Do the Small Thai Font Sizes on Drug Labels and Documentation Facilitate Thai Readers? A Practical Review

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Abstract

Background Most studies of the effectiveness of Thai drug labeling and documentation have focused on the readability and comprehension of drug contents without considering essential contributing factors (i.e., typographical design). This issue indicates a lack of knowledge about improving legibility through the use of appropriate typefaces and sizes for Thai drug packages and patient information leaflets. This study intended to review the Thai typefaces and sizes used in Thai drug labeling and documentation to discern their legibility and understand the problem of small typefaces. This study could lead to further studies and would be beneficial if applied to the development of appropriate legislation.

Methods To understand the status of the design of Thai drug labeling and documentation, the first part of this study qualitatively reviewed typographical issues related to the use of typefaces and determined the type sizes printed on several Thai drug packages and patient information leaflets. The typefaces and their letter sizes were observed via a digital microscope. Later, in the pilot study that followed, we comparatively examined the small font sizes in different typefaces through the participants’ reading of sample texts about drug content, and we measured their preferences by sorting reading text cards typed with different typefaces.

Results We found that two significant Thai typefaces have been used on drug labeling and drug documentation: conventional Thai text fonts and Roman-like Thai fonts. The typefaces are composed of varied small sizes. We found that the minimum type size is approximately 0.5 mm, which is diminutive. The average reading findings suggested that the conventional Thai text fonts facilitated the most participants who varied by age, more than the Roman-like Thai fonts. Moreover, we found that the average reading times between early adulthood participants and middle adulthood participants were dissimilar. The average reading times of the younger participants were fast, while the average reading times of the older participants were much slower.

Conclusions The present study examines how the use of proper typefaces and type sizes on Thai drug packages and patient information leaflets affects reading times and participants’ satisfaction. The study also reveals that few regulations have been developed and implemented, reflecting the fact that the designers and medicine manufacturers lack sufficient knowledge and social responsibility, based on typographic principles. These findings suggest the need for further studies featuring a synergy of disciplines, e.g., pharmaceutics, psychology, design, social sciences, and law.

Keywords Accessible Typography, User-Centered Information Design, Thai Typeface, Text Legibility, Usability, Drug Labels and Documentation, Social Design

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1. Introduction

Various conditions involve legibility and readability because typographers are reminded that “the majority of readers have less than perfect focusing with or without spectacles” (Jury, 2002: 62). The legibility of a letterform (typeface) influences the efficacy of reading (Noel, 2015; Slattery & Rayners, 2009). Therefore, the investigation and development of the legibility of fonts and typography are significant in every language.

Although some academic researchers have investigated the legibility of fonts in various industrialized countries, unfortunately, this issue has not been examined in detail in Thailand. Thus, research into the legibility of Thai fonts is scarce, and the current situation is challenging for visually impaired people and the aging population in Thailand. Knowledge is insufficient to recommend optimal Thai letterforms suitable for low vision or general readers. Even though a few scientific studies have examined Thai letterforms (e.g., Rattanakasamsuk, 2013; Teeravarunyou & Laosirihongthong, 2003; Waleetorncheepsawat et al., 2012), the studies did not discuss nor suggest design practices for improving Thai legibility. The experiments could evaluate which typeface or type size had more legibility than another. Nevertheless, these studies did not provide in-depth explanations concerning aspects of letterforms that influence recognition under tested conditions.

The user-centered design concept focuses on the approach that designers should not be concerned with creating products but with respecting the effect of interactions with people and with acquiring satisfactory reactions (Frascara, 2015). Principles of inclusive typography are central in communication design and could propose methods or tools that allow visually impaired people to continue reading under conditions of low visual acuity (Ompteda, 2009).

Although the Thai government has acted to heighten awareness and encourage policies concerning universal design (Office of the National Economic and Social Development Council, 2016: 148), inclusive Thai typography principles have not been considered in-depth, and sufficient knowledge has not been provided. By nature, the “Design for All” paradigm is multidisciplinary. However, the general role of universal design in Thailand has been recognized based on architectural design and environmental design more than other design disciplines. This conclusion is based on a review of some guidelines proposed by various departments of the Thai government and related organizations, for example, the Department of Packaging and Materials Technology, Faculty of Agro-Industry, Kasetsart University, (n.d.); National Office for Empowerment of Persons with Disabilities, (n.d.); Office of the Higher Education Commission, (2012); Office of Transport and Traffic Policy and Planning, (2015); The Association of Siamese Architects under Royal Patronage, (2014); and research by Sawangjaroen et al., (2017). This review indicated that these publications did not provide details of the specific principles of inclusive design for Thai typography. The guidelines addressed old general principles, and some knowledge was derived from foreign research though it was not up-to-date. This outcome reflects a paucity of attention paid to the value and materiality needed to expand self-knowledge boundaries.
Recent studies examining Thai drug labeling and drug documentation effectiveness have mainly focused on measuring the readability and comprehension of drug information (e.g., Pratumrat & Sitthiworanan, 2019; Semsawasdi & Kitikannakorn, 2014), without studying typography as a significant factor that can help or hinder readers. Although previous research and suggestions have contributed to improving medical information design and medicine package leaflets in the international language, English (e.g., Dickinson et al., 2010; Dickinson & Gallina, 2017; van der Waarde, 2017), the research does not address the design of Thai medical information, particularly in typographical matters, i.e., legibility and visibility.

The current study aims to unfold and review issues of the use of Thai typefaces focused on typeface classifications and type sizes (text legibility) used in Thai drug labeling and drug documentation. We anticipate that this study will contribute to an awareness of the problem that may provoke future studies of the development of Thai drug labeling and drug documentation based on typographic design instead of only the drug contents.

2. Method

We divided the present study into two steps. First, we qualitatively reviewed the typefaces and type sizes of texts used on Thai drug labels and documentation as the initial study. Afterward, we conducted an objective measurement as a pilot study of participants who read small sample texts cards including different typefaces and type sizes of Thai drug labels and drug documentation. After small sample texts were read, we performed subjective measurements by asking the participants to sort the texts cards by their preferences.

2. 1. Initial Study

2. 1. 1. Typefaces: Thai conventional text font versus Roman-like Thai font

As the first step, we surveyed the Thai fonts that have been used on the drug labels and documentation. We found that two significant kinds of Thai typefaces were presented, including conventional Thai text fonts and Roman-like Thai fonts (see Figure 1).

Figure 1 illustrates the conventional Thai text fonts and Roman-like Thai fonts used on the partial drug packages (Sub-Figure 1-A and 1-B), and the conventional Thai text fonts and Roman-like Thai fonts used on drug packages displayed on the partial patient information leaflets (Sub-Figure 1-C and 1-D). A Roman-like Thai typeface in regular and italic displays the texts of Sub-Figure 1-A (PSL Display). In contrast, Sub-Figure 1-B displays a conventional text typeface (larger text size) and a Roman-like Thai typeface (diminutive smaller text size). The partial patient information leaflet of Sub-Figure 1-C exhibits a conventional text typeface that was set in a tiny type size with very long line lengths. Also, Sub-Figure 1-D shows a Roman-like Thai typeface on a patient information leaflet with long line lengths.
Figure 1 Examples of Partial Drug Packages and Patient Information Leaflets

Note: Examples of the partial drug packages (A and B) and patient information leaflets (C and D) displaying information with a conventional text font and Roman-like Thai font, actual sizes.

The Thai conventional text fonts include typefaces with key letter features that enhance letter recognition for the readers. The key letter features include a line, first loop, tail, second loop, foot, beak, limb, and core (Punsongserm et al., 2017a). In contrast, the Roman-like Thai fonts tend to omit and reduce the key letter features and focus on imitating Roman or Latin letterforms (Punsongserm et al., 2018a).
Regarding the efficacy of conventional Thai text fonts and Roman-like Thai fonts, Punsongserm et al. (2018a) examined two methodologies for measuring the legibility and visibility of general words in Thai typefaces, including a method of distance study of single words and a method for identifying word strings in a low-illumination environment. Thai fonts with a high frequency of use in Thailand were employed in their experiments, including five conventional Thai fonts (Angsana New, Cordia New, DB FongNam, TH Sarabun New, and PSL Text) and five Roman-like Thai fonts (DB Adman, PSL Display, DB Heavent, PSL Kittithada, and DB Ozone). The findings of the first method indicated that the identification of single Roman-like Thai words was more error-prone than the identification of single conventional Thai words. The significant results of the second method suggested that the word strings typed with the conventional Thai fonts required less reading time than the Roman-like Thai fonts. Also, the findings revealed that the word strings typed with the Roman-like Thai fonts yielded a dramatically greater number of misread words than the conventional Thai fonts.

2. 1. 2. Type Sizes: Bo Baimai Height

We collected several Thai drug packages and patient information leaflets and measured the letters displayed. The characters’ sizes were measured in millimeter units by a digital microscope (KUAIQU: 180X of lens magnification with 38MP FHD Camera V6), which enabled us to observe a much larger character size as measured and captured via a UHD Monitor (BenQ BL2711U 27 inch). We found that a text size with a Bo Baimai height of approximately 0.75 mm was usually the smallest size used on the selected Thai drug packages and patient information leaflets, though some texts were smaller than 0.75 mm. Figure 2 exhibits examples of several typefaces set in diminutive types on Thai drug packages and patient information leaflets.
2. 1. 3. The Regulations

We investigated the current regulations that stipulate the use of typeface and typographic designs for Thai drug labels and drug documentation. Unfortunately, we could not find an essential regulation that focused on the determination of profound typographic guidelines for...
text designs for Thai drug labels and drug documentation that comprehensively consider the diversity of all readers. We found that Article 25 of Drug Act (No. 5), B.E. 2530 (A.D. 1987) specifies that “the texts on the label and medication leaflet must be able to be read clearly” (Office of the Council of State, 2019: 4). Regarding the regulations on the type sizes on Thai labels, in the Announcement of the Ministry of Public Health (No. 383) B.E. 2560 (A.D. 2017), we found “Subject: Displaying Food Labels on the Packages (No. 2),” which defines the requirements for the sizes of the characters for food quantity, key ingredients, allergen information, and expiration dates as no smaller than between 1, 1.5, and 2 mm, depending on the label area size of each product (Government Gazette, n.d.). Hence, we concluded that Thai governmental agencies lack sufficiently detailed guidelines regarding typeface and inclusive design of Thai patient information leaflets.

However, we found a Guideline for Leaflet Development issued by the Food and Drug Administration (FDA) that provides a Guideline for the Development of Patient Information Leaflet (Food and Drug Administration, 2013). The guideline mandates that drug documentation attached to a drug product should display information with a typeface that should be no smaller than Tahoma, 11 points for the subheading, subheading content, footer text, and information about the manufacturer, importer, and distributor. Also, a font no smaller than Tahoma, 14 points should be used at the beginning of a document (drug name, strength, dosage form, and trade name) and heading. We measured the Bo Baimai height of Tahoma (regular and bold) at 11 points and 14 points and found the size of Tahoma 11 points is 2.118 mm and 14 points is 2.691 mm. We do not know why the guideline prescribed only Tahoma and the defined point sizes. The guideline lacks any reasonable explanation for typography or empirical research evidence. However, the point sizes 11 and 14 of Tahoma are similar to those of 15 and 19 of Cordia New and Angsana New. These point sizes are regular type sizes that have been used in standard documents (14–16 points), such as reports manipulated by Microsoft Word, and they are larger than the text sizes set in Thai newspapers. Therefore, the 11 and 14 points of Tahoma are typical sizes, not small font sizes.

2. 2. Pilot Study

2. 2. 1. Materials

1) Sample Texts of Drug Documentation
Some Thai patient information leaflets from the website of Medicines Regulation Division, Food and Drug Administration (FDA), Ministry of Public Health, Thailand (FDA, n.d. a; FDA 2016a; FDA n.d. b; FDA 2016b) were applied in the present study. We selected partial texts from patient information leaflets, including aspirin, ergotamine tartrate, caffeine, and naproxen. The selected text contents were related to contraindications, as well as dosage, indications, limitations of application, and drug properties. The text included general words and transliterated words. The word count of the words that were used in the sample texts was 375.

2) Selected Typefaces
To measure the difficulty and ease of reading (legibility and visibility) of the Thai typefaces in small font sizes, the current study employed three conventional Thai text fonts and three Roman-like Thai fonts. The conventional Thai text fonts included DB FongNam, TH Sarabun
New, and FT Manifest UD. In comparison, the selected Roman-like Thai fonts included PSL Kittithada, PSL Display, and DB Ozone. The typestyle of the six fonts was regular. DB FongNam is a font with high-frequency use among Thai typographers. It has been used in publications since the beginning of Thai digital fonts. Likewise, TH Sarabun New is a familiar font for Thai readers (Punsongserm, 2019, 2020). However, FT Manifest UD is an unreleased font that was developed from the prototype of the Thai UD font, which was designed based on low visual acuity conditions (Punsongserm et al., 2017a; Punsongserm et al., 2017b; Punsongserm et al., 2018b; Punsongserm et al., 2018c; Punsongserm, 2019, 2020). The three Roman-like Thai fonts, especially PSL Kittithada, were widespread and popular among Thai graphic designers in the early 21st century in Thailand (Punsongserm et al., 2018a). Figure 3 illustrates the alphabetical set of the selected typefaces, including the three conventional Thai text typefaces (DB FongNam, TH Sarabun New, and FT Manifest UD) and three Roman-like Thai typefaces (PSL Kittithada, PSL Display, and DB Ozone).

Dan FongNam  กษัติของจริงชั้นภูฎัณฑ์มณฑลปั๊มน้ำพัฒนาการศึกษา
TH Sarabun New กษัติของจริงชั้นภูฎัณฑ์มณฑลปั๊มน้ำพัฒนาการศึกษา
FT Manifest UD กษัติของจริงชั้นภูฎัณฑ์มณฑลปั๊มน้ำพัฒนาการศึกษา

PSL Kittithada  กษัติของจริงชั้นภูฎัณฑ์มณฑลปั๊มน้ำพัฒนาการศึกษา
PSL Display  กษัติของจริงชั้นภูฎัณฑ์มณฑลปั๊มน้ำพัฒนาการศึกษา
DB Ozone กษัติของจริงชั้นภูฎัณฑ์มณฑลปั๊มน้ำพัฒนาการศึกษา

Figure 3 Alphabet Set of Thai Conventional Text Typefaces and Roman-Like Thai Typefaces

Note: Upper: Alphabetical DB FongNam, TH Sarabun New, and FT Manifest UD. Lower: Alphabetical PSL Kittithada, PSL Display, and DB Ozone.

3) Text Sizes

The typical font size unit of a typographic design is its “point size” measurement. However, different typefaces composed in the same point size affect the size of x-height. Legge and Bigelow (2011: 19) state that “Measures of x-height provide a convenient metric, being familiar to typographers and vision researchers.” In the similar way, Punsongserm et al. (2017a) defined Thai type-sizes in their study by Bo Baimai height measurements. This method provides normalization by the height of the character /u/ (Bo Baimai) and accurately regulates the equalization of character heights within any font. For this reason, we determined the type sizes of the typefaces that were composed as text material for the pilot study by their Bo Baimai heights.

A set of the selected texts was composed with each typeface in three variations of Bo Baimai height, e.g., 0.75 mm, 1 mm, and 1.25 mm. Table 1 exhibits the point sizes of each typeface corresponding to the specified variations of Bo Baimai height.
4) Text Cards

Following the previous topics (sample texts of drug documentation, selected typefaces, and text sizes), we made a set of reading cards. We divided them into six subsets, including Set A, Set B, Set C, Set D, Set E, and Set F. The selected fonts typed each set: DB FongNam, TH Sarabun New, FT Manifest UD, PSL Kittithada, PSL Display, and DB Ozone, respectively. The size of each cardboard was 9.9 × 21 cm, vertical.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Font Name</th>
<th>Bo Baimai Height (mm)</th>
<th>Point Size (pt)</th>
<th>Leading (pt)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DB FongNam</td>
<td>0.75</td>
<td>6.4</td>
<td>6.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>8.55</td>
<td>8.55</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.25</td>
<td>10.65</td>
<td>10.65</td>
</tr>
<tr>
<td>Conventional Text Typeface</td>
<td>TH Sarabun New</td>
<td>0.75</td>
<td>5.4</td>
<td>5.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>7.2</td>
<td>7.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.25</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>FT Manifest UD</td>
<td>0.75</td>
<td>6.4</td>
<td>6.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>8.55</td>
<td>8.55</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.25</td>
<td>10.65</td>
<td>10.65</td>
</tr>
<tr>
<td>Roman-Like Thai Typeface</td>
<td>PSL Kittithada</td>
<td>0.75</td>
<td>5.28</td>
<td>5.28</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>7.1</td>
<td>7.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.25</td>
<td>8.85</td>
<td>8.85</td>
</tr>
<tr>
<td></td>
<td>PSL Display</td>
<td>0.75</td>
<td>5.28</td>
<td>5.28</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>7.1</td>
<td>7.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.25</td>
<td>8.85</td>
<td>8.85</td>
</tr>
<tr>
<td></td>
<td>DB Ozone</td>
<td>0.75</td>
<td>5.25</td>
<td>5.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.25</td>
<td>8.8</td>
<td>8.8</td>
</tr>
</tbody>
</table>

Each subset of reading cards included three cards. Each subset was composed of the same texts displayed in different text sizes, but the position of each paragraph of text (out of three paragraphs) was switched paragraph order. The size of the texts on each card (three cards) was provided in three variations of Bo Baimai height; a smaller text size (0.75 mm), a medium text-size card (1 mm), and a larger text size card (1.25 mm). For impartiality, each font size’s line-spacing settings (leading) corresponded to the same value as the point size (see Table 1).

We printed the texts for each card sheet via a laser printer onto uncoated paper (70 grams), using grayscale-resolution 600 dpi. Each printed text was glued onto cardboard, 9.9 × 21 cm.

Figures 4 and 5 show examples of the texts displayed in TH Sarabun New (a conventional Thai text font) and DB Ozone (a Roman-like Thai font) in each variation of the type size (0.75 mm, 1 mm, and 1.25 mm).
Figure 4 Examples of Texts in TH Sarabun New–B Set

Note: An example of a set of text cards for experiments, Set B, is displayed with TH Sarabun New (Thai conventional text font), actual sizes.
Figure 5 Examples of Texts in DB Ozone-F Set

Note: An example of a set of text cards for experiments, Set F, is displayed with DB Ozone (Roman-like Thai font), actual sizes.
2. 2. 2. Participants
A sample of 16 native Thai participants with normal or corrected-to-normal visual acuity, including eight males and eight females between 22 and 62 years old (average = 42.06 years), participated in this pilot study. They were all literate. Table 2 shows each participant’s age, gender, educational background, and occupation.

<table>
<thead>
<tr>
<th>Participant No.</th>
<th>Age</th>
<th>Gender</th>
<th>Highest Educational Qualification Obtained</th>
<th>Occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>34</td>
<td>Male</td>
<td>Bachelor’s Degree</td>
<td>Freelancer/Stockist</td>
</tr>
<tr>
<td>2</td>
<td>50</td>
<td>Male</td>
<td>High Vocational Certificate</td>
<td>Coffee Shop Owner, Cook</td>
</tr>
<tr>
<td>3</td>
<td>44</td>
<td>Female</td>
<td>Bachelor’s Degree</td>
<td>Coffee Shop Owner</td>
</tr>
<tr>
<td>4</td>
<td>43</td>
<td>Male</td>
<td>Bachelor’s Degree</td>
<td>Coffee Shop Owner</td>
</tr>
<tr>
<td>5</td>
<td>62</td>
<td>Female</td>
<td>Bachelor’s Degree</td>
<td>Housewife</td>
</tr>
<tr>
<td>6</td>
<td>36</td>
<td>Female</td>
<td>Bachelor’s Degree</td>
<td>Retired Civil Servant/Elementary School Teacher</td>
</tr>
<tr>
<td>7</td>
<td>36</td>
<td>Female</td>
<td>Bachelor’s Degree</td>
<td>Company Employee/Accountant</td>
</tr>
<tr>
<td>8</td>
<td>41</td>
<td>Male</td>
<td>Bachelor’s Degree</td>
<td>Personal Business/Furniture Maker</td>
</tr>
<tr>
<td>9</td>
<td>44</td>
<td>Female</td>
<td>Bachelor’s Degree</td>
<td>Personal Business/Cotton Supplier</td>
</tr>
<tr>
<td>10</td>
<td>22</td>
<td>Female</td>
<td>High School</td>
<td>Undergraduate Student</td>
</tr>
<tr>
<td>11</td>
<td>23</td>
<td>Male</td>
<td>High School</td>
<td>Undergraduate Student</td>
</tr>
<tr>
<td>12</td>
<td>43</td>
<td>Male</td>
<td>Ph.D.</td>
<td>Company Employee/Product Training Manager</td>
</tr>
<tr>
<td>13</td>
<td>35</td>
<td>Female</td>
<td>Master’s Degree</td>
<td>University Staff/Policy and Plan Analyst</td>
</tr>
<tr>
<td>14</td>
<td>54</td>
<td>Male</td>
<td>Master’s Degree</td>
<td>Freelancer/Graphic Designer</td>
</tr>
<tr>
<td>15</td>
<td>53</td>
<td>Male</td>
<td>Master’s Degree</td>
<td>University Staff/Associate Professor</td>
</tr>
<tr>
<td>16</td>
<td>47</td>
<td>Female</td>
<td>Bachelor’s Degree</td>
<td>Public Servant/Pharmacist</td>
</tr>
</tbody>
</table>

2. 2. 3. Procedure
This pilot study measured the reading times of each participant, without focusing on the accuracy of the words that were read. This test aimed to measure the difficulty and ease of reading the printed texts (text legibility) by using different typefaces and sizes to investigate how different typefaces and type sizes affect Thai readers and to suggest further opportunities for research.

Because of the 2021 COVID-19 pandemic, we experimented in a general environment under natural light, not in a controlled room in a laboratory. Data collection was conducted in a well-ventilated location. Regarding the brightness for reading, we controlled the minimum level of light intensity to at least 500 lx for each participant’s reading. The light intensity was measured by a light meter before each data collection. When a participant was ready, they randomly chose a set of reading cards from the six-card sets. The participant started by reading aloud the first card that displayed the smaller text size (0.75 mm), followed by the medium text-size card (1 mm), and then the larger text size card (1.25 mm). When the participant finished reading their first chosen card, they randomly selected a second card set and continued until the last text card was read, a total of six sets. The reading aloud of each participant was recorded with a sound recorder application on a researcher’s smartphone.

Afterward, we presented a card set, including six cards displayed by the six different typefaces (DB FongNam, TH Sarabun New, FT Manifest UD, PSL Kittithada, PSL Display,
and DB Ozone) in the same Bo Baimai height of the text sizes, 1 mm. We asked each participant to sort the cards based on their satisfaction and the difficulty or ease of reading, from most to least.

3. Results

3.1. Reading Time

The findings suggested that the participants spent more time reading text cards that displayed each smaller text size (0.75 mm) than when reading the other text cards, e.g., 1 mm and 1.25 mm (see the black bars in Figure 6). The participants needed less time to read those text cards that displayed the larger text size (1.25 mm) than the others (see the medium-gray bars in Figure 6). In comparison, the conventional Thai fonts tended to contribute more to reading speed than the Roman-like Thai fonts, especially when the text cards displayed smaller text sizes (0.75 mm). This issue was apparent in DB FongNam, TH Sarabun New, and FT Manifest UD (Thai conventional text fonts), compared to PSL Kittithada, PSL Display, and DB Ozone (Roman-like Thai fonts; see Figure 6).

The findings suggested that a typeface with a heavy stroke weight such as DB Ozone may enhance the ease of reading texts in small sizes (see Figure 6). DB Ozone (type size = 0.75 mm) had average reading times equal to TH Sarabun New (a conventional text typeface) and better than PSL Kittithada and PSL Display, which are in the same typeface classification, Roman-like Thai typefaces. PSL Kittithada, with a very light stroke weight, could not support better reading for the smaller text size (0.75 mm). This typeface also exhibited the slowest reading times for texts with type sizes of 1 mm and 1.25 mm.

Although FT Manifest UD has a stroke weight that is somewhat thinner than the others, except PSL Kittithada, its reading times were better, particularly in the smaller text size (0.75 mm). This finding reveals that the FT Manifest UD typeface design based on low visual acuity may also contribute to the effectiveness of reading texts in a small size.
Figure 6 Comparative Average Reading Times in the Selected Typefaces

Note: Comparative average reading times in the selected typefaces varied in different type sizes, for sixteen participants of various ages.

To understand how age affects the problem of reading, we divided the 16 participants (see Table 2) into two groups: early adulthood participants and middle adulthood participants. We determined participants 1, 7, 10, 11, and 13 as the group of early adulthood (aged between 22 and 36 years old [average = 30 years]), while we placed participants 2, 3, 4, 5, 6, 8, 9, 12, 14, 15, and 16 as the group of middle adulthood and later adulthood (aged between 41 and 62 years old [average = 47.54 years]). The results between the two groups suggested an apparent difference.

Figure 7 shows the reading findings of the early adulthood participants. Overall, the results showed that the early adulthood readers spent less time than the 16 participants whose results are reported in Figure 6 and who were highly varied in age (between 22 and 62 years old). The average reading times in the texts displayed by the conventional Thai text fonts provided decreasing reading times, evident in DB FongNam. Conversely, the Roman-like Thai fonts took more time to read as was evident in PSL Kittithada (0.75 mm) and DB Ozone (1 and 1.25 mm).
Figure 7 Comparative Average Reading Times in the Selected Typefaces

Note: Comparative average reading times in the selected typefaces varied in different type sizes, for five early adulthood participants.

We found a significant difference between the findings of the early adulthood participants and middle adulthood participants, as shown in Figures 7 and 8. The complete results in the middle adulthood group exhibited dramatically slower reading times compared to the early adulthood participants’ results. In the middle adulthood participants, every text size displayed with PSL Kittithada font had the slowest reading time, particularly in the smaller text size (0.75 mm), caused by the very light stroke weight of the PSL Kittithada typeface. The results indicated that FT Manifest UD might encourage reading in the middle adulthood participants, especially when reading the smaller text size (0.75 mm), better than the other typefaces. These results suggested that the FT Manifest UD typeface design based on low visual acuity may also contribute to the better effectiveness of reading texts in small sizes for people in middle adulthood and perhaps in later adulthood.

![Figure 7 Comparative Average Reading Times in the Selected Typefaces](image-url)
Note: Comparative average reading times in the selected typefaces varied in different type sizes, for eleven middle adulthood participants.

### 3. 2. Participants’ Satisfaction

According to the procedure, when the text-reading task was finished, we asked each participant to sort the cards based on their satisfaction, from most to least. The results in Table 3 reveal that most participants assigned the top ranks (1–3) for satisfaction to DB FongNam and TH Sarabun New, both conventional text typefaces. Meanwhile, in ranks 4–6, satisfaction was focused on DB Ozone, PSL Display, and PSL Kittithada, which are Roman-like Thai typefaces. With 16 participants, the most satisfaction (rank 1) was given for DB FongNam (5 scores), followed by TH Sarabun New (rank 2, 7 scores), TH Sarabun New (rank 3, 5 scores), DB Ozone (rank 4, 8 scores), and PSL Display (rank 5, 8 scores). In comparison, the least satisfaction (rank 6) was allotted to PSL Kittithada, with 12 scores.

The finding was varied when comparing participants’ satisfaction levels to the reading texts in the first task. The findings revealed consistent and inconsistent results between...
the two methods. In other words, the 12 scores for the text displayed with PSL Kittithada corresponded to the findings of the task of reading texts (because more reading time was spent than with the other typefaces). These results can predict that most Thai readers may prefer not to read a small text size typed with a typeface in which the glyphs have a very light stroke weight. The inconsistent results between the findings of the two methods occurred in FT Manifest UD. Particularly, the task of reading text cards required the least, reading time, as shown in Figures 6, 7, and 8. In contrast, the sorting task showed five scores in rank 5. However, FT Manifest UD was rated in rank 1 with three scores and rank 2 with three. This issue may be explained by the fact that FT Manifest UD is an unfamiliar typeface among Thai readers because the font has never been released or used in any media. Hence, five participants assigned this font to rank 5.

Perhaps because it is familiar to the Thai readers, a Roman-like Thai font, PSL Display, was sorted equally with TH Sarabun New and FT Manifest UD (conventional text fonts; see Table 3: Rank 1). Also, PSL Display’s somewhat heavy stroke weight may support the readers’ satisfaction. However, the number of scores that each typeface received in rank 1 was relatively low, unlike the highest scores in the other ranks, especially in rank 6 (PSL Kittithada), rank 4 (DB Ozone), and rank 5 (PSL Display).

Table 3 Ranking of Participants’ Satisfaction in the Selected Typefaces

<table>
<thead>
<tr>
<th>Rank 1</th>
<th>Rank 2</th>
<th>Rank 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>*DB FongNam (5)</td>
<td>DB FongNam (4)</td>
<td>DB FongNam (4)</td>
</tr>
<tr>
<td>TH Sarabun New (3)</td>
<td>*TH Sarabun New (7)</td>
<td>*TH Sarabun New (5)</td>
</tr>
<tr>
<td>FT Manifest UD (3)</td>
<td>FT Manifest UD (3)</td>
<td>FT Manifest UD (2)</td>
</tr>
<tr>
<td>PSL Kittithada (0)</td>
<td>PSL Kittithada (0)</td>
<td>PSL Kittithada (0)</td>
</tr>
<tr>
<td>PSL Diaply (3)</td>
<td>PSL Diaply (1)</td>
<td>PSL Diaply (1)</td>
</tr>
<tr>
<td>DB Ozone (2)</td>
<td>DB Ozone (1)</td>
<td>DB Ozone (4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rank 4</th>
<th>Rank 5</th>
<th>Rank 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB FongNam (3)</td>
<td>DB FongNam (0)</td>
<td>DB FongNam (0)</td>
</tr>
<tr>
<td>TH Sarabun New (1)</td>
<td>TH Sarabun New (0)</td>
<td>TH Sarabun New (0)</td>
</tr>
<tr>
<td>FT Manifest UD (2)</td>
<td>FT Manifest UD (5)</td>
<td>FT Manifest UD (1)</td>
</tr>
<tr>
<td>PSL Kittithada (1)</td>
<td>PSL Kittithada (3)</td>
<td>*PSL Kittithada (12)</td>
</tr>
<tr>
<td>PSL Diaply (1)</td>
<td>*PSL Diaply (8)</td>
<td>PSL Diaply (2)</td>
</tr>
<tr>
<td>*DB Ozone (8)</td>
<td>DB Ozone (0)</td>
<td>DB Ozone (1)</td>
</tr>
</tbody>
</table>

4. Discussion and Conclusions

The seed of this study was a remark about the use of typefaces and type sizes on Thai drug packages and patient information leaflets. We view this as a silent issue that has been ignored. Those involved still lack profound awareness and may not have sufficient knowledge to address these issues adequately. The current study was an initial review of the use of Thai typefaces focusing on typeface classifications and type sizes used in Thai drug labeling and drug documentation. This study consisted of two steps. The first step was a review of
the typefaces and type sizes of texts. In the second step, we conducted a pilot study with participants who read small sample texts cards that varied by typeface and type size. We also made subjective measurements by asking the participants to rank the texts cards by their satisfaction.

The pilot study suggested that Thai conventional text typefaces, rather than Roman-like Thai typefaces, may be needed to help Thai readers with information contents in Thai drug labeling and drug documentation, corresponding to the results of Punsongserm et al. (2018a). This significant result should be emphasized for middle-aged and elderly individuals.

Additional reasons can explain why conventional text typefaces facilitate readers, especially in early adulthood and middle adulthood, better than Roman-like Thai typefaces. First, the Thai text letterforms have adequate letter features, which contribute to letter and word identification when the text size that is displayed is very small. In contrast, Roman-like Thai typefaces are characterized by the omission and attenuation of key letter features (Punsongserm et al., 2018a) and may not support the reading of small text sizes. Second, loops and terminals that jut out from the main body of the letterforms enhance the horizontal space in the Thai text font when composed as words and sentences (see Figure 9, FT Manifest UD). Moreover, the jutting parts’ presence in specific Thai letterforms also enhances legibility (Punsongserm et al., 2017b; Punsongserm et al., 2018b; Punsongserm et al., 2018b; Punsongserm, 2020). On the other hand, Roman-like Thai typefaces with considerable omission and reduction of key letter features (e.g., PSL Kittithada) feature tight horizontal letter spaces (see Figure 9, PSL Kittithada). Some Roman-like Thai typefaces (e.g., DB Ozone) provide loop representatives (short horizontal lines) that widen better letter spaces than loopless ones (see Figure 9, DB Ozone).

Figure 9 exhibits the sample typed words (transliteration of lopinavir [a type of drug], in Thai) with FT Manifest UD (top), PSL Kittithada (middle), and DB Ozone (bottom). FT Manifest UD’s words provide broader horizontal letter spaces and protrusion benefits that enhance visibility. In comparison, PSL Kittithada words have narrow letter spaces, affected by the lack of jutting parts. It omits more key letter features. DB Ozone provides better loop representation than PSL Kittithada, which supports broader horizontal letter spaces. In addition, the tracking (regular spacing) of DB Ozone was designed to be airier than PSL Kittithada.
Developing a typeface and specific principles in Thai typography for the effective reading of small texts is an important matter that needs a stronger awareness. We realize that larger font sizes benefit more Thai readers than smaller ones. However, we have not yet understood which appropriate range of type sizes of each regular typeface has the advantage in small texts for Thai drug labeling and drug documentation. This is a significant question for further research. Regarding the suitability of the thickness of line strokes, we realize that this matter is an essential factor that must be taken into account to select or design a suitable typeface that is efficient in displaying small text sizes.

The objective and subjective measurements were diverse in this study; in particular, the measurement of reading times differed from the measurement of participants’ satisfaction in similar texts that were different in typefaces. This inconsistency reflects a significant difference in the two methods of measurement. However, using the objective method is a priority because it provides empirical evidence, but the parallel use of both methods may be necessary for specific research.
Regarding the diversity of readers (by age, visual performance, and literacy), further studies should be supported by a comprehensive group of participants that includes a wide variety of readers.

We have reclaimed the development of Thai legibility in designs for Thai drug labeling and drug documentation to deal with current and upcoming issues. This result may enhance the development of Thai typography based on social responsibility, especially when applied to guidelines or legislation related to typography and typefaces for effective use in Thai drug labeling and drug documentation and media in which small type sizes convey essential information. The trend of typeface development and typography should not engage only designers; there should be a synergy of discipline among other fields, especially pharmaceutics, psychology, social sciences, and law, to encourage authentic development that promotes competition in developing Thai typography that provides value for reading performance based on scientific research.

References

12. National Office for Empowerment of Persons with Disabilities, Ministry of Social Development and


