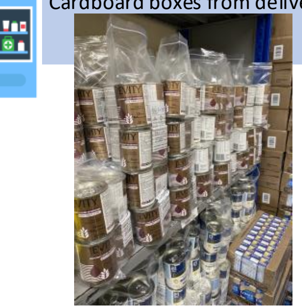
Reduce packaging waste at Pharmacy

Pharmacy



Cardboard boxes from delivery

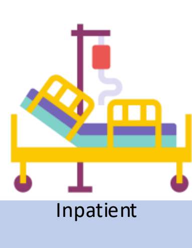
Plastic bags for discharge



Ziploc bag for re-packaging

Primary packaging boxes

Amber pill bottles



Inpatient

Outpatient

PLASTIC

BOXES PAPER

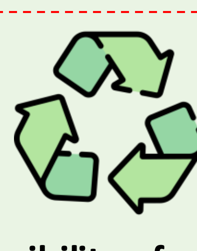
All treated as confidential waste (plastic/paper)

25,000KG of plastics waste over 3 years

Plaspulp Union

Sorting and shredding the plastic

Possibility of recycle?



Plastic recycled pellets

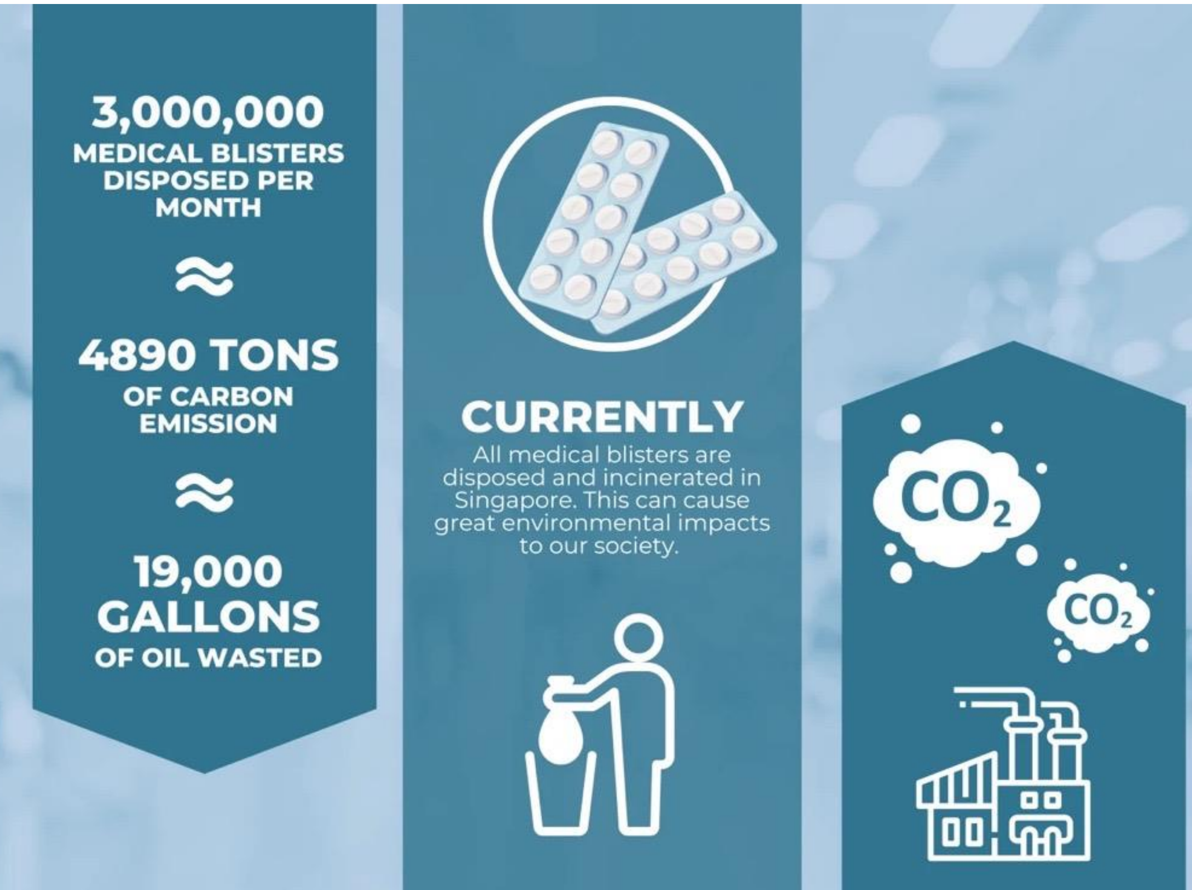
Recycling of Insulin pens

A collaboration with Sanofi

Solostar Reborn

Challenges in recycling Medication waste

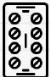
Multi-material blister packs are made of plastic polymers and aluminium. This is challenging to recycle given the current technology gap.



https://greendoctorsprogramme.com

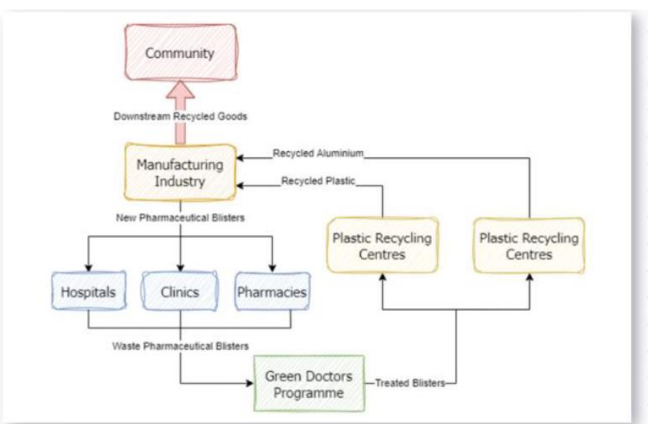
GREEN DOCTORS PROGRAMME

Social enterprise that aims to **promote circular economy** in the field of medical wastes



The first chemical recycling programme to treat medical blisters in the world

Using a proprietry chemical treatment process developed by Green Doctors Programme at National University of Singapore



NUS students come up with recycling method for medicine strips

Shabana Begum
The Straits Times

PUBLISHED: Aug 21, 2022, 10:00am

SINGAPORE - Once the last pill is taken, a patient or nurse will - without giving it a second thought - discard the medicine strip, whic[h is] made of polluting plastic and sought-after aluminium.

98% recovery
of Aluiminium and Plastic

GDP'S CHEMICAL SEPARATION PROCESS

Materials are separated within 20-30min

Recovered Materials

Aluminium
- aluminium can
- aluminium foil

Plastic (PVC)
- plastic pallets
- green concrete
- piping materials

https://greendoctorsprogramme.com. *Slide content from NUHS*

Painless Safe Discreet by PharLyfe+
Oral films as Drug delivery system

PharLyfe+

Film premix

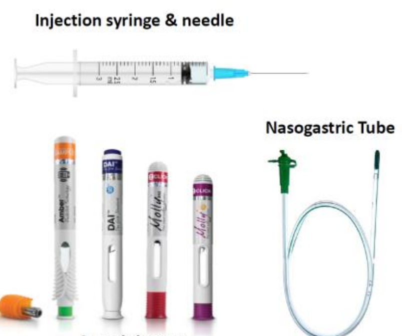
Film premix containing excipients to be made into oral films within healthcare institutions.

Extemporaneous compounding workshops catered to the specific films will be conducted .

- Elimination of Devices, Bulk Packaging & Less Wastes

ORAL LIQUIDS	FILMS
• Short shelf-life: *Freshly prepared* • Packaging: Bulky, multi-dose • Inconvenient administration: *needs measure-dosing device*	• Longer shelf-life: *Low water activity* • Packaging: Compact, unit-dose • Convenient administration

- Elimination of Devices, Bulk Packaging & Less Wastes



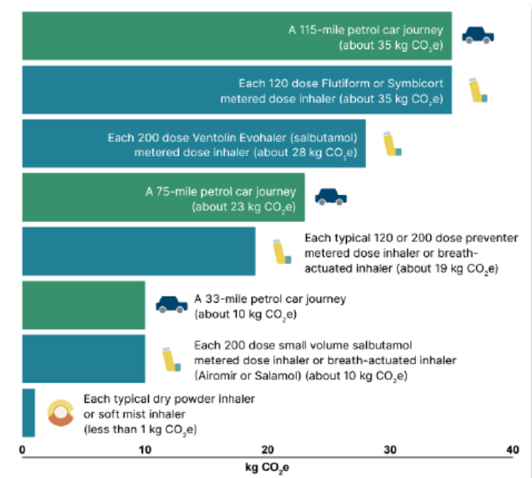
A/P CHAN Sui Yung **Dr TAN** Poh Leng **Ms CHUA** Qi Shan

founders@pharlyfeplus.com

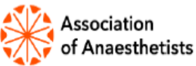
https://pharlyfeplus.com. Slide content from Prof Chan Sui Yong.

Reducing emissions from anaesthetic gases & inhalers

- Medicines account for 25% of the total NHS carbon footprint. **We are focusing on tackling emissions from the highest carbon medicines** (~5% of the footprint).
- In January, NHS England, with the support of the Royal College of Anaesthetists, announced the **decommissioning of the anaesthetic gas desflurane by early 2024.**
- The NHS is working with patients to improve asthma care and reduce the carbon footprint of prescribed inhalers through **encouraging lifestyle changes (such as stopping smoking), optimising inhaler use, and when appropriate supporting a change to dry powder inhalers.**



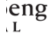
Source: NICE Patient Decision Aid – Asthma inhalers and climate change



Joint statement on NHSE's plan to decommission desflurane by early 2024

Thursday 12 January 2023

The climate emergency is a health emergency, and as such we, the Association of Anaesthetists and the Royal College of Anaesthetists (RCoA) are committed to promoting actions that encourage environmental sustainability within anaesthetic practice and amongst our members and fellows.



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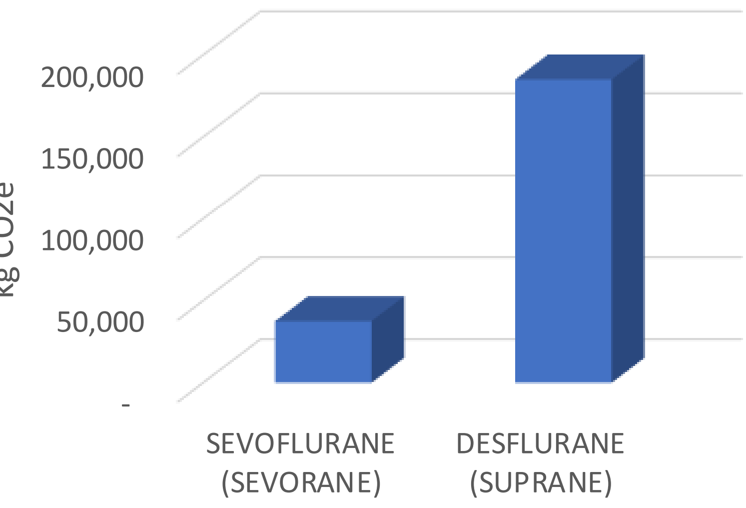
Inhaled anaesthetics

- Sevoflurane and desflurane are potent greenhouse gases (GHGs) with heat trapping properties.

Inhaled anesthetic	GWP_{100}
Sevoflurane	144
Desflurane	2,590
GWP ratio of the amount of heat trapped by 1kg of gas vs CO2 over a 100-years	

- These gases undergoes minimal metabolism and exerts greenhouse gas effects atmosphere
- 1 bottle of sevoflurane (250mL) = driving for 196km
- 1 bottle of desflurane (240mL) = driving for 3,539km

Total carbon footprint of inhaled anesthetics – TTSH data Jan 2023 to Dec 2023



Raise awareness:
- Consider total IV anaesthetic or switching to sevoflurane
  - Potential cost savings sevoflurane ($154) vs. desflurane ($347)
- Use lowest appropriate flow

Inhaled anesthetic used in TTSH from Jan 2023 to Dec 2023	
Agent	**Total Qty**
Sevoflurane 250mL	767
Desflurane 240mL	209

Wyssusek K, et al. BMJ Open Qual. 2022 Aug;11(3):e001867.

Asthma inhalers and climate change

A 115-mile petrol car journey (about 35 kg CO_2e)

Each 120 dose Flutiform or Symbicort metered dose inhaler (about 35 kg CO_2e)

Each 200 dose Ventolin Evohaler (salbutamol) metered dose inhaler (about 28 kg CO_2e)

A 75-mile petrol car journey (about 23 kg CO_2e)

Each typical 120 or 200 dose preventer metered dose inhaler or breath-actuated inhaler (about 19 kg CO_2e)

A 33-mile petrol car journey (about 10 kg CO_2e)

Each 200 dose small volume salbutamol metered dose inhaler or breath-actuated inhaler (Airomir or Salamol) (about 10 kg CO_2e)

Each typical dry powder inhaler or soft mist inhaler (less than 1 kg CO_2e)

0 10 20 30 40

kg CO_2e

Source: NICE Patient Decision Aid – Asthma inhalers and climate change

Inhalers usage in TTSH_2023

TTSH utilization data for CY 2023

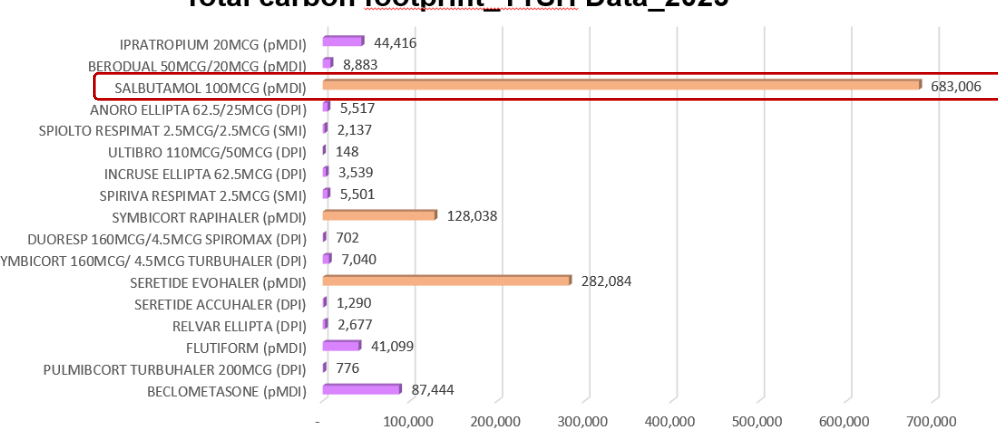
Types of inhalers	Device	Class	Total quantity
PULMIBCORT TURBUHALER 200MCG	DPI	ICS	554
BECLOMETASONE 50MCG	pMDI	ICS	1,374
BECLOMETASONE 250MCG	pMDI	ICS	2,923
FLUTIFORM 125/5MCG	pMDI	ICS/LABA	397
FLUTIFORM 250/10MCG	pMDI	ICS/LABA	729
RELVAR ELLIPTA 100/25MCG	DPI	ICS/LABA	2,026
RELVAR ELLIPTA 200/25MCG	DPI	ICS/LABA	1,525
SERETIDE 25MCG/125MCG EVOHALER	pMDI	ICS/LABA	7,586
SERETIDE 25MCG/250MCG EVOHALER	pMDI	ICS/LABA	6,891
SERETIDE 50MCG/100MCG ACCUHALER	DPI	ICS/LABA	365
SERETIDE 50MCG/250MCG ACCUHALER	DPI	ICS/LABA	608
SERETIDE 50MCG/500MCG ACCUHALER	DPI	ICS/LABA	464
SYMBICORT 160MCG/ 4.5MCG TURBUHALER	DPI	ICS/LABA	8,796
DUORESP 160MCG/4.5MCG SPIROMAX	DPI	ICS/LABA	1,114
SYMBICORT 160MCG/4.5MCG RAPIHALER	pMDI	ICS/LABA	1,233
SYMBICORT 80MCG/2.25MCG RAPIHALER	pMDI	ICS/LABA	2,489
SPIRIVA RESPIMAT 2.5MCG	SMI	LAMA	7,098
INCRUSE ELLIPTA 62.5MCG	DPI	LAMA	4,841
ULTIBRO 110MCG/50MCG	DPI	LAMA/LABA	263
SPIOLTO RESPIMAT 2.5MCG/2.5MCG	SMI	LAMA/LABA	2,757
ANORO ELLIPTA 62.5/25MCG	DPI	LAMA/LABA	7,386
SALBUTAMOL 100MCG	pMDI	SABA	27,039
BERODUAL 50MCG/20MCG	pMDI	SABA/SAMA	539
IPRATROPIUM 20MCG	pMDI	SAMA	3,106

DPI/SMI 41%

pMDI 59%

Top 3 pMDI dispensed (by Qty):
1. Salbutamol (27,039)
2. Seretide evohaler (14,477)
3. Beclometasone (4,297)

Total carbon footprint_TTSH Data_2023



Reducing Inhalers Carbon Footprint

Tan Tock Seng HOSPITAL
National Healthcare Group

For Medical Professionals Only

Respiratory Inhalers

At A Glance

The choice of inhalers is a shared decision-making process based on:

- Disease and its severity/control
- Technique of inhaler use
- Patient's satisfaction
- Environmental impact

ICS/LABA

- SDL ECO A C M — DuoResp 160mcg/4.5mcg Spiromax (DPI)[5] (Budesonide 160mcg, Formoterol 4.5mcg)
- SDL ECO A C M — Symbicort 160mcg/4.5mcg Turbuhaler (DPI)[1] (Budesonide 160mcg, Formoterol 4.5mcg)
- SDL A C M — Symbicort 80mcg/2.25mcg Rapihaler (MDI)[4] (Budesonide 80mcg, Formoterol 2.25mcg)
- SDL ECO A C — Seretide 50/500 Accuhaler (DPI)[1] (Fluticasone 500mcg, Salmeterol 50mcg)
- SDL A — Seretide 25/125 Evohaler (MDI)[1] (Fluticasone 125mcg, Salmeterol 25mcg)
- SDL A — Seretide 25/250 Evohaler (MDI)[1] (Fluticasone 250mcg, Salmeterol 25mcg)
- SDL ECO A — Seretide 50/100 Accuhaler (DPI)[1] (Fluticasone 100mcg, Salmeterol 50mcg)
- SDL ECO A — Seretide 50/250 Accuhaler (DPI)[1] (Fluticasone 250mcg, Salmeterol 50mcg)
- SDL ECO A C — Relvar 100/25 Ellipta (DPI)[1,3] (Fluticasone 100mcg, vilanterol 25mcg)
- SDL ECO A — Relvar 200/25 Ellipta (DPI)[1,3] (Fluticasone 200mcg, vilanterol 25mcg)
- A — Flutiform 250/10 MDI[2] (Fluticasone 250mcg, Formoterol 10mcg)
- A — Flutiform 125/5 MDI[1] (Fluticasone 125mcg, Formoterol 5mcg)

LAMA/LABA

- ECO C — Spiolto Respimat (SMI)[1] (Tiotropium 2.5mcg, Olodaterol 2.5mcg)
- SDL ECO C — Anoro Ellipta (DPI)[3] (Umeclidinium 62.5mcg, Vilanterol 25mcg)
- ECO C — Ultibro Breezhaler (DPI)[2] (Indacaterol 110mcg, Glycopyrronium 50mcg)

LAMA

- ECO A C — Spiriva Respimat (SMI)[2] (Tiotropium 2.5mcg)
- SDL ECO C — Incruse Ellipta (DPI)[3] (Umeclidinium 62.5mcg)

ICS

- SDL ECO A — Pulmicort Turbuhaler (DPI)[1] (Budesonide 200mcg)
- SDL A — Beclometasone 50mcg MDI[1]
- SDL A — Beclometasone 250mcg MDI[1]

SABA

- SDL A C — Salbutamol 100mcg MDI[1]

SAMA

- SDL A C — Ipratropium 20mcg MDI[1]

SABA/SAMA

- A C — Berodual MDI[1] (Fenoterol 50mcg, Ipratropium 20mcg)

Not in formulary

- ECO C — Trelegy Ellipta (DPI)[3]
- SDL A C — Symbicort 160mcg/4.5mcg Rapihaler (MDI)[4]
- C — Breztri (MDI)[4]
- C — Trimbow (MDI)[6]

Abbreviations: SAMA – short-acting muscarinic antagonist, SABA – short-acting beta agonist, LAMA - long-acting muscarinic antagonist, LABA - long-acting beta agonist, ICS – inhaled corticosteroid, MDI – metered-dose inhaler, DPI – dry-powder inhaler, SMI – soft mist inhaler, SDL – standard drug list

[1]Photo credits from MediView (https://www.mediview.sg/)
[2]Photo credits from MIMS Online (http://www.mims.com/Singapore/home/Index)
[3]Photo courtesy of GlaxoSmithKline
[4]Photo courtesy of AstraZeneca
[5]Photo courtesy of Teva Pharmaceutical
[6]Photo courtesy of Orient EuroPharma

A = Asthma (HSA-registered indication)
C = COPD (HSA-registered indication)
M = HSA-registered indication for Maintenance and Reliever Therapy for Asthma

Prepared by: Lee Tingfeng
Vetted by: Dr Esther Pang, Dr Xu Huiying, Dr Benjamin Ho
Version 8a, 22-Sep-2023

ECO MDIs contain hydrofluorocarbon (HFC) propellants that are powerful greenhouse gases and can contribute to global warming. In comparison, DPIs and SMIs do not use these propellants and have substantially lower carbon footprints. However, there should be a shared decision-making between prescribers and patients.

© Division of Pharmacy, Tan Tock Seng Hospital

- Optimize prescribing
- Substitute high carbon products for low-carbon alternatives
- Improvements in production and waste process

Teva Ireland Teva Ireland: inhaler recycling https://www.teva.ie/patients/inhalerrecycling/ (2022).

EVALUATING CARBON FOOTPRINT ARISING FROM SEDATION PRACTICES IN THE INTENSIVE CARE UNITS (ICU)

Home

Soong Jie Lin[1,2], Ho Pei Lin[2], Valerie Neo Ser Hwee[2], Lie Sui An[3]

[1] Department of Pharmacy, Singapore General Hospital, [2] Department of Pharmacy, National University of Singapore, [3] Department of Surgical Intensive Care, Singapore General Hospital

PATIENTS: A total of 20 patients from NICU and 11 from SICU were recruited, with median age of 67.5 and 70.0 years, respectively.

SEDATIVES USED AND WASTED:

- The sedative and analgesic with the highest total amount used in both ICUs are propofol and fentanyl, respectively.
- Carbon footprint arising from sedation practices for all patients over 1.5 months was **2.492 kg CO_2-e**, which is equivalent to driving approximately **16 km** by car.

Table 1: Total amount of drugs used and wasted, their CO_2-e and the distance by car eq

Name of Drugs	Total amt used (mg)	CO_2-e used (kg)	Total amt wasted (mg)	CO_2-e wasted (kg)	Total CO_2-e used and wasted (kg)	Distance by car eq (km)
Sedatives						
Propofol	98,060	2.059	12,040	0.253	2.312	14.634
Dexmedetomidine	3.9	0.011	0.9	0.003	0.014	0.091
Midazolam	251.5	0.112	67.5	0.030	0.142	0.897
Analgesics						
Fentanyl	65.2	0.006	4.7	0.001	0.007	0.043
Morphine	11	0.017	0	0	0.017	0.105
Remifentanil	4.5	0.001	1.4	0.000	0.001	0.004
Total:		2.206		0.286	2.492	15.774

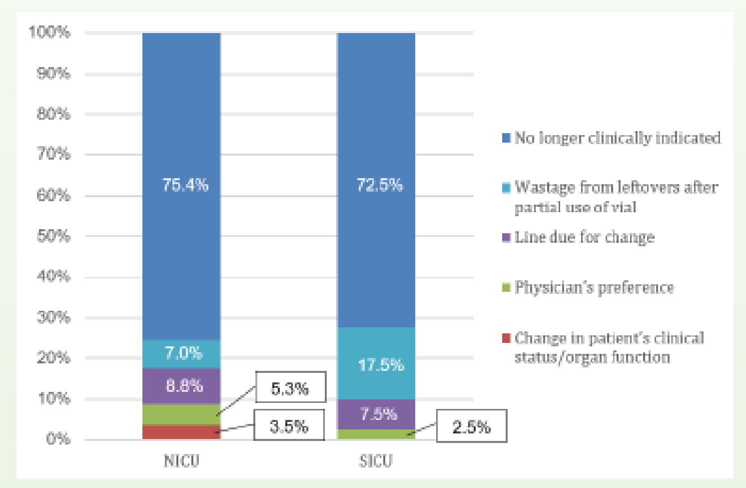


Figure 1: Reasons for wastage of sedatives and analgesics in both ICUs

Recommendations to reduce carbon footprints:

1. Use comparative LCA data to guide selection of drugs
- Current first-line agents e.g. propofol and fentanyl are greener options.

2. Minimise pharmaceutical wastage
- Enhance communication among healthcare professionals to **better inform of any changes to the therapeutic plan to avoid unnecessary top up of excess sedative agent**
- Changes in nursing practice e.g. using **smaller volume vials**, **diluting smaller amounts for short term usage**

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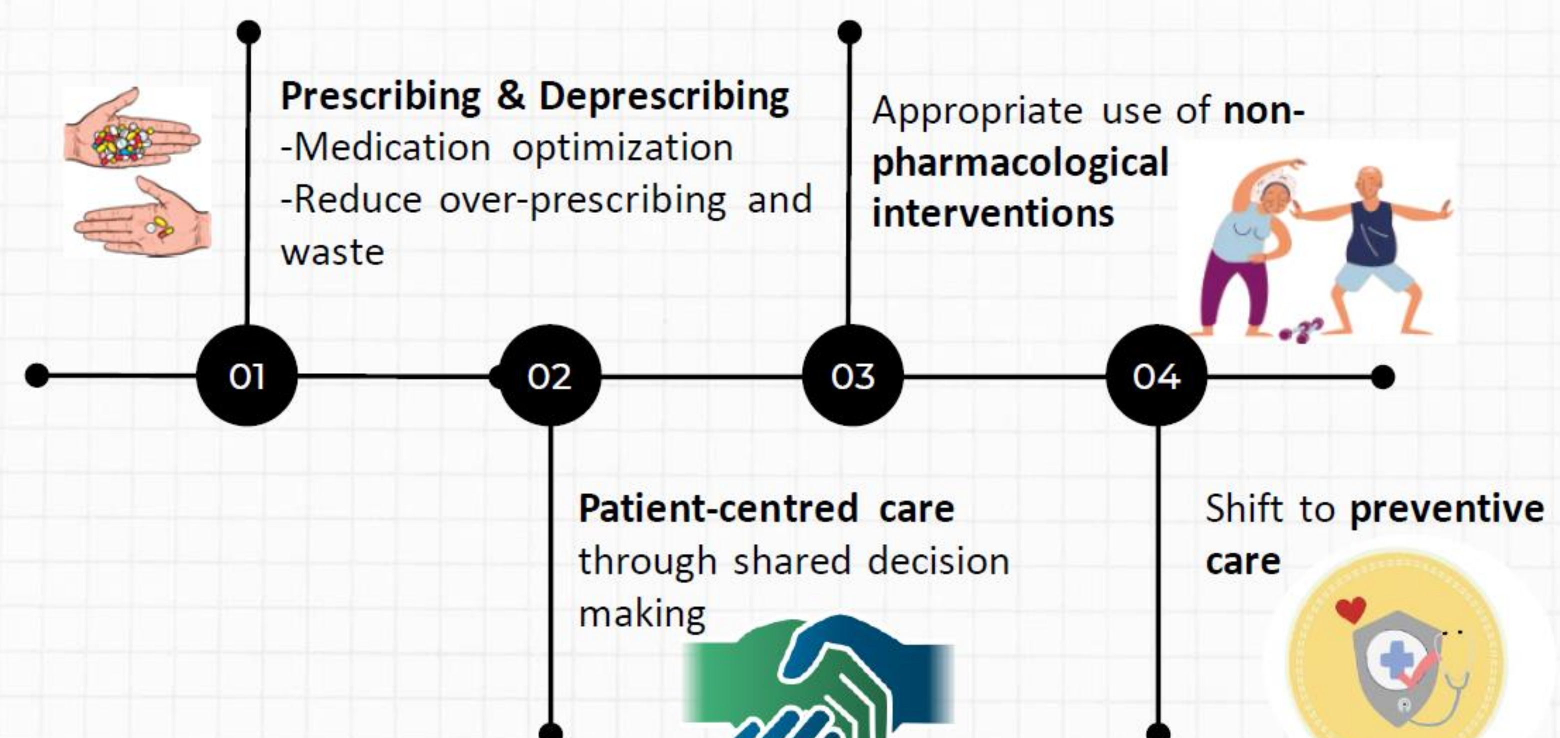
Slides credit from SGH, presented at Spore Pharmacy Congress 2023



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Slide content with credits from NUH

MedsWise

Let's talk about "Using Medicines Wisely"

Did you know?

15% of community-dwelling older adults in Singapore experience polypharmacy (≥ 5 medications)

83% of older adults are willing to stop ≥ 1 medication if their doctor said it was possible

We can all do a part to reduce inappropriate polypharmacy

1 Actively conduct medication review

If a medication is:

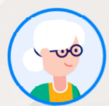
- **Potentially inappropriate?**
- **Lacking an indication?**
- **Failing to provide additional benefit?**
- **Lacking efficacy?**
- **Causing an adverse reaction?**
- **Too complex to follow?**

→ Discuss with your patient about deprescribing

2 Start a Conversation...

Within our **healthcare team:**

- **Think beyond medicines** – Seek allied health expert advice on dietary / lifestyle as options if relevant



With our **patients** - Engage them as **active partners** in their own health

The Journals of Gerontology: Series A. 2021;76(6):1053-1060.
Proceedings of Singapore Healthcare. 2019;28(4):224-231.
https://www.aafp.org/fpm/2018/0500/p28.html

Prepared by Christina Tan & Azrina Imran Tan from Division of Pharmacy

Tan Tock Seng Hospital

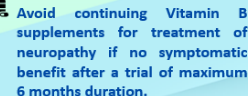
MEDSWISE *Using Medicines Wisely*

Vitamin Bs

Avoid routinely continuing vitamin B supplements without evaluating it for effectiveness and continued benefit when used for treatment of neuropathy and radiculopathy.

QUICK TAKE

- In TTSH, 4382 tablets of Neurobion® /Neuroforte® / Princi-B forte® / Neurogen-E® per 1000 prescriptions, amounting to $451,000 in expenditure, were dispensed in 2019
- Available limited data on the efficacy of Vitamin B for treating peripheral neuropathy and radiculopathy is insufficient to determine benefit or harm. Guidelines on management of neuropathies do not support the use of Vitamin Bs.



OUR RECOMMENDATIONS

- **Avoid continuing Vitamin B supplements for treatment of neuropathy if no symptomatic benefit after a trial of maximum 6 months duration.**

You can direct patients to speak to a pharmacist if any queries

EXPLANATION

Guidelines on management of neuropathies generally do not support the use of Vitamin Bs:

- ADA has no recommendations for the use of Vitamin Bs in diabetic neuropathy
- AAN acknowledges that it cannot recommend the use of vitamins for treatment of diabetic neuropathy due to insufficient evidence
- National Institute for Health & Care Excellence, Canadian Pain Society, European Federation of Neurological Societies & the Neuropathic Pain Special Interest Group has no recommendations for use of Vitamin Bs for all types of neuropathic pain
- North American Spine Society has no recommendation for use of Vitamin Bs in cervical radiculopathy. North American Spine Society6also has no recommendations for use of Vitamin Bs in lumbar disc herniation.
- Vitamin B6 (Pyridoxine) induced neuropathy has also been reported in several case reports when taken at doses less than 50mg/day, which is much lower than in preparations routinely prescribed in our institution. This has been reported even in individuals after taking just one dose of a vitamin B6 containing preparation.

References:

MEDSWISE *Using Medicines Wisely*

Glucosamine

Encourage people with osteoarthritis to exercise as a core treatment. Avoid routine initiation of glucosamine, and evaluate continued benefits among existing users.

QUICK TAKE

- Guidelines generally do not recommend the use of glucosamine for the management of osteoarthritis (OA). Benefits of glucosamine at doses of 1500 mg per day have not been consistently demonstrated.
- In TTSH, 2.3 million capsules amounting to $280,000 were dispensed to 4271 individuals in year 2019.

OUR RECOMMENDATIONS

- Glucosamine is generally not recommended and may increase pill burden and cost.
- Encourage people with osteoarthritis to take on simple exercises. The "Know Your Knees" app is a good resource for basic exercises.
- Refer to a physiotherapist for patients with more complex needs.

Scan here!

EXPLANATION

- The 2014 NICE guideline, 2012 American College of Rheumatology (ACR) guideline and 2013 American Academy of Orthopedic Surgeons (AAOS) guideline do not recommend the use of glucosamine for the management of osteoarthritis (OA). The 2014 Osteoarthritis Research Society International (OARSI) guideline recommends against the use of glucosamine for disease modification but gave an uncertain rating for use of glucosamine for symptom relief of OA.
- Systematic reviews and meta-analyses were not uniformly positive for the benefits of glucosamine hydrochloride or glucosamine sulfate at standard doses of 1500 mg daily in improving knee, hip or hand OA versus placebo.
- Although glucosamine appears to be well-tolerated with no major safety concerns, mild gastrointestinal disturbances (e.g. nausea, vomiting, heartburn, diarrhea etc.) may occur and they add to the pill burden and cost.

References:

MedsWise

Proton-Pump Inhibitors (PPIs)

Did you know?

54.9% of PPIs prescribed to hospitalised patients discharged from TTSH had no relevant diagnosis for use*

*Point prevalence audit of 4 weeks of PPI prescriptions in 2018; appropriateness of PPI prescription assessed based on ICD codes and at-risk medications such as antiplatelets, anticoagulants and steroids.

Let's debunk some PPI myths!

Myth 1: PPIs are harmless

Fact: PPIs, like any other drugs, are NOT absolutely safe

Chronic PPI use has been associated with increased risk of **bone fractures, nutritional deficiencies** (e.g. Vit B12, magnesium), ***C.difficile*** **diarrhoea**, and **pneumonia.**[1]

Myth 2: PPIs are effective for all dyspepsia/ reflux-like symptoms

Fact: PPIs are only effective for acid-related dyspepsia/reflux symptoms

- PPIs **should not be used** for dyspepsia-related symptoms caused by hepatobiliary disorders (e.g. cholelithiasis) or pancreatitis
- PPIs have **no convincing evidence for use** in patients with extra-oesophageal reflux symptoms (e.g. chronic cough, persistent throat symptoms) in the absence of peptic symptoms / evidence of acid reflux.[1-3]

OUR RECOMMENDATIONS[4-5]

- Prescribe the **lowest, effective** dose that manages the acid-related GI symptoms
- Avoid maintaining long-term PPI use for GI symptoms; review to stop or reduce PPI at least annually in most patients

A stepwise approach to reviewing PPIs in dyspepsia

Indication	Recommendation
For gastro-esophageal reflux disease (GERD) & dyspepsia	Prescribe the lowest effective dose for shortest possible duration, based on symptoms.
If symptoms recur after initial course	• Step down to the lowest effective dose or trial "as needed" PPI if appropriate • Educate patient on self-treatment with antacids / alginate therapies
For patients who require long term PPIs	Review at least once annually and encourage stopping treatment (unless existing underlying condition or medication warrants continued treatment)

Note: Above recommendations are not applicable for patients with Los Angeles Grade C-D esophagitis, hyper-secretory syndrome or high risk patients on medications like antiplatelets/ anticoagulants

Tan Tock Seng HOSPITAL

Prepared by Christina Tan & Azrina Imran Tan from Division of Pharmacy

Inhaled Corticosteroids (ICS) For All Asthma

Did you know?

1 in 3 asthma patients with severe life-threatening asthma exacerbations in Singapore were not on ICS[1]

- Guidelines <u>do not recommend</u> the use of short-acting beta-2 agonists (SABA) alone in all asthmatic adolescents and adults[2,3]
- SABA-only treatment is associated with an increased risk of severe asthma exacerbations and asthma-related death as it does not treat the underlying chronic airway inflammation[4,5]
- ICS treatment significantly reduces the risk of exacerbations, hospitalizations, and mortality[4-9]

OUR RECOMMENDATIONS

- Use an ICS-containing preventer treatment for all asthmatic adolescent and adult patients
- Avoid SABA-only treatment in these patients
- If your asthmatic patient is only on SABA alone, please consider switching to ICS-containing preventer treatment after counselling

Guidelines	Summary of Evidence
ACG 2020[2]	• Use ICS as the mainstay of long term asthma management • For patients aged 6 years and above, do not use SABA alone (without a preventer) to treat asthma long term
GINA 2021[3]	• No longer recommends SABA-only treatment for mild asthma • All asthmatic adults and adolescents should receive ICS-containing preventer treatment to reduce risk of serious exacerbations

ACG – Agency for Care Effectiveness (ACE) Clinical Guidance; GINA – Global Initiative for Asthma

Respiratory Inhalers

↑Click for list of inhalers in TTSH↑

References:
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4. New England Journal of Medicine. 2000;343(5):332-336.
5. Thorax. 2002;57(10):880-884.
6. Am J Respir Crit Care Med. 2001;164(8 Pt 1):1392-1397.
7. Lancet. 2003;361(9363):1071-1076.
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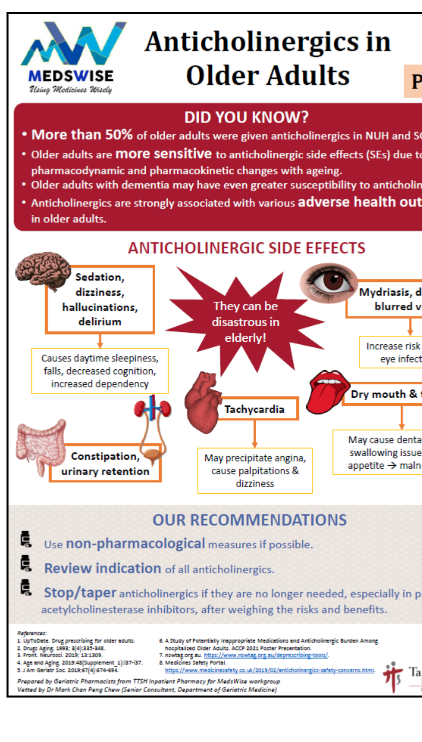

Anticholinergics in Older Adults — Part 1

DID YOU KNOW?

- **More than 50%** of older adults were given anticholinergics in NUH and SGH.
- Older adults are **more sensitive** to anticholinergic side effects (SEs) due to pharmacodynamic and pharmacokinetic changes with ageing.
- Older adults with dementia may have even greater susceptibility to anticholinergic SEs.
- Anticholinergics are strongly associated with various **adverse health outcomes** in older adults.

ANTICHOLINERGIC SIDE EFFECTS

OUR RECOMMENDATIONS

- Use **non-pharmacological** measures if possible.
- **Review indication** of all anticholinergics.
- **Stop/taper** anticholinergics if they are no longer needed, especially in patients on acetylcholinesterase inhibitors, after weighing the risks and benefits.

Prepared by Geriatric Pharmacists from TTSH Inpatient Pharmacy for MedsWise workgroup
Vetted by Dr Mark Chan Peng Chew (Senior Consultant, Department of Geriatric Medicine)

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Anticholinergics in Older Adults — Part 2

DID YOU KNOW?

- Medications can have low, moderate or high **anticholinergic activity (AA).**
- Medications with low or moderate AA used at **higher doses** or **concomitant use** of multiple medications with low AA can lead to significant anticholinergic effects.

OUR RECOMMENDATIONS

- Select medication classes with **little/no AA.**
- Select medications with the **least AA** within the same class.
- **Keep doses low**, especially in older adults.
- **Avoid concomitant** anticholinergics.

	Cough, cold/flu	Analgesics	Antiemetics, vertigo	Urinary incontinence	Anti-depressants
LOWER AA	Cough *Dry:* No good alternatives; consider dextromethorphan *Wet:* Acetylcysteine, guaifenesin Runny nose, itch 2nd generation antihistamines (e.g. loratadine, fexofenadine)	Neuropathic Gabapentin, pregabalin Non-neuropathic Paracetamol, topical NSAIDs, opioids (e.g. codeine)	Domperidone, ondansetron, metoclopramide	Mirabegron, intravaginal estrogens, alpha-blockers (for some male patients)	SSRIs other than paroxetine (e.g. sertraline, fluvoxamine), SNRIs (e.g. duloxetine), mirtazapine, trazodone
HIGHER AA	Cough *Dry:* Procodin *Wet:* Diphenhydramine Runny nose, itch 1st generation antihistamines (e.g. chlorpheniramine, hydroxyzine)	Neuropathic TCAs (e.g. amitriptyline) Non-neuropathic Anarex (contains orphenadrine)	Promethazine, dimenhydrinate, prochlorperazine	Tolterodine, solifenacin, oxybutynin	TCAs (e.g. amitriptyline, imipramine), paroxetine

Abbreviations: TCAs: tricyclic antidepressants; SSRIs: selective serotonin reuptake inhibitors; SNRIs: serotonin-norepinephrine reuptake inhibitors.

Prepared by Geriatric Pharmacists from TTSH Inpatient Pharmacy for MedsWise workgroup
Vetted by Dr Mark Chan Peng Chew (Senior Consultant, Department of Geriatric Medicine)

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NUH Pharmacy Deprescribing Initiative

Deprescribing one drug at a time

Drug of the month: Antibiotics Deprescribing [IV to PO switch]

August 2023

THINK before you prescribe/verify IV antibiotics! Could my patient benefit from **ORAL** therapy?

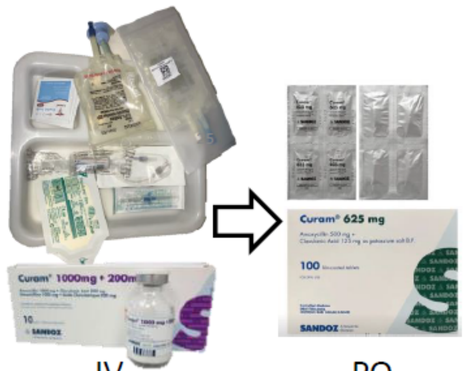
Consider switch from IV to Oral antibiotics when clinically appropriate

If your patient meets the following criteria:

- ✓ Oral route reliably available
- ✓ Gut absorption not compromised
- ✓ Clinical stability, absence of deep seated infection

Advantages of ORAL route:

1) Ease of administration and reduce nursing time
2) Decrease complications secondary to IV access e.g. line infection, phlebitis
3) Reduce hospital length of stay
4) Cost savings (cost of IV sets and pumps, drug cost, hospitalization cost)
   IV route ~27 times more expensive than oral
5) More patient friendly: improved comfort & mobility
6) Improve sustainability & reduce plastic waste (Go green!)



Antibiotics with excellent oral bioavailability

IV antibiotic	**PO** antibiotic	Bioavailability
Azithromycin 500mg OD	Azithromycin 500mg OD	34 – 52%^
Ciprofloxacin 400mg BD	Ciprofloxacin 500mg BD	60 – 95%
Clindamycin 600–900mg Q8H	Clindamycin 300–450mg QDS	90%
Augmentin 1.2g Q8H	Augmentin 625mg TDS	75 – 85%
Co-trimoxazole	Co-trimoxazole (1:1 conversion)	90 – 100%
Fluconazole 400mg OD	Fluconazole 400mg OD	>90%
Levofloxacin 750mg OD	Levofloxacin 750mg OD	99%
Metronidazole 500mg Q8H	Metronidazole 400mg TDS	80%

^Exceptionally well distributed into tissues

For more information on IV to oral antibiotic switch options, refer to: IV to PO Antibiotic Conversion.pdf

Note: The document is to be used as a guide only. Always apply clinical judgement and consult your pharmacist/ ASP team when in doubt

Slide content with credits from NUH

SG Green Pharma

Sustainable medicine: The future of healthcare, for the people and for the environment

Delivering sustainable healthcare while maintaining safe, efficient and patient centred care

Core Team: Deborah Chia, Anne Neo, Chee Pheng Loh

Our Team & Partners

Anne Neo
Snr Pharmacist
Mural artist

Lab pharmacist
TTSH (NHG)

Deborah Chia
Principal Clinical Pharmacist
PSS Public Education Chapter Lead

Inpatient pharmacist
NUH (NUHS)

Loh Chee Pheng
Snr Pharmacist
PSS Professional Education Chapter member & part of Green MOCA

Outpatient pharmacist
KKH (Singhealth)

Public education to older adults at West Coast SASCO

Public education to older adults at Know-your-medications Get it right event with mural painting in

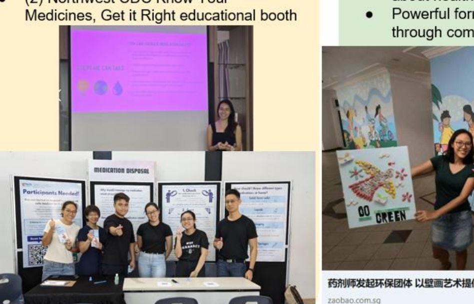
NUS Pharmacy Students (NUSPS), Pharmaceutical Society of ...hnics, ITE - provide platform to educate ...acy students in healthcare sustainability & ...treach event

MOCA TANGLIN CC
MOCA MOULMEIN-CAIRNHILL

Our Green MoCa - partners for mural painting and sustainability outreach to community 2

Our Outreach - 700+ pax since March 2024

1. **Public education to reduce unnecessary over-collection and to educate on proper storage and disposal of medicine**
   - (1) SASCO@West Coast Active Aging Centre
   - (2) Northwest CDC Know Your Medicines, Get it Right educational booth



2. **Upcycling & mural painting projects to raise awareness on healthcare sustainability**
   - **Mural painting/art installation** with healthcare disposables to stir conversation among HCPs & public about healthcare waste
   - Powerful form of social prescribing through community art

药剂师发起环保团体 以壁画艺术提倡医疗可持续性
zaobao.com.sg

3. **Webinars/lectures targeting healthcare professionals including pharmacists, pharmacist technicians, HCP students**
   - **Webinars/ lectures will focus on sharing on healthcare sustainability issues**
   - TP Pharmaceutical Science Talk
   - RP Sustainability Sharing

Upcoming
   - SPC Congress sustainability track
   - PT sustainability track in SPC Congress
   - PT Day in Oct 24

Thank You

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