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# Readability, suitability, actionability and understandability of Malay-language patient education materials on asthma, tuberculosis and chronic obstructive pulmonary disease

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***Abstract*---**The 3 most prevalent respiratory diseases in Malaysia are asthma, chronic obstructive pulmonary disease (COPD) and tuberculosis (TB). Patient education materials (PEMs) have been utilised to deliver information about the disease, ways to manage and to prevent the conditions. Therefore, PEMs produced must be effective. Methods: Malay language PEMs on asthma, COPD and TB were assessed using Khadijah Rohani's Readability Formula (KRRF), Suitability Assessment of Materials (SAM) instrument and Patient Education Materials Assessment Tools (PEMAT) by 2 independent assessors. Results: 11 eligible PEMs were found on the Internet with only 8 PEMs eligible for readability assessment. Overall, 62.5% of PEMs achieved recommended grade 6 level. PEMs attained a mean suitability score of 74% which was categorised as superior, however PEMs failed to provide summary (100%) and did not did not use captions to explain graphic (90.9%). PEMs attained a mean understandability score of 78% and a lower mean actionability score of 60%. Despite high understandability, PEMs did not necessarily have high actionability. Conclusion: Majority of Malay-language PEMs on asthma, COPD and TB found are readable, suitable and understandable for most Malaysians even though some improvements on actionability are required to produce more effective PEMs.

***Keywords*---**patient education materials; asthma; COPD; tuberculosis; PEMAT; SAM; readability; KRRF; health literacy.

## Introduction

Respiratory or lung diseases are among of the most common illnesses around the world. In Malaysia, common respiratory diseases includes lower respiratory tract infection (LRTI) such as pneumonia, chronic obstructive pulmonary disorder (COPD) and lung cancer which ranked the 2nd, 5th and 7th respectively from the top 10 diseases that causes mortality in Malaysia in 2019 [1]. Asthma is also common which affects 339 million population worldwide including both infants and adults. However, many of them have poor control of disease due to suboptimal treatment and inadequate knowledge about asthma [2]. Meanwhile, tuberculosis keeps showing increasing trend annually despite preventive care taken as it is now facing a re-emergence contributed by the increased prevalence of HIV infection and other immunocompromised conditions [3]. Therefore, education is utilized as management strategy as a way of increasing health literacy among population. Health literacy enables an individual to seek, understand and act on health information. One of education tools is patient education materials (PEMs), which provide resources that aid in delivering information on health for the patients. Despite having many PEMs, there has been minimal assessment on the effectiveness, especially locally in Malaysia. If the education materials are not readable, or too complicated, the information will not reach the targeted audiences.

## 2. Materials and Methods

### *2.1 Selection of PEMs*

The method used to retrieve patient education materials is by searching through the Internet. PEMs were selected conveniently from the Internet that were written in Malay-language, easy to access, readily available and within Malaysia, Brunei and Singapore. This method was also chosen as it is affordable and can be done quickly. In this study, 11 PEMs were obtained from websites such as myHealth, InfoSihat, Lung Foundation Malaysia, JurongHealth and Ministry of Health Brunei. Then, they were analysed via readability formula, suitability, understandability and actionability tools.

### *2.2 Readability assessment*

Readability of PEMs were assessed using Khadijah Rohani's Readability Formula (KRRF) which was constructed by Khadijah Rohani in 1982 [4] to assess the difficulty of text written in the Malay language. It focuses on construction of text, particularly number of sentences, words, syllables and vocabulary. The formula is given as follows

**Khadijah Rohani's Readability Level = A – 13.988**, where

$$A = \left(\frac{\text{number of words}}{\text{number of sentences}} \times 0.3793\right) + (0.0207 \times \text{number of syllable}) \quad (1)$$

Readability calculations were performed by the main author. To maintain accuracy of the readability level, only 300 words were extracted from all materials

(Text more than 300 words resulted in higher KRRF reading). All texts were copied and pasted into a Microsoft Word document using special paste function to sort out unformatted text. For long text (i.e. booklet), 100 words from each first, middle and last page were copied before pasting them into Word. Only words were studied and numbers were omitted. Any texts that were not related to the health content, such as hyperlinks or URLs were removed. The syllables counted by using syllables calculator from Syllables Counter's website (https://syllablecounter.net/), while sentences were manually calculated by the author, where only full sentences were counted whereas pictures were disregarded. The obtained result was presented as readability level.

Table 1: Readability level and its associated school level and duration of formal education

| Readability level | Primary or secondary level | Duration of formal education |
|---|---|---|
| **1** | Primary 1 | 1 |
| **2** | Primary 2 | 2 |
| **3** | Primary 3 | 3 |
| **4** | Primary 4 | 4 |
| **5** | Primary 5 | 5 |
| **6** | Primary 6 | 6 |
| **7** | Secondary 1 | 7 |
| **8** | Secondary 2 | 8 |
| **9** | Secondary 3 | 9 |
| **10** | Secondary 4 | 10 |
| **11** | Secondary 5 | 11 |

2.3 Suitability assessment

Suitability of assessment (SAM) tools was used to assess suitability. It is a tool developed as a systematic method to quickly assess suitability of health information materials for targeted audiences and was validated by 172 healthcare providers from several cultures [5]. The instrument provides guidance to rate the materials on factors that affect readability and comprehension such as content, literacy demand, graphics, layout and typography, learning stimulation and cultural appropriateness. Each factor was further divided into subfactors. Each subfactors was rated with score of either 0, 1, 2 or not applicable. The scores for each factor were summed and divided by the total highest possible score for and then was converted into a percentage score.

*2.4 Understandability and actionability assessment*

Actionability and understandability was assessed using Patient Education Material Assessment Tool (PEMAT), a tool developed by Shoemaker and colleagues for Agency for Healthcare Research and Quality (AHRQ) to aid healthcare professionals and policymakers based in United States to make informed healthcare decisions [6]. The form has two versions: printable (PEMAT-P) and audio-visual (PEMAT-A/V). There were 6 topics under the understandability domain which were: 1) content, 2) word choice and style, 3) use of numbers, 4) organization 5) layout and design and 6) use of visual aids. T actionability

consists of 7-items statements (Appendix A). The PEMs were rated based on PEMAT's user guide provided by AHRQ, where they also provided online Auto-scoring PEMAT form in their website (https://www.ahrq.gov/ncepcr/tools/self-mgmt/pemat.html). The form will automatically calculate PEMAT score after evaluators keyed in their score for each factor. Each item was rated 1 for agree, 0 for disagree and N/A for not applicable. The total summed score was divided by the total possible points and multiplied by 100 to convert into percentage. The obtained percent scores were reviewed and compared between the materials to determine which materials have higher score on both understandability and actionability or lower compare to the others and were analysed.

*2.5 Data Analysis*

All data extracted were entered into Excel sheet. IBM Statistics Version 26 was used to process the collected data for generation of descriptive statistics such as frequency, proportion (%), mean percent, standard deviation (SD), maximum and minimum mean percent. After understanding the guides provided for the SAM tool and PEMAT, two independent reviewers who were fluent in BM and English and were not involved in the development of the pamphlets evaluated each PEM independently. Following the assessment, a meeting was held with the reviewers to examine any disagreement in factor rating. The degree of inter-rater agreement was determined by calculating the Kappa inter-rater reliability coefficient via SPSS.

*2.6 Ethics*

This study is exempted by Ethical Board as there is no human interaction involved and materials used are openly accessed by the providers for public use.

**Results**

Table 2: Overall results of assessment of KRRF, SAM instrument and PEMAT on 11 PEMs.

| PEM | Title | Type | Source | KRRF (Reading level) | SAM Score (%) | SAM Rating | PEMAT Score (%) | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Understandability | Actionability |
| 1 | Asma dan Pekerjaan: Apa yang anda perlu tahu | Pamphlet | InfoSihat portal | Not eligible | 75 | Superior | 56 | 33 |
| 2 | Asma (2018) | Pamphlet | | 5 | 75 | Superior | 69 | 67 |
| 3 | Asma | Poster | | Not | 80 | Super | 91 | 67 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (2020) | | | eligible | | ior | | |
| 4 | Asma: Bernafas dengan mudah. Panduan untuk pesakit (2013) | Booklet | Lung Foundation Malaysia | 9 | 81 | Superior | 82 | 67 |
| 5 | Tanda dan Gejala Penyakit TIBI (2016) | Pamphlet | InfoSihat portal | 4 | 82 | Superior | 87 | 60 |
| 6 | Penyakit TIBI: Dapatkan pengesanan awal (2018) | Pamphlet | | 4 | 81 | Superior | 84 | 70 |
| 7 | Ingin Tahu Mengenai TIBI (2015) | Booklet | | 7 | 81 | Superior | 84 | 80 |
| 8 | Apakah Penyakit TIBI? | Pamphlet | Brunei Ministry of Health portal | 6 | 65 | Adequate | 84 | 40 |
| 9 | COPD (2010) | Poster | myHealth portal | Not eligible | 29 | Not Suitable | 53 | 20 |
| 10 | Menghargungi Hidup dengan COPD: Panduan (2016) | Booklet | Lung Foundation Malaysia | 6 | 83 | Superior | 82 | 70 |
| 11 | Program Penyakit Pulmonari Obstruktif Kronik | Booklet | Singapore JurongHealth Campus COPD program | 7 | 84 | Superior | 88 | 82 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (COPD): Buku Panduan Pesakit | | | | | | | |

*3.1. Readability*

Only 8 out of 11 materials were eligible to be assessed for readability. The readability of Malay-written materials ranges from Level 4 to Level 9 which is equivalent to primary four (Standard 4) to secondary three (Form 3). Overall, 62.5% of the materials are within the recommended grade 6 level, while mean readability level for all asthma, TB and COPD materials is Grade 6. Therefore, the produced respiratory diseases PEMs will be able to be read by most of the Malaysian population or those who used Malay language as their mother tongue in Brunei and Singapore.

*3.2 Suitability*

The suitability of Malay-language respiratory PEMs were assessed using Suitability Assessment of Materials (SAM) tool. The PEMs had SAM scores which ranged from 29% – 84% and a mean of 74% (SD=16). This result indicates that overall suitability is within recommendation as the percent score is greater than 70.0%. Out of 11 materials, 9 materials as obtained superior suitability, 1 material as adequate and 1 material was rated as not suitable based on their respective SAM percent scores.

*3.3 Understandability and actionability*

The understandability and actionability of Malay-language respiratory PEMs were assessed using the Patient Education Material Assessment Tool (PEMAT). Most of the PEMs have good understandability score that range from 53% - 91%. The understandability score of was 78% (SD = 13%). However, the PEMs had actionability scores which ranged from 20% to 82%, with a mean of 60% (SD = 20%). The Asma poster obtained the highest understandability score and the COPD booklet from JurongHealth obtained the highest actionability score. Meanwhile the COPD poster obtained the lowest score for both understandability and actionability score.

From the assessments all PEMs have lower actionability scores than understandability scores. Four PEMs obtained good understandability score of more than 70.0% but have poor actionability score of lower than 70.0% (PEM 3, 4, 5, 8)., Four PEMs have good understandability and actionability scores (PEM 6, 7, 10, 11) and 3 PEMs have poor scores for both PEMAT components (PEM 1, 2, 9).

*3.4 Inter-rater agreement*

The kappa statistic for SAM tools was 0.29 (95% CI 0.19 to 0.39) which indicates fair agreement while for PEMAT was 0.71 (95% CI 0.60 to 0.81), which indicates

substantial agreement. Both results show variabilities in the reviewers' use of tools.

**Discussion**

Patients' understanding on self-care is essential in managing and preventing diseases from worsening. This study evaluates the readability, suitability, understandability and actionability of asthma, COPD and tuberculosis patient education materials found on the Internet. Doak et al. recommended a readability level for PEMs of not more than grade 6 [5], which is equivalent to primary 6 school students in Malaysia. Even though the standard was made according to education system in the US, it is applicable for Malaysian population as based on Table 1 by Khadijah Rohani. Grade 6 also is considered to represent primary education in which the education that has been received by majority Malaysians. In context of literacy, as reported by Malaysian Ministry of Education in 2019, 4.1% of Malaysians aged 15 and above are illiterate, while in the remaining of 95.9%, 17.2% managed to complete their primary school, 52.6% progressed to their secondary education and 26.1% managed to graduate with tertiary education [7]. Therefore, these statistics and our results indicate that at least three-quarters of Malaysian would be able to read the respiratory diseases materials.

Readability level alone which corresponds to education level or duration of formal education might not be a reliable indicator to determine an individual's comprehension on written materials and on to use the health information as intended. However, there is sufficient evidence based on Hahn and Truman's finding that education level is a vital determinant of better health behaviours, those who had formal education for nine years and above has lesser prevalence to severe health risk and further declined when there are additional years of education [8].

Despite being readable, PEMs also should be suitable for the readers. Majority of the materials score superior in literacy demand (90.9%), layout and typography (90.9%) and cultural appropriateness (81.8%). This means that majority of the PEMs used suitable sentences and vocabulary, fonts and layouts, and used culture-relevant examples. In the content domain, almost half of the PEMs were superior (45.5%) and adequate (45.5%). All PEMs failed to provide a summary and review of their contents. This is especially important as review offers readers opportunities to see the key points of instructions [5]. The summary can be in the form of visual aids or by retelling the key messages in different words with additional of examples. This is proven in study by Johnson et al. which found that additional of summary showed significant increase in PEMAT's understandability and actionability percent score of PEMs for sickle cell [9].

54.5% of PEMs were rated as superior under the graphics domain. Although PEMs used relevant illustrations and suitable types of illustrations, majority of the PEMs did not include any captions to explain their graphics. Two of the materials are not rated in cover graphic as they do not have cover page.

Captions are required to highlight to readers on information should be obtained from the graphics. Graphic without caption is usually an inferior instruction and missed learning opportunity [5]. One material did not have direct caption for their graphic, nonetheless, the graphics were placed in every context appropriately which can be considered as caption that successfully explained the use of the diagrams. Proper use of graphics in patient education materials together with oral or written instructions is proven to be beneficial to increase patient's comprehension and medication adherence [10]. This is also agreed by Price et al. that suggested to use visual aids to tackle the misunderstandings to improve treatment outcome as some patients had different understanding on 'well-controlled asthma' compared to their physicians which affects the handling of their medication [11].

All except one material received superior rating on writing style. The one material was categorized as adequate as it had used passive voice in half of their content. The use of passive voice is not recommended because it does not exactly direct one's action, which may lead to vagueness of health messages. The use of active voice is more preferred as it is stronger and clearly identify the action and the doer of the action. Using active voice will ensure effective communication by giving the patient responsibility to perform the action [12]. The individual SAM is illustrated in Table 3.

Table 3: Percentage of suitability for each domain of SAM tool

| **SAM evaluation component** | **Frequency (%)** | | | |
|---|---|---|---|---|
| | **Superior** | **Adequate** | **Not Suitable** | **Non-applicable** |
| **Content** | | | | |
| **Overall** | 5 (45.5) | 5 (45.5) | 1 (9.1) | 0 (0.0) |
| **Purpose** | 10 (90.9) | 0 (0.0) | 1 (9.1) | 0 (0.0) |
| **Content Graphic** | 8 (72.7) | 1 (9.1) | 2 (18.2) | 0 (0.0) |
| **Scope** | 11 (100.0) | 0 (0.0) | 0 (0.0) | 0 (0.0) |
| **Summary & review** | 0 (0.0) | 0 (0.0) | 11 (100.0) | 0 (0.0) |
| **Literacy Demand** | | | | |
| **Overall** | 10 (90.9) | 0 (0.0) | 1 (9.1) | 0 (0.0) |
| **Writing style** | 10 (90.9) | 1 (9.1) | 0 (0.0) | 0 (0.0) |
| **Sentence construction** | 10 (90.9) | 0 (0.0) | 1 (9.1) | 0 (0.0) |
| **Vocabulary** | 9 (81.8) | 1 (9.1) | 1 (9.1) | 0 (0.0) |
| **Learning aids** | 10 (90.9) | 0 (0.0) | 1 (9.1) | 0 (0.0) |
| **Graphics** | | | | |
| **Overall** | 6 (54.5) | 3 (27.3) | 2 (18.2) | 0 (0.0) |
| **Cover graphic** | 7 (63.6) | 1 (9.1) | 1 (9.1) | 2 (18.2) |

| | | | | |
|---|---|---|---|---|
| **Relevance of illustration** | 10 (90.9) | 1 (9.1) | 0 (0.0) | 0 (0.0) |
| **Type of illustration** | 11 (100.0) | 0 (0.0) | 0 (0.0) | 0 (0.0) |
| **Graphic** | 5 (45.5) | 2 (18.2) | 4 (36.4) | 0 (0.0) |
| **Captions** | 1 (9.1) | 0 (0.0) | 10 (90.9) | 0 (0.0) |
| **Layout and typography** | | | | |
| **Overall** | 10 (90.9) | 1 (9.1) | 0 (0.0) | (0.0) |
| **Typography** | 11 (100.0) | 0 (0.0) | 0 (0.0) | 0 (0.0) |
| **Layout** | 8 (72.7) | 3 (27.3) | 0 (0.0) | 0 (0.0) |
| **Subheading & chunking** | 10 (90.9) | 1 (9.1) | 0 (0.0) | 0 (0.0) |
| **Learning Stimulation & Motivation** | | | | |
| **Overall** | 4 (36.4) | 6 (54.5) | 1 (9.1) | 0 (0.0) |
| **Interaction** | 0 (0.0) | 9 (81.8) | 2 (18.2) | 0 (0.0) |
| **Desired behaviours are modelled** | 9 (81.8) | 1 (9.1) | 1 (9.1) | 0 (0.0) |
| **Motivation** | 9 (81.8) | 1 (9.1) | 1 (9.1) | 0 (0.0) |
| **Cultural Appropriateness** | | | | |
| **Overall** | 9 (81.8) | 2 (18.2) | 0 (0.0) | 0 (0.0) |
| **Cultural match** | 11 (100.0) | 0 (0.0) | 0 (0.0) | 0 (0.0) |
| **Cultural image and Example** | 9 (81.8) | 1 (9.1) | 1 (9.1) | 0 (0.0) |

In addition, effective PEMs are also supposed to be understandable and actionable. Based on PEMAT, most PEMs score well in assessment of understandability, especially in terms of content, word choice and style, organization and layout and design. However, 5 PEMs (36.4%) had vague titles such as COPD poster, pamphlet of *Asma* and *Apakah Itu Tibi?* that does not specifically explain the specific behaviours or action that the providers would like the readers to achieve. Similar to SAM scores, all PEMs scored were rated 0 (disagree) for item 11 in PEMAT (Appendix A) as no summaries were provided. Within the actionability domain, all PEMs managed to identify at least one action the user can perform and addressed users directly using active sentences when describing the action. However, all PEMs failed to provide more specific instructions in undertaking the action such as providing checklists or contact numbers.

Besides, common languages should be utilised throughout the PEMs. If medical terms or jargons are required, they should be explained in layman terms. A systematic review of 19 studies found that used of jargons led to communication barrier between patients and health care provider which contributed to medication non-adherence in COPD/asthma patients [13]. Two materials have been identified to have complex words, for instance, isocyanate and colophony

has been written as substances to cause occupational asthma in *Asma dan Pekerjaan* pamphlet.

Most materials provide context before new information which allows readers to learn new things quickly except for one material that does not provide context, thus was rated not suitable. Materials should break up information into sections or "chunks" of information for ease of understanding for both short and long contents. All materials were rated superior in chunking of information using both SAM and PEMAT tool. Learning aids such as headers or topic caption are important to aid readers in the flow of the topics and what to expect. Almost all PEMs provide sufficient headers in their material. Overall, all materials present information in logical sequence that can be easily understood by the readers.

In PEMs that included numbers, the numbers that appeared in the material are clear and easy to understand. Numbers were included in the PEMs in order to emphasize magnitude or duration. Additionally, all PEMs did not expect the users to perform calculation. Use of calculations should be minimised because there are differences in numerical comprehension and words comprehension that can affect understanding of information. This was discovered by Rothman et al. in their study on patient understanding of food labels that requires numeracy, where most of the patients have poor label comprehension which was highly correlated not just among low-level literacy, but also with high-level literacy patients. These conditions resulted in misapplication of food serving size and incorrect calculations [14].

The SAM tool assessed 5 components in its graphic domain: cover graphic, types of illustration, relevance of illustration, explanation about the graphics used and used of captions, which is similar to PEMAT instrument that assessed use of visual aids which consist of five items. The use of visual aids and graphics are significant as people tend to remember picture better than words [15]. Most materials had friendly, attractive and easy to understand cover graphic except "*Apakah itu Tibi?*" pamphlet which require medical knowledge to understand.

All materials contain appropriate types of illustration that is familiar and easily to recognized and relevance with the key points. This enables the content to be more easily understood. However, the *Asma* pamphlet used the same picture of anti-asthmatic medications for different types inhaler (prevention and reliever).

Layout also strongly influence on the suitability of materials. Despite having high quality content, poorly formatted materials may not be visually appealing to readers [16]. Most materials assessed in this study fulfilled at least 6 out 8 superior layout domains in SAM which take account of placement of illustrations, consistency of layout and sequence of information, use of visual cueing devices such as boxes, arrow and shading (similar to item 12 of PEMAT), clutter, contrast between paper and type, use of colour support and line length. Typography, or the art and technique of arranging type to make written words to be visually appealing and legible for all individuals, is also essential since type size and fonts can make the text either easy or difficult to comprehend at all skill levels [5]. All materials had superior typography factors such as text type is in uppercase and lowercase, use at least 12-point font size, use typographic cues (bold, different

colour or size) and does not use all uppercase for long headlines and running text. Maintaining few types and sizes of fonts in a page will make the materials appear more focus and prevent confusion [5].

None of the PEM assessed in this study received superior rating for the use of interaction. Rather, passive question-and-answer format has been used for most of the materials to discuss problems while some did not provide interactive learning stimulation at all. Materials with superior interaction provide readers with chances to make choices and demonstrate the procedure, which is preferred as it can enhance readers' retention in the long-term memory [5].

In PEMAT's actionability assessment, all studied materials clearly identified at least one action the user can take directly addressed the users when describing actions. Some materials break down the instructions into manageable explicit steps, but majority of PEMs only state the desirable actions without further explanation. Good PEM will suggest specific health goals and explain clearly how to achieve them without the need for the readers to perform self-interpretation [6]. However, major finding of this study found that all materials did not provide a tangible tool such as checklist that will aid the readers to act on the instructions. Tangible tools are usually used to facilitate multimodal communication of difficult topics; however, it is still not commonly adopted in medical field yet [17].

As stated by Doak et al., PEMs are deemed culturally appropriate when the words and pictures used are culturally sensitive and matched to the logic, language and experiences of the audiences [5]. In this context, the audiences are Malaysians and Malay-language users from Singapore and Brunei. Moreover, half of the Malaysians approximately are Malays, with huge minorities of Chinese, Indians and the indigenous Bumiputra [18]. Of course, there are also large discrepancies in cultural identities, however these groups have lived together for many generations and the integration has created a unique Malaysian culture [19]. The main concept used in the materials assessed are all culturally appropriate, hence were rated superior. Furthermore, images, setting, and paraphernalia featured in all materials were culturally relevant to readers from Malaysia, Brunei and Singapore and were presented in positively and realistic manner. One of the materials was rated not suitable in cultural image because it did not reflect any culturally related examples.

However, this study has several limitations. First, our sample only involved printed materials available online. Thus, materials that only available in physical form were not assessed. Second, this study only focuses on assessing printable materials rather than websites articles, which also are assessed by Malaysian population. Thus, the findings may not reflect readability and suitability of overall Malay-language PEMs. The use of KRRF as readability formula is limited to text with a minimum of 300 words, thus not all materials could be evaluated for readability assessment. Besides, readability formula only measured criteria such as number of words and number of syllables in determining the readability grade level with the assumption that shorter words with less syllables are more understandable compared to longer words, which may not be relevant for medical terms [20]. Therefore, a new readability formula should be developed for medical text. The formula should also have no lower and upper limit for number of words

since PEM varies from long text booklet or merely short text such as poster or brief fact sheet.

As SAM and PEMAT are commonly used as assessment tool for suitability, understandability and actionability of PEM, the scoring process is subjective for the majority of the evaluation criteria by independent evaluators, which poses the risk of evaluator bias. However, this bias is minimized by examining any responses that substantially differed and achieved consensus through discussion. Other potential bias includes the wide range of SAM instrument for all three SAM rating: superior 70-100%, adequate 40-69% and not suitable 40-69%. This situation may cause considerable variations of materials been categorized under similar suitability rating. This is also similar to PEMAT that divided the rating into two rating only: Agree and Disagree. There is also no standardized “good” or “poor” score, rather it serves only as comparison between materials.

Other than that, the assessments do not assess accuracy, for example, a material can be inaccurate but understandable. Other limitations include search engine bias, missed websites and no assessment on additional links, audio-visual media content and layout.

**Conclusions**

The readability level of the majority the materials are appropriate for most Malaysian population and Malay users from Brunei and Singapore who had obtained completed at least their primary education (level 6). Long text materials such as booklet may be quite difficult for individuals with low educational attainment but can be made more readable by shorter sentences. The suitability of the materials is superior with the mean suitability score of 74% using the SAM tool. All materials also possess good understandability score with mean score of 78% using the PEMAT. However, the PEMs have poor actionability with mean score of 60%, which require more improvements in the future. These findings also suggested that PEM should be made based on criteria provided in SAM and PEMAT before produced, contrary to the current practises that assesses materials only after they are produced and circulated for use. Healthcare providers should prioritise using of visual aids, tangible tools and summaries in order to make informative PEMs and also to provide steps that enable patients to take action in managing their disease.

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Appendix A

Table A1: Items in PEMAT, where (a) is the items within Understandability category, while (b) is the items within Actionability category

(a)

| **Item tandability** | |
|---|---|
| **Content** | |
| **1** | The material makes its purpose completely evident. |
| **2** | The material does not include information or content that distracts from its purpose. |
| **Word Choice and Style** | |
| **3** | The material uses common, everyday language |
| **4** | Medical terms are used only to familiarize audience with the terms. When used, medical terms are defined |
| **5** | The material uses the active voice |
| **Use of Numbers** | |
| **6** | Numbers appearing in the material are clear and easy to understand. |
| **7** | The material does not expect the user to perform calculations. |
| **Organization** | |
| **8** | The material breaks or "chunks" information into short sections. |
| **9** | The material's sections have informative headers |
| **10** | The material presents information in a logical sequence |
| **11** | The material provides a summary |
| **Layout and Design** | |
| **12** | The material uses visual cues (e.g., arrows, boxes, bullets, bold, larger font, highlighting) to draw attention to key points |
| **Use of Visual Aids** | |
| **15** | The material uses visual aids whenever they could make content more easily understood (e.g., illustration of healthy portion size). |
| **16** | The material's visual aids reinforce rather than distract from the content. |
| **17** | The material's visual aids have clear titles or captions. |
| **18** | The material uses illustrations and photographs that are clear and uncluttered. |
| **19** | The material uses simple tables with short and clear row and column headings |

Note: Item 13 and 14 are not applicable for PEMAT-P version, thus are excluded.

(b)

| **Actionability** | |
|---|---|
| **20** | The material clearly identifies at least one action the user can take. |
| **21** | The material addresses the user directly when describing actions. |
| **22** | The material breaks down any action into manageable, explicit steps. |
| **23** | The material provides a tangible tool (e.g., menu planners, checklists) whenever it could help the user take action. |
| **24** | The material provides simple instructions or examples of how to perform calculations. |

| | |
|---|---|
| **25** | The material explains how to use the charts, graphs, tables, or diagrams to take actions. |
| **26** | The material uses visual aids whenever they could make it easier to act on the instructions |

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