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## Challenges encountered by pharmacy staff in using prescription medication labels during medication counselling with older adults and solutions employed: A mixed-methods study

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## ABSTRACT

**Background:** Prescription medication labels (PMLs) predominantly dispensed in English, are an important adjunct to medication counselling. PMLs are routinely used by pharmacy staff to counsel older adults about their medications. This study sought to identify challenges that pharmacy staff observe older adults face in using their PMLs, and to identify and quantify solutions employed by pharmacy staff during medication counselling to address such challenges.

**Methods:** Ten in-depth interviews were done with primary care pharmacy staff to gather the range of challenges and solutions. Subsequently, a quantitative survey, informed by the qualitative findings, was administered to 121 pharmacy staff to assess if the reported solutions were commonly used.

**Results:** The two main challenges were incongruity between PML language (English) and older adults' language proficiency, and poor PML legibility. The solutions, classified under three themes, were simplifying medication information on PMLs, supplementing PMLs with additional medication information and mitigating poor readability.

**Conclusions:** Pharmacy staff observed challenges faced by older adults in using PMLs during medication counselling. Ad-hoc improvisations by pharmacy staff to PMLs were pervasive. System-level PML improvements, such as provision of legible bilingual medication instructions, pharmaceutical pictograms and additional medication information, through patient information leaflets or using quick response (QR) codes on PMLs, should be considered. This will facilitate patient-provider communication, especially in settings with language dissonance between PMLs and patients.

## 1. Introduction

The world is ageing. By 2050, 1 in 6 people globally would be aged 65 years and older [1]. Given the increase in healthcare use with age [2–5], older adults are more likely to be on prescription medications [6,7]. Thus, pharmaceutical care delivery should evolve to meet the needs of older adults.

In pharmacies, verbal medication counselling is routinely undertaken for communicating medication-related information to patients [8]. Prescription medication labels (PMLs), which are affixed on medication packets and bottles [9], contain printed medication information and are

used during such interactions to reinforce verbal counselling [10,11]. Furthermore, as older, versus younger, adults are less likely to recall verbal information about their medications [12], PMLs are critical for communicating medication information to them. However, previous studies have shown that there is a pressing need for PMLs in different languages; apart from English as there are patient populations who face language barriers [13–16] Furthermore studies have shown that PMLs are not always well-understood by low-literate older patients [17–19].

In public healthcare institutions in Singapore, the setting for this study, medication counselling is performed by pharmacists and pharmacy

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technicians (hereafter known as “pharmacy staff”) [20]. Pharmacy staff in Singapore use PMLs that are largely only in English, yet 53% of Singaporeans aged  $\geq 65$  years cannot read in English [21]. This mismatch between the language of PMLs and older adults' language proficiency is concerning, as understanding of PMLs is key to medication safety and adherence [22–25]. It is also noteworthy that apart from PMLs, patients in Singapore do not routinely receive additional printed medication information materials [26].

A recent study conducted by our research group reported that older Singaporeans faced major challenges with PMLs, which led them to seek help from pharmacy staff to facilitate interpretation of PMLs [27]. As the information printed on PMLs appears to be inadequate in meeting the medication information needs of older adults, it is necessary to know if pharmacy staff are able to identify the challenges faced by older patients in using their PMLs during medication counselling, and what solutions they employ to facilitate older adults' understanding of PMLs. It is also important to quantify any such solutions through a survey, to enable an understanding of how widely pharmacy staff utilise these solutions.

Therefore, we conducted a mixed-methods study to a) identify the challenges that pharmacy staff observe older adults face in reading and understanding PMLs during medication counselling, and b) identify and quantify the solutions employed by pharmacy staff during medication counselling to overcome these challenges.

## 2. Methods

### 2.1. Theoretical framework

The Communication-Human Information Processing (C-HIP) model underpinned this study. The C-HIP model has been widely used in research on the communication of drug and safety warnings [28]. It combines both communication and information processing theories. The communication theory brings in the concepts of the “source”, “channel” and “receiver”, while the information processing theory introduces the stages of information processing, which include attention or noticeability, comprehension and memory, attitudes and beliefs, and motivation and behaviour [28]. Briefly, the C-HIP model outlines that when an individual receives an intended message from a source through a channel, the individual experiences a series of cognitive processes when interpreting this message. The message is generally aimed at promoting a specific action or behaviour in the receiver, and bottlenecks in any of the information processing stages can affect the actionability of and compliance to the intended message.

Previously, the C-HIP model has been used to investigate individual and PML characteristics that impeded or facilitated reading and understanding of PMLs [27]. In the context of this study, the source is the healthcare system that provides medication-related information through two channels – PMLs and through pharmacy staff during medication counselling, while the receiver is the older patient. The C-HIP framework can enable a comprehensive understanding of how factors, related to the older patient, PML and pharmacy staff's mitigation solutions, influence the delivery and processing of PML information. These factors were explored through prompts and probes in the in-depth interview (IDI) guide (Supplementary Table 1) and pharmacy staff's mitigation solutions were quantified through the survey component.

### 2.2. Research design and analysis

An exploratory sequential mixed-methods approach was used. This entailed an initial qualitative data collection and analysis phase, followed by a quantitative data collection and analysis phase, with a final phase of integrating the data from the two initial phases [29]. First, IDIs were conducted with 10 pharmacy staff, which elucidated the range of PML-related challenges and solutions from their perspective and informed the content of a survey questionnaire. Then, the questionnaire was administered to a larger sample of 121 pharmacy staff to document the pervasiveness of the solutions. Thematic analysis was used for analysing the IDI

data [30]. NVivo12 was used to store and facilitate the qualitative data analysis. Stata14 was used to conduct the descriptive analysis of the IDI participants' socio-demographic data and the quantitative survey data.

### 2.3. Setting, participants, sample size and data collection

Primary care services in Singapore are provided by both public and private healthcare institutions. This study was conducted at public primary care clinics, also known as polyclinics. As of 2022, there are 23 polyclinics, divided into three groups, SingHealth Polyclinics (SHP), National Healthcare Group Polyclinics (NHGP) and National University Polyclinics (NUP) [31].

#### 2.3.1. Qualitative phase

Polyclinic pharmacy staff who dispensed prescription medications and provided medication counselling to older adults were eligible. A pragmatic approach determined the sample size, based on recommendations in the literature [32] and attainment of data saturation. A total of 10 potential participants, (five from SHP and five from NHGP, across six polyclinics) were referred to the research team through PROMISE investigators. All 10 were eligible, provided written informed consent and were interviewed in English at their respective polyclinics, at a convenient date and time, using a semi-structured interview guide (Supplementary Table 1). The IDIs were audio recorded and then transcribed verbatim. Supplementary Table 2 provides the completed Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist.

#### 2.3.2. Quantitative phase

Pharmacy staff who had performed medication counselling for at least one older patient in the past one year were eligible. All pharmacy staff ( $n = 149$ ) at five SHP and NHGP polyclinics were approached, of whom 122 (81.9%) agreed for eligibility assessment. After excluding one ineligible staff, a total of 121 (81.2%) pharmacy staff (74 from SHP and 47 from NHGP polyclinics) were recruited. All participants provided written informed consent prior to completing a two-part online survey via Qualtrics®. The first part gathered data on demographics (age, gender, nationality and language(s) spoken and written), professional training and experience. The second part included questions based on themes derived from the IDIs to quantify the solutions that the pharmacy staff had employed during medication counselling in the past one year to facilitate older adults' understanding of PMLs.

### 2.4. Data analysis

Thematic analysis was used for analysing the IDI data [30]. Of the various thematic analysis approaches, namely “coding reliability”, “codebook” and “reflexive” [33], the “codebook” approach, which sits between the “coding reliability” and “reflexive” ends of the thematic analysis spectrum, was used. It allows researchers to include both pre-identified topics from the interview guide (Supplementary Table 1) and themes generated from data analysis [33].

The initial codebook was developed based on broad categories that were pre-identified in the interview guide, as well as emergent codes from the first few transcripts. These themes and codes, derived through a mix of deductive and inductive approaches [34,35], were cross-checked between two investigators (S.D.S. and Y.W.T.). Subsequently, the codebook was systematically applied to the remaining transcripts. The coding process was iterative, whereby the codebook was updated to accommodate emergent themes and codes from later transcripts, until no new codes were identified. NVivo12 was used to store and facilitate the qualitative data analysis. Stata14 was used to conduct the descriptive analysis of the IDI participants' socio-demographic data and the quantitative survey data.

## 2.5. Ethical considerations

This study is part of a larger health services research project titled “Prescription Medication Label Improvement for Singaporean Elderly” (PROMISE), which aims to provide the evidence-base for developing and implementing easily understood, context- and culturally-appropriate PMLs. The PROMISE study was approved by the SingHealth Centralised Institutional Review Board (CIRB Reference number: 2017/3023). All participants provided written informed consent.

## 3. Results

The 10 IDIs, each lasting between 61 and 120 min, were conducted from August to October 2018. In line with a recent systematic review that noted that qualitative studies can reach saturation at relatively small sample sizes [36], repetition of codes was observed in the last few interviews, supporting data saturation. Majority of the IDI participants were pharmacy technicians (70.0%), with >5–10 years of pharmacy practice (60.0%) and were females (80.0%) (Table 1). The quantitative survey, with 121

**Table 1**  
Characteristics of pharmacy staff participating in the in-depth interviews and the survey.

Characteristics	Mean $\pm$ SD or N (%)	
	In-depth interview participants (N = 10)	Survey participants (N = 121)
Age, years		
Mean	37.1 $\pm$ 3.8	35.4 $\pm$ 13.2
Gender		
Female	8 (80.0)	104 (86.0)
Nationality		
Singapore citizen or permanent resident	7 (70.0)	119 (98.4)
Others	3 (30.0)	2 (1.6)
Ethnicity		
Chinese	5 (50.0)	76 (62.8)
Malay	1 (10.0)	29 (24.0)
Indian	1 (10.0)	10 (8.3)
Others	3 (30.0)	6 (4.9)
Designation		
Pharmacy technician	7 (70.0)	92 (76.0)
Pharmacist	3 (30.0)	29 (24.0)
Experience in pharmacy practice, years		10.1 $\pm$ 10.5
$\leq$ 1	–	11 (9.1)
>1 to 5	2 (20.0)	34 (28.1)
>5 to 10	6 (60.0)	28 (23.1)
>10 to 50	2 (20.0)	48 (39.7)
Speaking ability (self-reported)		
English	–	121 (100.0)
Chinese (Mandarin)	–	115 (95.0)
Malay	–	88 (72.7)
Tamil	–	9 (7.4)
Other Chinese dialects <sup>a</sup>	–	74 (61.2)
Non-official languages <sup>b</sup>	–	4 (3.3)
English and 1 other official language <sup>c</sup>	–	37 (30.6)
English and 2 other official languages <sup>c</sup>	–	77 (63.6)
English and 3 other official languages <sup>c</sup>	–	7 (5.8)
Writing ability (self-reported)		
English only	–	4 (3.3)
English	–	121 (100.0)
Chinese (Mandarin)	–	82 (67.8)
Malay	–	67 (55.3)
Tamil	–	7 (5.8)
English and 1 other official language <sup>c</sup>	–	80 (66.1)
English and 2 other official languages <sup>c</sup>	–	35 (28.9)
English and 3 other official languages <sup>c</sup>	–	2 (1.7)

SD: Standard Deviation.

<sup>a</sup> Hokkien, Teochew, Cantonese, Hakka and Hainanese.

<sup>b</sup> Indonesian, Malayalam.

<sup>c</sup> Official languages of Singapore are English, Chinese (Mandarin), Malay and Tamil.

pharmacy staff, was conducted from November 2020 to March 2021. Majority of the survey participants were pharmacy technicians (76.0%) with >10 years of pharmacy practice (39.7%) and were females (86.0%) (Table 1).

### QUALITATIVE PHASE

Five major themes were identified (Table 2). Two themes related to the challenges faced by older adults in using PMLs, as observed by pharmacy staff during medication counselling: incongruity between PML language and older adults' English proficiency and illiteracy, and poor PML legibility for older adults with compromised visual acuity. The other three themes, which pertained to solutions adopted by pharmacy staff during medication counselling to overcome the observed challenges, included simplifying medication information on PMLs, supplementing PMLs with additional medication information, and mitigating poor readability of PMLs. Supporting quotes for each theme, from the IDIs, are presented in Table 3.

#### 3.1. Challenges faced by older adults in reading and understanding PMLs, as observed by pharmacy staff

Pharmacy staff shared that PMLs were not well-understood by older adults, particularly those with limited English proficiency (LEP) and illiteracy, and compromised visual acuity.

##### Theme 1: Incongruity between PML language and older adults' English proficiency and illiteracy.

Pharmacy staff raised concerns that older adults' understanding of PMLs was limited due to their LEP. Older adults struggled to read and understand all the medication information on their PMLs. Their understanding was usually limited only to the dose and dosage frequency instructions. Additional medication information, such as precautionary instructions, were not well understood. Pharmacy staff also shared that illiteracy was prevalent among older adults, especially the oldest-old, which contributed to PML-related challenges.

##### Theme 2: Poor PML legibility for older adults with compromised visual acuity.

Pharmacy staff noted that older adults had poor visual acuity that hindered their ability to read their PMLs.

**Table 2**

Challenges faced by older adults in using prescription medication labels (PMLs), as observed by pharmacy staff during medication counselling, and the solutions employed by pharmacy staff during medication counselling to overcome such challenges: Themes elicited from pharmacy staff during in-depth interviews.

Topics	Major themes and sub-themes (if any)
Challenges faced by older adults in reading and understanding PMLs, as observed by pharmacy staff during medication counselling	Theme 1: Incongruity between PML language and older adults' English language proficiency and illiteracy Theme 2: Poor PML legibility for older adults with compromised visual acuity
Solutions employed by pharmacy staff during medication counselling to mitigate older adults' challenges with PMLs	Theme 3: Simplifying medication information already present on PMLs • Writing medication information in English or in another preferred language in combination with numerals • Sketching to represent medication information Theme 4: Supplementing PMLs with additional medication information • Writing additional medication information in English or in another preferred language • Sketching to represent additional medication information • Provision of additional medication information verbally Theme 5: Mitigating poor readability of PMLs • Hand-writing medication information in a larger size • Annotating to accentuate PML information

**Table 3**

Quotes from in-depth interview participants, for each of the five themes.

Challenges faced by older adults in reading and understanding PMLs, as observed by pharmacy staff during medication counselling

Theme 1: Incongruity between PML language and older adults' English language proficiency and illiteracy

"Some of them... they don't know how to read right, then over here... like the words are so tiny [precautionary instructions which are commonly present on PMLs]. Additional information stated there so, sometimes they also, like, don't really read." (HCP-005)

"Because now our label all in English right, so if they are Chinese-educated or even dialect-speaking, then that will be a problem, definitely." (HCP-007)

"Some of them they can speak, but they can't read. [The word] 'sip' they don't understand, 'three times' [a day] they don't know how frequently to take." (HCP-008)

"I think most of them, in their eighties... some of them really can't read or write." (HCP-006)

Theme 2: Poor PML legibility for older adults with compromised visual acuity

"...because usually, for our chronic patients, they tend to be elderly? And their vision sometimes might not be so good. So, they actually can't read... on the label itself. Font is a bit too small for them." (HCP-004)

"Because old people, they have poor eyesight, right? So, they do have difficulty seeing. Even though... our label contains all the... information like 'before food' and 'after food', but just that even with that, they will still come back and then they will clarify how to take [their medications]." (HCP-009)

"Their eyesight really not that good sometimes, we notice [that they] cannot see. They can't even see our [pharmacy] queue numbers even, [which are] very big and lighted, what more written? We get this kind of patient, especially sixty, sixty-five and above usually...they are like that." (HCP-010)

Solutions employed by pharmacy staff during medication counselling to mitigate older adults' challenges with PMLs

Theme 3: Simplifying medication information already present on PMLs

Writing medication information in English or in another preferred language in combination with numerals

"We write in... numerals, like two times then '1, 1' like that. '1, 1'. If one tablet two times a day, if we can write in proper. But sometimes our Mandarin also handicapped (not proficient) right, because we are English-educated. So we'll write '1, 1'. Whether we write in complete (sentences) or write '1, 1', the important [thing] is that we must make sure the patient can understand what we write." (HCP-007)

"For elderly right, I say 'ok this is '2 tablet 4 times a day', so I will write here '2, 2, 2, 2' which [represents] 'morning', 'afternoon', 'evening', [and] night..." (HCP-006)

"Usually, they would ask you to specifically write 'AM' and 'PM'. So, 'AM' will represent morning 'AM' and '1' [for the dose]. (HCP-004)

Even simple items like Panadol (paracetamol) also they... don't know how [to take], so four times they don't know how frequently to take. [It] is six hourly. So even that we need to get someone to write for them. Usually we write for them 'morning afternoon night' in Mandarin. If it's a Malay patient I will just write here 'pagi, malam' (morning, night)." (HCP-009)

Sketching to represent medication information

"Depends, that's why I said all these elderly... if two tablets they will ask you to draw two circles. This is also sometimes, yes, like I said depends. Some patients they only want, 'ok you don't draw the digit one, you just draw circle.' So, one circle, two circles." (HCP-006)

"I used to have a couple of patients who don't know how to read. So even when I write 'morning' [and] 'night' in Chinese they also don't understand. Then I will attempt to draw a sun and a moon." (HCP-005)

"Ok for morning, I'll draw the sun on the right, so that means he knows that this is morning is always on the left-hand side. If it's night, I will draw the moon on this side. I will draw the moon on this side and I will say night. (HCP-006)

Theme 4: Supplementing PMLs with additional medication information

Writing additional medication information in English or in another preferred language

"And we also can understand that they don't understand English right? Then we will have to write the indication in Mandarin for them also." (HCP-007)

"Like blood pressure we will write 'high blood', unless like a bit educated right, I will put 'BP'. Because sometimes is two indications. Blood pressure as well as to protect kidney. So we put there BP (and) protect kidney, then they very happy they can see. So, indications are important but until now, I think the high blood pressure and diabetes, no indications on the labels." (HCP-006)

"Even for acute [medication] we will write for them also. Actually, especially acute [medication] because there are so many medications that look alike." (HCP-005)

Sketching to represent additional medication information

"Oh... I only draw... [for] those medicines that need dilution. I will draw. Like, 1 cup of the gargle, the medicine right, so the medicine, plus 3 parts of water – use dilution only. (HCP-003)

For those tablets [that need to be] dissolved in water. So, 1 cup of water then you put 1 tablet inside... just a simple drawing. I just try my best, so the patient can understand." (HCP-003)

"Then, if the old folks come alone, they take back, of course we do write. New medicine, normally for me... My label, on the label will write 'new' or the Chinese [translation] of 'new'." (HCP-008)

Provision of additional medication information verbally

"Labels, so far quite ok. Only the before and after food, that's why we need to like ok, this one is an example right, is, they (the label) never write before or after, they (patients) will show us [and ask] 'is this before or after food?' So, I will say, most medicine best [to] take after food. Unless indicated as before, then we will circle the 'before food', then we will tell her is before food. Most of them will say, because sometime elderly they have the gastric pain and all that, so if you tell them [that] you can take anytime, then will have problem later. So will tell them most of them is after food, unless indicated." (HCP-006)

For [indications such as] giddiness, vomiting, diarrhoea, cannot! How to draw diarrhoea? Will just say 'lao sai' ['diarrhoea' in a Chinese dialect], ok, uncle [referring to himself] knows already. (HCP-006)

"The most common question might be in terms of the side effects." (HCP-002)

"Side effect, ... they will ask as well, but it's not... written on the label itself. Because sometimes one drug could be many side effects. So, we will counsel based on our information leaflet instead." (HCP-004)

Theme 5: Mitigating poor readability of PMLs

Handwriting medication information in a larger size

"Most of the time, we still have to write in a bigger font size, using our marker. To indicate one tablet or two or three." (HCP-003)

Annotating to accentuate PML information

"[For] morning and night dose, I will circle morning, the night one I will just double underline or something. At least they know is morning is different, night is different." (HCP-009)

"Different people will have [a] different perspective. Some people would underline and all that. For me, I try not to clutter the label even more, that's why I usually avoid doing that. Make it even worse, more... un-readable." (HCP-002)

### 3.2. Solutions employed by pharmacy staff to mitigate older adults' challenges with PMLs

Pharmacy staff adopted several solutions to facilitate older adults' understanding of PMLs. These solutions also stemmed from specific patient requests.

#### Theme 3: Simplifying medication information already present on PMLs.

Pharmacy staff shared that medication information that was *already present* on PMLs (medication information commonly found on PMLs includes dose, dosage frequency, food instructions, indication, precautionary instructions, side effects and expiry date) was not always easy for older adults to understand due to patient-level factors previously described – LEP and illiteracy.

### 3.3. Writing medication information in English or in another preferred language in combination with numerals

Pharmacy staff often simplified medication information relating to indication, dose and dosage frequency during medication counselling. Dose was commonly simplified by using numerals. Dosage frequency was simplified by applying the universal medication schedule (UMS), which specifies the time of day for dosing. Dosage frequency and dose were commonly written together.

Latin abbreviations "AM" (*ante meridiem*) or "PM" (*post meridiem*) were also utilised to communicate dosage frequency. Dosage frequency was commonly translated for patients with LEP or inability to read in English.

### 3.4. Sketching to represent medication information

Another common strategy applied by pharmacy staff to simplify medication information, mainly in the context of dose and dosage frequency, was sketching. Dose was represented by drawing circles to signify tablets. Sketching of the sun and moon was commonly used to simplify dosage frequency.

#### Theme 4: Supplementing PMLs with additional medication information.

Older adults desired more medication information than what the PMLs provided. This was evident through the various medication information that pharmacy staff had to provide *in addition* to what was already printed on the PMLs. Examples of such additional medication information included indication, side effects, food instructions, precautionary instructions, missed dose action, expiry information and duration of use. This additional information was provided either in writing, sketching or verbally.

### 3.5. Writing additional medication information in English or in another preferred language

Pharmacy staff highlighted that the therapeutic intention of the dispensed medication, also commonly known as the medication indication, is not always present on PMLs. Upon patient request, pharmacy staff reported writing it on the PMLs in English or another preferred language. It was also noted that pharmacy staff used colloquial terms that are more widely understood by older adults rather than medical terms to communicate the medication indication. Pharmacy staff also reported writing the word “new” on PMLs to indicate that the medication was newly prescribed by the doctor and the patient was receiving it for the first time.

### 3.6. Sketching to represent additional medication information

Sketching was adopted by pharmacy staff whenever necessary to provide additional information on medication preparations, prior to use. This included sketching of cups to illustrate gargle dilutions or to prepare effervescent tablets.

### 3.7. Provision of additional medication information verbally

Pharmacy staff also shared additional medication information with older patients verbally, this included indications, side effects and food instructions. This was especially done when the information was difficult to be provided through sketching. It was also noted that pharmacy staff sometimes used patient information leaflets (PILs) developed by the pharmacy, or product inserts supplied by drug manufacturers, to verbally counsel the medications' side effects.

#### Theme 5: Mitigating poor readability of PMLs.

Concerns about PML readability were frequently raised by pharmacy staff. The font size on PMLs was reportedly too small for older adults to read comfortably, as explained in Theme 1. Pharmacy staff employed various solutions to overcome this format deficiency.

### 3.8. Handwriting medication information in a larger size

Given the limited space on PMLs, it was impractical to re-write all the information presented on the PML. As such, pharmacy staff re-wrote only the most critical medication information in a larger handwriting, especially for dose and dosage frequency. Even for older patients who could read in English, pharmacy staff sometimes re-wrote the English instructions on the PMLs, in a larger size. Pharmacy staff also used markers to achieve a bolder font, which was desired by older adults.

### 3.9. Annotating to accentuate PML information

Annotating on PMLs was frequently done to improve their readability, with pharmacy staff underlining, circling or highlighting specific content

to draw attention to important information. However, some pharmacy staff avoided making any of such annotations to prevent cluttering the PML. From their perspective, annotating could affect readability and be counterproductive.

#### QUANTITATIVE PHASE

The survey quantified the various solutions used by the pharmacy staff, detailed under themes 3 to 5 of the qualitative phase, in the context of the specific medication information simplified or provided by them on PMLs.

Majority of the pharmacy staff reported writing (98.3%) or sketching (73.6%) on PMLs to simplify medication information that was already present on PMLs (Fig. 1). Medication information types that were frequently simplified through both writing and sketching were indication, dose and dosage frequency, while side effects were least commonly simplified (Fig. 2).

Additional medication information which was not already present on PMLs was commonly provided by pharmacy staff, though writing on PMLs (95.0%), sketching on PMLs (54.5%) and verbal explanation (95.0%) (Fig. 1). The most frequently provided additional medication information was indication while precautionary instructions were the least frequently provided (Fig. 3).

In the context of solutions used to mitigate readability, majority of the pharmacy staff reported writing in a larger handwriting on PMLs (81.8%) and/or with a bold point pen or marker (72.7%) to enable patients to be able to read critical information present on PMLs. They also reported circling (71.1%), underlining (67.8%), or highlighting medication information with a coloured highlighter (59.5%) to draw patients' attention to important information on PMLs (Table 4).

## 4. Discussion

This study enabled a thorough investigation of patient-related and medication label-related factors, as well as pharmacy staff's mitigation solutions that could influence the processing of medication information on PMLs provided by the healthcare system. Public primary care pharmacy staff in Singapore were able to identify challenges faced by older adults in reading and understanding the information on PMLs during medication counselling. The challenges were attributed to incongruity between PML language and older adults' language proficiency, and their poor visual acuity.

Previous studies have highlighted that pharmacy staff take on several roles during patient counselling. These include working collaboratively with physicians in ensuring medication safety and adherence [37], providing medication information verbally [37], and maintaining a positive interpersonal relationship with their patients [38]. In this study, pharmacy staff frequently employed ad-hoc solutions to improve the communication and delivery of printed medication information on the PMLs “on-the-spot” during medication counselling to support older adults' medication information needs. The novel mitigation solutions identified in this study add to the literature by expanding the current understanding of what medication counselling may entail. Furthermore, these findings have implications on the systemic gaps in medication counselling using PMLs. Therefore, in this section, the findings are discussed, in the context of older adults in Singapore and elsewhere. When discussing the ad-hoc solutions employed by pharmacy staff, we suggest system-level improvements for enhancing PMLs to meet the needs of older adults and reduce the workload of pharmacy staff.

### 4.1. Challenges faced by older adults in reading and understanding PMLs, as observed by the pharmacy staff

#### Theme 1: Incongruity between PML language and older adults' English language proficiency and illiteracy.

Pharmacy staff reported older adults' LEP and illiteracy as barriers to understanding PMLs. This is not surprising since 53% of adults aged  $\geq 65$  years in Singapore are not able to read in English, while 12% are illiterate [39]. As the majority of older adults use prescription medications [40], pharmacy staff in Singapore would inevitably encounter older adults from

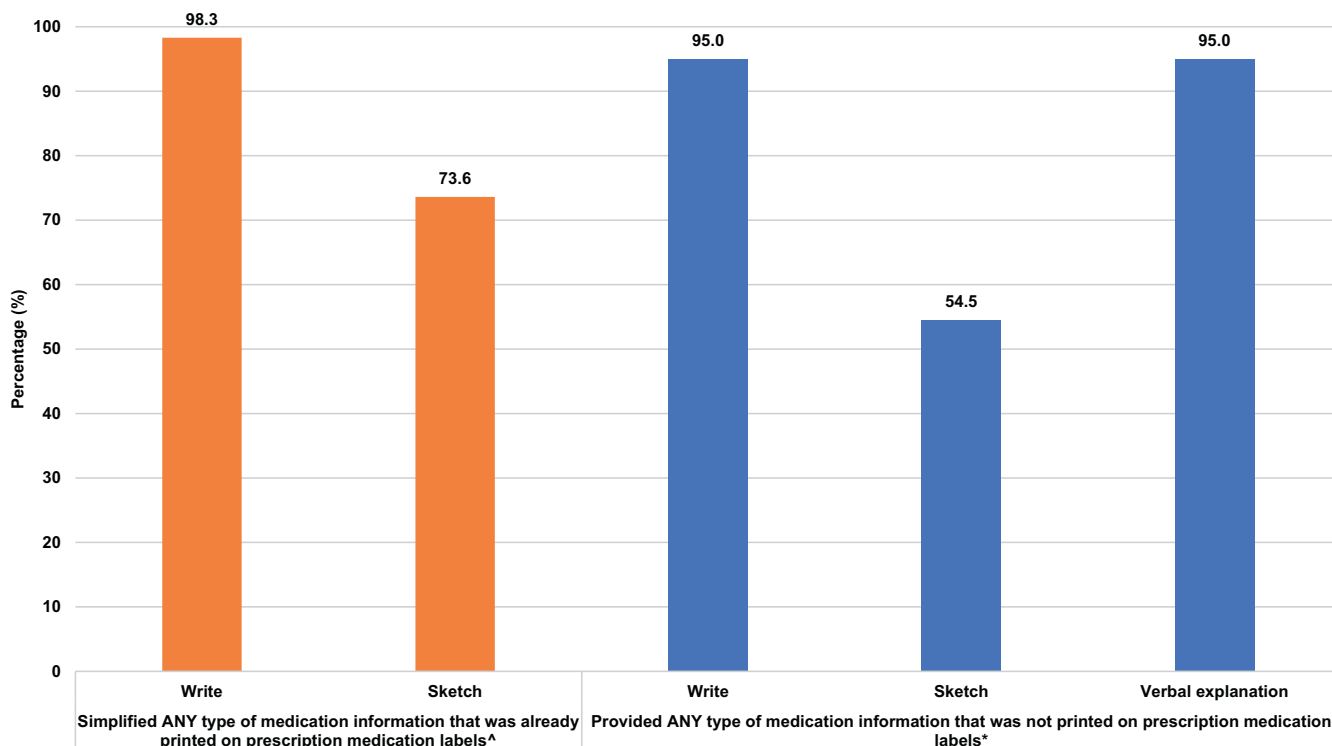


Fig. 1. Proportion (%) of pharmacy staff who simplified medication information already present on prescription medication labels, or provided any type of additional medication information on prescription medication labels, in the past one year, either by writing, sketching or verbal explanation (N = 121). ^Types of medication information that were already printed on prescription medication labels included dose, dosage frequency, food instructions, indication, precautionary instructions, side effect(s) and expiry date. \*Types of medication information that were not printed on prescription medication labels (and provided by pharmacy staff during medication counselling) included food instructions, indication, precautionary instructions, side effect(s), expiry date and whether it was a newly prescribed chronic medicine.

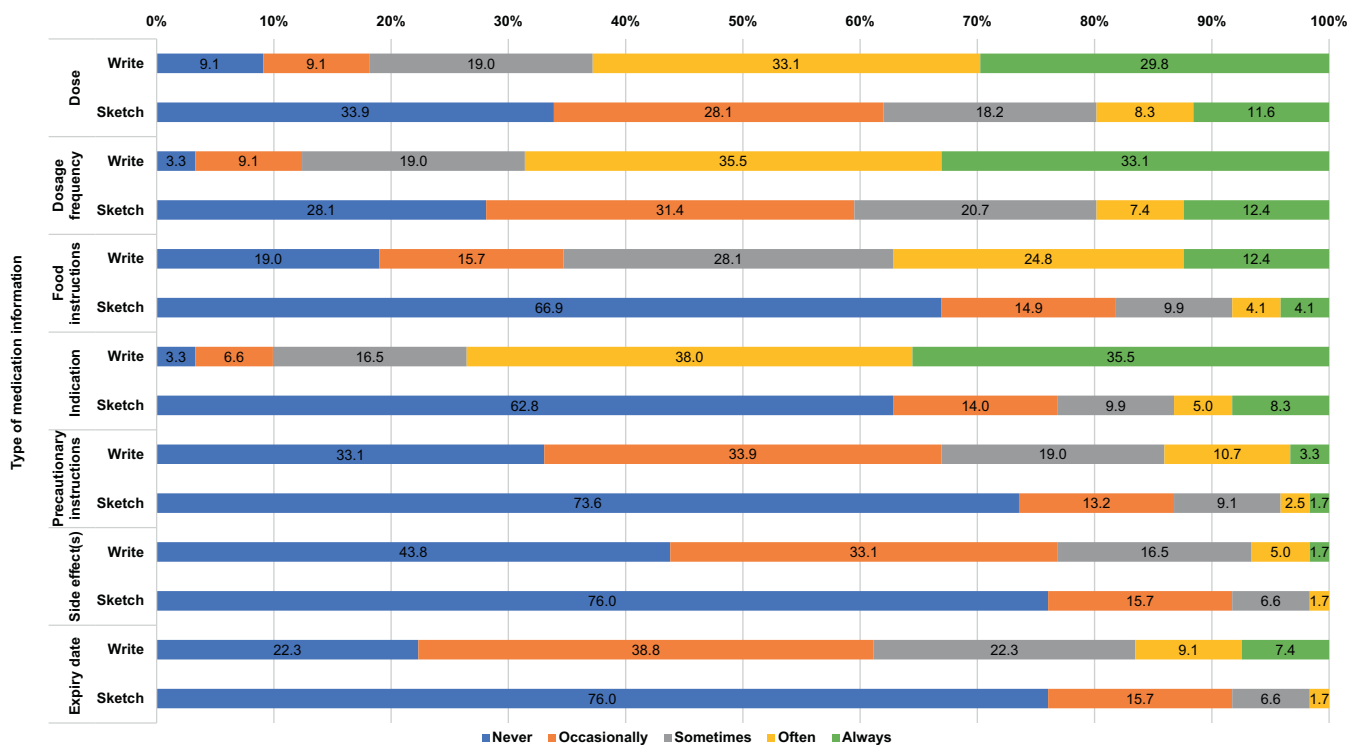


Fig. 2. Frequency of writing and sketching by pharmacy staff to simplify medication information that was already printed on prescription medication labels, in the past one year (N = 121).

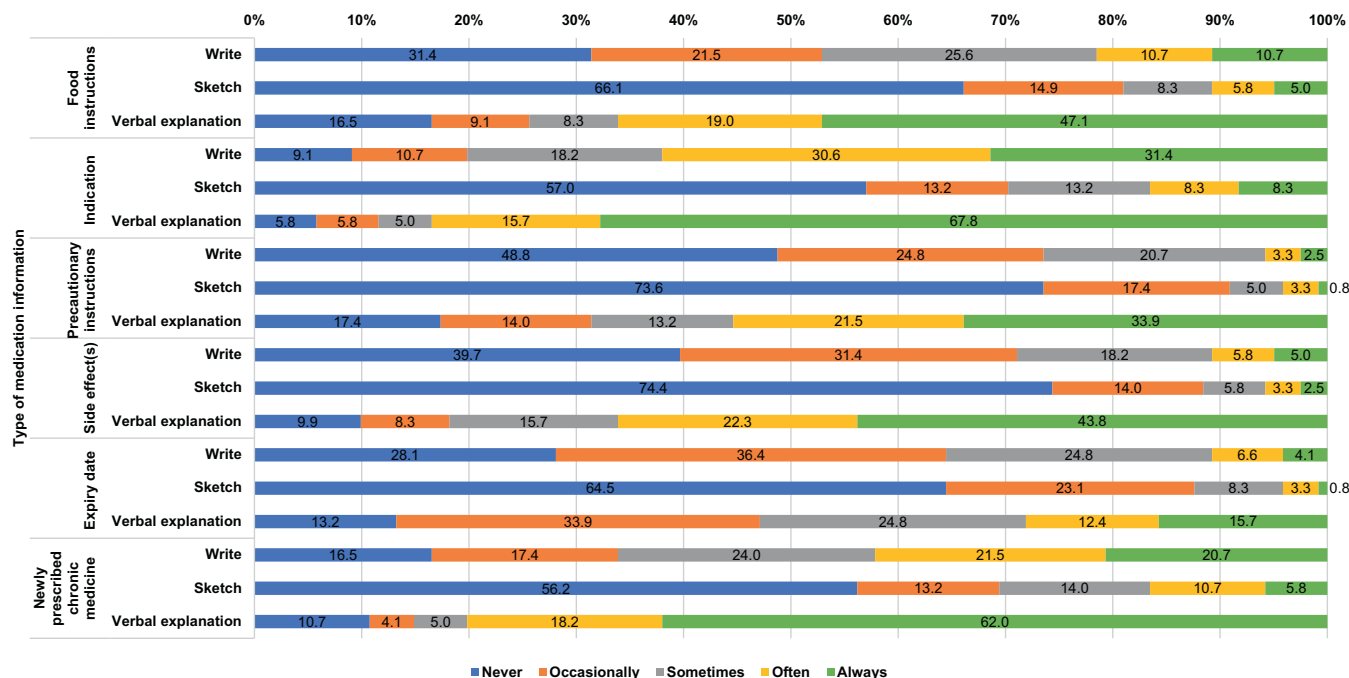


Fig. 3. Frequency of writing, sketching and verbal explanation by pharmacy staff to provide additional medication information that was not printed on prescription medication labels, in the past one year (N = 121).

these subgroups, who are challenged by the ‘usual’ English PMLs. This phenomenon is not unique to Singapore. A study in Sri Lanka found that patients were not well-informed about their medications as their labels were almost always in English only [41]. Studies have also shown that older adults do not completely understand their medications [42–46], even when medication information is provided in a language they can read. Therefore, PMLs in a language that older adults are not proficient in will only further aggravates this problem. As healthcare organisations embrace patient-centred models, patients need to have sufficient medication information, in a preferred language, to be a knowledgeable partner who is engaged and empowered to manage their health.

**Theme 2: Poor PML legibility for older adults with compromised visual acuity.**

Pharmacy staff reported compromised visual acuity of older patients as a barrier to their PML understanding. Vision impairment is prevalent among older adults [47,48]. Currently, in Singapore, there are no labelling recommendations for font height or size that are tailored to those with vision impairment. Studies from elsewhere support the call for using large font sizes on PMLs [49,50]. Thus, health systems globally should consider

**Table 4**

Solutions adopted by pharmacy staff to annotate on the prescription medication label for mitigating poor readability for older adults during medication counselling, in the past one year.

Solution	N of pharmacy staff who adopted the solution (%) (N = 121)
Write or re-write medication information in larger handwriting	99 (81.8)
Write with a bold point pen/marker	88 (72.7)
Write with a coloured pen/marker	68 (56.2)
Circle medication information	86 (71.1)
Underline medication information	82 (67.8)
Highlight medication information with a coloured highlighter	72 (59.5)
Strike out medication information	21 (17.4)
Indicate an asterisk for medications that should be taken together	2 (1.7)

recommending a larger font, to the extent feasible, for the benefit of those with visual impairment.

**4.2. Solutions employed by pharmacy staff to mitigate older adults' challenges with PMLs**

**Theme 3: Simplifying medication information already present on PMLs.**

Pharmacy staff reported writing on PMLs to simplify medication information which were already present on PMLs. Writing in English or in another preferred language in combination with numerals were reported. In particular, dose and dosage frequency were often simplified. PMLs dispensed in Singapore often use non-specific dosing instructions and sometimes express quantitative values in alphabetic characters, such as “Take two tablets two times a day” [51]. Older adults have found such instructions challenging to interpret, compared to instructions using the universal medication schedule (UMS), such as “morning, noon, evening and bedtime” and numerals [27,52]. There is a strong body of work supporting the use of the UMS [53,54]. A trial found that patients were 33% more likely to correctly interpret a PML with, versus without, UMS instructions [19]. The use of the UMS aids patients' medication routines by allowing them to consolidate multiple medications into fewer dosing times throughout the day [55]. Furthermore, numerals are better understood instead of alphabetic characters for quantitative values [52]. Thus, pre-setting pharmacy information technology (IT) systems to print dosage frequency using the UMS and the dose in numerals could reduce manual writing by pharmacy staff. This would also promote medication safety, as handwriting on the PML, while being a quick ad-hoc solution, can lead to human errors [56,57].

Another challenge that prompted pharmacy staff to handwrite translated information on PMLs was the prevalence of LEP among patients, as discussed earlier. Studies have shown that patients with LEP are at high risk of poor health outcomes and adverse medication events [58]. Printing medication instructions on PMLs in another preferred language, which mirror the English medication instructions, may help those with LEP. A study showed that bilingual PMLs led to a substantial increase in PML content understanding among older Singaporeans [59]. Another U.K. study, conducted among patients who do not speak English as their first language,



reported that patients who received bilingual PMLs could understand their PMLs independently [60]. In Singapore, the Health Products Act mandates the provision of PMLs in English [61]. However, there is no restriction to adding another language, thus, the provision of bilingual PMLs can be explored. Furthermore, if a pharmacy staff is not sufficiently proficient in the patients' preferred language to provide written translations, having pre-printed bilingual medication information will be useful.

Pharmacy staff employed sketching to simplify medication information. Sketching of the sun and moon to depict medication frequency information was common. However, hand-drawn sketches carry the risk of misinterpretation by patients and even family caregivers, who play a significant role in the medication management of older adults [62]. Validated pharmaceutical pictograms aid in the understanding of medication information, recall and adherence [23,63–68]. Best practice guidelines also support the use of validated pharmaceutical pictograms [54]. As part of the PROMISE study, pictograms from the International Pharmaceutical Federation (FIP) have been validated among older Singaporeans with LEP [69]. In a subsequent related study, an iterative, user-centred pictogram development process was adopted to redesign FIP pictograms which had previously failed to achieve validation [69,70]. These pictograms should be incorporated on PMLs to minimise hand-drawn sketches by pharmacy staff. Furthermore, pharmacy schools should train students on the effective use of pictograms to enhance future delivery of medication counselling for low-literate populations.

#### Theme 4: Supplementing PMLs with additional medication information.

The study findings reiterate that the usual content on PMLs do not entirely fulfil patients' medication information needs. Intervention by pharmacy staff was needed to supplement medication information on PMLs through writing, sketching or verbal counselling. The provision of sufficient medication information is central to patient-centred care. Studies have documented poor patient satisfaction with pharmacy services in relation to medication information provision [71–73] affirming patients' desire for more medication information. As medication counselling is generally brief, it is impractical for pharmacy staff to provide all of patients' desired medication information during this short encounter. In our study, medication indication was one of the most frequently requested medication information. Similarly, best practice guidelines recommend that medication indication should be printed on PMLs as far as possible [52]. Including medication indication by default on PMLs could reduce the need for pharmacy staff to provide this information during medication counselling. Flexible IT solutions that allow for selection of the specific indication will be needed for medications with multiple therapeutic indications. Nonetheless, exceptions may be necessary for medications used for stigmatised health conditions.

Sketching was also used to communicate additional medication information not provided on PMLs. It can be challenging to illustrate certain medication information through sketches, such as side effects and precautionary instructions. As previously discussed, validated pharmaceutical pictograms should be considered for use on PMLs, as they are less prone to misinterpretation than sketches.

The limited space on PMLs makes it impractical to provide an exhaustive amount of medication information on them. Given the ubiquitous use of quick response (QR) codes in Singapore for the 'SafeEntry' national digital 'check-in' system, as a Coronavirus Disease 2019 (COVID-19) control measure, even older adults are likely to be familiar with their concept and use [74]. Thus, QR codes could potentially be used on PMLs to lead patients to a website providing multilingual medication information, in text and audio forms. This multilingual information should be ideally customised for the patient (i.e., mirror the instructions on the patient's English-only PMLs) and provide additional medication information. This will provide patients with a readily accessible avenue to obtain medication information in a language comprehensible to them.

The provision and use of PILs during medication counselling is not routine [75]. However, more recently, several public healthcare institutions in Singapore have implemented QR codes on PMLs to direct patients to English-only PILs on Health Hub®, which is a national population

enablement platform for digital health accessible to Singapore residents via a website or mobile application [76]. However, digital PILs need to be optimally designed, accurate, written in simple language, and available in official languages other than English. This is crucial, as a recent study highlighted that asthma PILs in Singapore required high reading skill levels, were of poor format quality and contained inaccuracies [77].

#### Theme 5: Mitigating poor readability.

Pharmacy staff employed several solutions to overcome poor readability of PMLs, such as small font size. Pharmacy staff reported writing in a larger handwriting and using annotations to enhance the readability of PMLs.

Older Singaporeans have expressed that the font size on PMLs is too small [27]. Another study reported that font size should be at least 10 point to be readable, preferably larger [78]. As a larger font has been shown to improve PML readability and understanding [79], enhancing the printed font size on PMLs would benefit older patients and reduce the need for pharmacy staff to re-write instructions in a larger handwriting.

Pharmacy staff also attempted to accentuate PML information by highlighting, circling, underlining and striking out text. Since these annotations are done "free-hand", they can result in a cluttered PML, affecting readability. Nonetheless, annotations such as highlighting are not uncommon. It is recommended that providers use highlighters or markers on the PMLs of investigational drugs to draw attention to key medication information and to prevent errors [80]. Another guideline suggests the use of varying typography, such as highlighting and bolding to accentuate PML information [81]. If the pharmacy IT system capabilities allow for the printing of PMLs with varying typography, this potential change to PMLs should be explored.

Best practice guidelines are available to promote legible and clear PMLs [59,82–84]. Our findings are in line with these recommendations, further supporting the need for health systems to consciously adopt them to facilitate medication counselling by pharmacy staff. The ongoing COVID-19 pandemic has prompted pharmacy staff to adopt novel strategies to overcome disruptions in pharmaceutical care delivery [85]. Such initiatives included the provision of virtual pharmacy services and home delivery of medications, some of which were also adopted in Singapore [86,87]. However, these innovative pharmaceutical care delivery solutions limit patient-provider interaction. In the context of Singapore, when patients receive medications without face-to-face counselling, they will not benefit from ad-hoc solutions that pharmacy staff employ to aid older adults' understanding of their PMLs. Therefore, there is an urgent need, more than ever, to implement patient-centered PMLs that incorporate recommendations discussed in this study [27].

#### *4.2.1. Strengths*

This study employed a mixed-methods approach to investigate challenges that pharmacy staff observe older adults face in using real-world PMLs and solutions employed by pharmacy staff during medication counselling to overcome such challenges. To our knowledge, this is the first study in Singapore and elsewhere of this nature. Although the study only recruited pharmacy staff from public primary care institutions, its findings are generalisable to other public healthcare settings in Singapore. As PMLs from various Singapore healthcare institutions are also dispensed in English and perceived to be poor in legibility [27], pharmacy staff in acute hospitals and community hospitals likely observe similar challenges among older adults and employ similar solutions.

#### *4.2.2. Limitations*

Our study has some limitations. First, for the survey component, we only recruited pharmacy staff from five polyclinics. However, almost all the selected polyclinics have a high patient load. A high response rate [88] was also observed, supporting representativeness of pharmacy staff who practise in public primary care settings. Although our sample is mostly made of pharmacy technicians, it should be noted that, in public primary care settings, medication counselling is primarily performed by pharmacy technicians. This further supports the representativeness of the sample [20]. Second, although PMLs are handed out by clinic assistants at private

general practitioner (GP) clinics, they were not included in this study. Unlike pharmacy staff, clinic assistants do not have formal pharmacy training and any solutions they may employ to aid older persons' PML understanding may be different from the ones identified in this study. Nevertheless, the over 2000 GP clinics in Singapore do play a key role in chronic disease management within the primary care sector, and future research should include GP clinics and explore clinic assistants' perspectives. Future studies should also assess if the solutions employed by pharmacy staff were indeed helpful for older adults, and if they have an impact on medication-related outcomes, such as medication adherence, management self-efficacy and safety. Finally, we recognise that health literacy plays a significant role in determining how well patients interpret PMLs, however this was beyond the scope of our study.

## 5. Conclusion

Pharmacy staff observed that older adults' face challenges in reading and understanding their PMLs during medication counselling. Ad-hoc improvisations were frequently made by pharmacy staff to address these problems, indicating a pressing need for system-level improvements to PMLs. Provision of legible bilingual medication instructions, pharmaceutical pictograms and additional medication information, possibly through PILs or the use of QR codes on PMLs leading to user-friendly portals for medication information, will likely facilitate patient-provider communication during medication counselling and allow more efficient utilisation of time by pharmacy staff.

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## CRedit authorship contribution statement

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## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.rcsop.2023.100226>.

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