

Health literacy demand of printed lifestyle patient information materials aimed at people with Chronic Kidney Disease: Are materials easy to understand and act on and do they use meaningful visual aids?

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Abstract

Aim

People with Chronic Kidney Disease (CKD) need usable information on how to live well and slow disease progression. This information is complex, difficult to communicate, and changes during the course of the disease. We examined lifestyle-related printed CKD patient education materials focusing on actionability and visual aids.

Methods

From a previous systematic review assessing readability of CKD patient information we identified materials targeting nutrition, exercise, and self-management. We applied the Suitability Assessment of Materials (SAM), and Patient Education Materials Assessment Tool (PEMAT-P) to evaluate how easy materials were to understand (understandability) and act on (actionability). We created the 5C Image Checklist and systematically examined all visual aids for clarity, contribution, contradiction, and caption.

Results

Of the 26 materials included, one fifth (n=5, 19%) were rated “not suitable” on SAM and fewer than half (n=11, 42%) were rated “superior”. PEMAT mean subdomain scores were suboptimal for actionability (52) and visuals (37). Overall, more than half of all 223 graphics (n=127, 57%) contributed no meaning to the text. Images in 3 documents (12%) directly contradicted messaging in the text.

Conclusion

CKD lifestyle information materials require focused improvements in both actionability of advice given and use of visual aids to support people with CKD to self-manage their condition. The 5th C is culture and is best evaluated by user-testing.

Keywords

Chronic Kidney Disease (CKD); Education of Patients; Health Literacy; Lifestyle Risk Reduction, Actionability, PEMAT, SAM, Visual aids, chronic disease, self-management, checklist

Running Head: HEALTH LITERACY DEMAND OF CKD PATIENT MATERIALS

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Background

Self-management is a critical part of effective chronic disease care, and patient education leaflets and brochures are intended to support this. In Chronic Kidney Disease (CKD), self-management and dietary advice is complex, and changes as the condition progresses (Jain & Green, 2016). Lifestyle modification including diet and exercise can slow disease progression and is within the patients' control, yet may receive less attention from time-limited clinicians (Palmer et al., 2014) compared with other aspects of care, such as medication review.

At least 20-25% of the CKD population have low health literacy (Fraser et al., 2013), which is associated with significantly less knowledge about their disease (Gazmararian, Williams, Peel, & Baker, 2003); and attitudes of difficulty or unwillingness towards making lifestyle changes to self-manage health, and poor understanding of health information (Lambert, Mullan, Mansfield, & Lonergan, 2015). Limited health literacy is estimated to cost health systems an additional 3% to 5% of the total health cost per year (Eichler, Wieser, & Brugger, 2009). When the health literacy demands of information materials are too high for many people to access the content, such materials are not useful. Lack of access to information about preventative behaviors has been cited as one important factor in the strong link between poverty and complications from CKD (García-García & Jha, 2015), even in developed nations where information is plentiful.

Repeated calls from patients, clinicians, caregivers and researchers to prioritize CKD self-management interventions (Kidney Health Australia, 2014; National Institute for Health and Care Excellence, 2014; Tong et al., 2008; Walker & Buchbinder, 2012), suggest that currently available CKD self-management materials may not be serving patients' needs.

CKD patient information materials

Effective patient information materials should adopt a universal precautions approach,

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3 (Brown et al., 2004) and be both easy to understand by a wide audience, and facilitate
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5 consumers from varying backgrounds knowing what actions to take (Shoemaker, Wolf, &
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7 Brach, 2013). Our previous work demonstrated that the reading level of CKD texts is
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9 frequently too high (Morony, Flynn, McCaffery, Jansen, & Webster, 2015). Elsewhere, lower
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11 reading grade has been associated with more suitable CKD patient information materials
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13 (assessed by a modified Suitability Assessment of Materials checklist) in a study that also
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15 found the quality of visual aids in CKD patient materials to be lacking (Tuot, Davis,
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17 Velasquez, Banerjee, & Powe, 2013). For (CKD) self-management, materials should be
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19 explicit about which actions patients need to take (Seligman et al., 2007; Tuot et al., 2013).
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21 The US National Action Plan on Health Literacy lists the need to develop “actionable” health
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23 information as a key goal (U.S. Department of Health and Human Services, 2010), yet we are
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25 not aware of any other study specifically focusing on actionability of CKD self-management
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27 materials.
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32 For readers with low literacy, visual design and appeal is particularly important (Doak, Doak,
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34 & Root, 1996), and visual aids attract people to the document and increase the likelihood that
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36 health information will be read (Houts, Doak, Doak, & Loscalzo, 2006). Whilst visual aids
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38 are important for low-literacy populations, pictures that are unrelated to text have no
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40 beneficial effect on comprehension (Houts et al., 2006), and a possible detrimental effect
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42 (Griffin & Wright, 2009). Cognitive deficits in attention and memory are associated with
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44 kidney disease (O'Lone et al., 2016), which suggests that repetition and reinforcement of key
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46 messages (e.g. using clear and meaningful images with informative captions that reinforce
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48 messages in the text) may be particularly important in CKD patient information materials.
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52 53 Evaluating patient materials – SAM and PEMAT

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55 Instruments to assess patient information materials include the Suitability Assessment of
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3 Materials (SAM) (Doak et al., 1996), and more recently the Patient Education Materials
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5 Assessment Tool (PEMAT) (Shoemaker et al., 2013; Shoemaker, Wolf, & Brach, 2014).
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7 These tools examine the content, language and style, use of visual aids, layout, cultural
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9 appropriateness (SAM only), use of numerical information (PEMAT only), and engagement
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11 with the reader and directions for action to take. PEMAT systematically examines
12
13 ‘actionability’ or how clearly required actions to take are presented. The SAM classifies
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15 materials as “superior”, “adequate”, or “inadequate”; whereas the PEMAT does not currently
16
17 offer guidelines for how to interpret specific scores. An advantage of the PEMAT is the
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19 specific evaluation criteria, including examples of what is (in)appropriate. Appendix 1
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21 illustrates overlap between SAM and PEMAT – many items are similar, but the level and
22
23 depth at which domains are explored differs between instruments.
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27 28 Focus on visual aids

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31 Visual aids including graphs, tables, charts, diagrams, and pictures should present
32
33 unambiguous messages and reinforce text. When examining documents as a whole using the
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35 SAM or PEMAT tools, the deficiencies of individual visual aids can be overlooked. For
36
37 example, no item in either SAM or PEMAT specifically addresses the consistency of text and
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39 images (although PEMAT implies it to some extent in item 16: “The material’s visual aids
40
41 reinforce rather than distract from the content”). Images and graphics are particularly
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43 important to a low-literacy population. For example, an image that (explicitly or
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45 inadvertently) illustrates what *not* to do can easily be misinterpreted if the only explanation is
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47 in the text; readers who do not understand the text may guess the intended meaning from the
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49 picture (Houts et al., 2006). Informed by the Simply Put guide (Centers for Disease Control
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51 and Prevention, 2009) we designed the 5C Image Checklist to evaluate each image or graphic
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53 individually for clarity, contribution, contradiction, caption, and culture.
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Aim

We examine the health literacy demand of printed materials targeted at CKD patients and with a healthy lifestyle (diet, exercise, self-management) theme using SAM and PEMAT, and explore the relationship of these variables with readability scores. We also introduce a brief image checklist.

Method

Selection of materials

From a systematic review of 494 kidney patient information materials (search conducted March 2014), we identified 94 English-language documents aimed specifically at CKD patients and designed for print (Morony et al., 2015). These materials ranged in length from 1-12 pages; were mostly produced by non-profit organizations (61%) and health facilities (23%); and covered topics such as general CKD information (26%), related conditions (37%) including diabetes, and lifestyle (36%). From those, we identified a subset of 30 that focused specifically on lifestyle and self-management, and excluded 4 materials that focused on specific cultural groups (n=1; booklet on Australian Aboriginal “bush tucker”), or technical details of tests (n=2), and issues not directly related to physical health such as employment (n=1).

Suitability Assessment of Materials (SAM)

The SAM assesses the quality and functionality of health materials with 22 items over 6 domains: content; literacy demand; graphics; layout and typography; learning stimulation and motivation; and cultural appropriateness (Doak et al., 1996). Items are scored against published criteria, with each item scored “superior” (2 points), “adequate” (1 point), or “not suitable” (0 points). These categories also apply to final scores, which are expressed as percentages: “superior” (≥ 70); “adequate” (40-69); “not suitable” (≤ 39). When an item is not

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3 relevant to the document, the item is scored “not applicable”, and the maximum number of
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5 points (2) for each non-applicable item is subtracted from the maximum SAM score (44) to
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7 form the denominator when calculating the overall percentage score.

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9 Because we consider images to be essential when preparing lifestyle change literature for
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11 low-literacy populations, we scored the entire section on visual aids as 0 (rather than N/A) if
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13 graphics or lists and tables were absent, so the denominator would not be adjusted downward
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15 when calculating the final (percentage) score.
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18 19 Patient Education Materials Assessment Tool (PEMAT)

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21 PEMAT covers similar domains to SAM, but adds a section on numerical information, and
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23 places greater emphasis on instructions for taking action. PEMAT produces two scores:
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25 understandability and actionability. “Understandability” items broadly map onto SAM
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27 domains of content, word choice, organization, layout, use of visual aids; adding the domain
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29 use of numbers. “Actionability” evaluates how clearly instructions or recommended
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31 behaviors are presented, including breaking down actions into explicit steps, or using tools or
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33 visual aids to assist the user to take actions. See Shoemaker et al (2013).
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37 38 *Domain analysis*

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40 The items and domains for SAM and PEMAT are presented in Appendix 1. For ease of visual
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42 comparison, we have reorganized items of the PEMAT to map onto SAM domains (but
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44 retained the original domain structure for analysis). For clarity and ease of comparison, all
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46 subdomain scores in this paper are calculated as proportions of the maximum possible score
47
48 and reported on a 0-100 point scale.
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52 We deconstructed Understandability scores by converting domain scores to percentages, in
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54 order to understand relative strengths and weaknesses of materials. We collapsed PEMAT
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56 categories “organization” (4 items) and “layout and design” (1 item) for this purpose.
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3 PEMAT subdomains (plus SAM cultural appropriateness) were mapped against SAM
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5 categories (superior, adequate, and not suitable; Figure 1); and Flesh-Kincaid Grade levels
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7 (\leq grade 5, grade 6-8, \geq grade 9; Figure 2).
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10 Visual aids: Clarity, Contribution, Contradiction, Caption, Culture

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12 We examined each visual aid individually including cover photographs, illustrations, graphs,
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14 charts, and proformas. This is to provide a more complete overview of use of graphics to
15
16 assist interpretation of our other analyses.
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20 Guided by the CDC Simply Put Checklist, we assessed 4 properties of each visual aid:
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- 23 • Clarity: Is it easy to see what it is?
- 24 • Contribution: Does it contribute or reinforce meaning in the document?
- 25 • Contradiction: Does this image contradict messages communicated in text?
- 26 • Caption: Is a caption present?
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33 Evaluation of the cultural appropriateness of each image is best done by the users that the
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35 materials are intended for and outside the scope of this paper.
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38 Readability (Flesch-Kincaid)

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40 We correlated SAM and PEMAT scores with Flesch-Kincaid grade levels (obtained in our
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42 prior systematic review (Morony et al., 2015)). To avoid overweighting reading grade, we
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44 removed the single SAM item measuring (Fry) reading grade and recalculated overall scores
45
46 accordingly before conducting this analysis.
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50 Scoring and analysis

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52 Two authors trained in psychology and health communication (SM, SK) independently
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54 scored materials on PEMAT, and met to resolve any differences. SAM ratings were made by
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3 SM, and for the SAM domain of cultural appropriateness, items were assessed by SM, JJ and
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5 AW and scored by group consensus. Individual item scores on both measures for a random
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7 subset of 10% of materials (n=2) were scored separately by a third party (DM) to test for
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9 consistency. In addition to overall (percentage) scores, we also calculated (percentage) scores
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11 for individual domains on both SAM and PEMAT. During this process, any contentious or
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13 difficult to score items identified were discussed in meetings with all authors.
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17 “Contradiction”, or consistency of visuals and text was scored Y, N, or unclear by one author
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19 (SM), and reviewed independently by a nephrologist (AW) to resolve unclear items. All
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21 visual aids were then systematically examined (by SK) using the purpose-designed checklist
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23 and reviewed by SM.
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26 27 **Results**

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29 The 26 lifestyle-focused materials we identified for this review included advice about diet
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31 (n=15), exercise (n=3), and general self-management (n=8). Half were produced by the not-
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33 for profit sector (n=13); others were produced by Government (n=6), health facilities (n=5)
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35 and pharmaceutical (n=2) organizations. A total of 12 organizations were represented. The 26
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37 documents included a total of 223 visual aids (range 0 to 27), including photographs,
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39 illustrations, tables and graphs, and proformas. See Table 1 for characteristics of included
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41 materials.
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45 46 SAM

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48 According to SAM criteria, 11/26 materials were scored “superior” (≥ 70), 10 “adequate” (40-
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50 69) and 5 “not suitable” (≥ 39). Total scores ranged from 20 to 93 (mean=63; median 69).
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53 Across all materials the lowest scoring SAM domain was visuals and graphics (45); the only
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55 domain scored “superior” was layout (82). Appendix 2 details mean SAM subdomain scores
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57 together with corresponding PEMAT scores.
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PEMAT

Across materials all PEMAT domain scores ranged from 0-100 points. Interrater reliability (percent agreement) was calculated for each domain: content (87%), word choice and style (77%), use of numbers (90%), organization (72%), layout & design (88%), use of visual aids (84%), actionability (88%). Materials varied greatly on both PEMAT understandability (mean 57; range 15-100) and actionability (mean 52; range 0-100). The understandability and actionability scores were strongly correlated with each other ($r=.64$, $p<.01$) and with SAM scores ($r=.78$, $p<.01$; and $r=.62$, $p<.01$ respectively). Mean understandability scores are higher for “superior” materials (73) than they are for “adequate” materials (52), which have higher scores again than “not suitable” materials (31). This is expected, given that PEMAT understandability is conceptually very close to overall SAM score (see Appendix 1). The actionability scores were lower overall. There was a 14 point difference on actionability between “superior” (64) and “adequate” materials (50), and a reasonably large (33 points) difference between “adequate” and “not suitable” (31) materials.

To illustrate patterns of domain scores in materials that differ according to overall SAM rating, we plotted the mean PEMAT domain score for materials categorized as superior, adequate, and not suitable (Figure 1). The domain that materials scored strongest on was use of numbers (mean 79; 3 materials did not present any numbers). The collapsing of “layout, typography and design” with “organization” produced a mean score of 60. This masks the finding that layout, or use of visual cues, was generally very good (mean 73). On the other hand, “organization” scores were typically lower due to poor use of “chunking” (mean 58) according to PEMAT criteria.

Despite the importance of visuals for low literacy readers, most materials scored poorly, making use of visual aids the lowest rated domain on both PEMAT (mean 37) and SAM

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3 (mean 45). Mean PEMAT visual domain scores for not suitable, adequate, and superior
4 materials were 16, 33, and 51 respectively. Two documents had no visual aids at all. Of the
5 24 materials containing images, 19 (79%) scored “0” on PEMAT item 16: “The material’s
6 visual aids reinforce rather than distract from the content”. Visuals were mainly decorative
7 (e.g. showing people dining out) rather than informative (e.g. illustrating healthy eating
8 choices).
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17 Image checklist

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20 Table 2 summarizes the analysis of the 223 images and graphics (including tables) using the
21 image checklist. In 199 (89%) it was clear what the image or graphic illustrated, yet half of
22 materials (n=12) contained at least 1 unclear image. A minority (96, 43%) of visual aids were
23 assessed to contribute or reinforce some meaning to the document. Captions were present in
24 half the materials (n=13), but only 23% of visual aids. Only 4 of 24 (17%) materials
25 contained *only* images and graphics that contributed some meaning. One document
26 contained 17 images that added no meaning (and no captions).
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36 We found contradiction or confusion between words and text in 5 images, representing 3 of
37 24 (13%) documents (or 2% of 223 visual aids). For example one dietary guide had
38 illustrations of restricted foods together with suitable foods in the same image (with a human
39 figure eating some of the food), and no clear indicator of which was which. Another showed
40 an image of a woman eating a salad (possibly restricted food), with salt (always restricted)
41 and pepper shakers within reach. Of the 3 materials with internal contradiction, 2 were rated
42 “adequate” according to SAM, and 1 “superior” (range 55-73). Other score ranges for these
43 materials were: Understandability (59-82); Actionability (50); SAM graphics (30-60);
44 PEMAT graphics 20-60); Flesch-Kincaid Reading grade (6.2-8.2). Ratings for each material
45 are presented in Appendix 3.
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Readability

We investigated the extent to which Flesch-Kincaid score, a simple and easy to measure index of readability, was related to SAM and PEMAT scores. Correlational analysis illustrates that lower Flesch-Kincaid reading grade (i.e. reading level) is strongly associated with higher SAM ($r=-.73$, $p<.001$; $r=-.70$, $p<.001$ when Fry reading grade is removed from SAM scores) and PEMAT Understandability ($r=-.68$, $p<.001$) scores. The relationship with Actionability was weaker ($r=-.41$, $p<.05$). We categorized materials according to Flesch-Kincaid reading grade level to investigate how PEMAT scores mapped onto these (Figure 2). Materials rated “ \leq grade 5” on Flesch-Kincaid Grade clearly outperform “ \geq grade 9” materials in every PEMAT domain by 22-67 points. Unsurprisingly, the largest difference was on the “word choice” domain. Differences between grade 5 and grade 6-8 were sizable for visual aids and actionability (both 32 points).

Discussion and Conclusion

Discussion

Our primary aim was to investigate actionability and use of visual aids in a selection of CKD patient information materials focused on lifestyle factors. Actionability ranged from 0-100 across materials and followed a predictable pattern when materials were stratified by SAM score. Although PEMAT does not yet have any published criteria on which to interpret scores, it might be concerning that the highest rated materials (i.e. “superior”) according to SAM had a mean actionability score of only 64. The relationship between actionability and readability was not particularly strong; however, materials with an appropriate (\leq grade 5) reading grade were better on both visuals and actionability than those with a higher reading grade. Most images were clear, yet often did not contribute any meaning to the document,

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2
3 suggesting that health material producers are focusing on aesthetics rather than function when
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5 choosing images. The presence of contradictions between images and text in even a minority
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7 of texts is problematic. Most troubling is that even relatively well-rated materials can have
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9 important defects that can interfere with comprehension, particularly for people with low
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11 literacy.
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14 The highest rating domain on SAM was layout, which is consistent with previous work using
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16 SAM to evaluate cardiovascular (Taylor-Clarke et al., 2012), cancer, (Weintraub, Maliski,
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18 Fink, Choe, & Litwin, 2004) and CKD materials (Tuot et al., 2013). On both SAM and
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20 PEMAT the lowest-scoring domain was visuals/graphics, consistent with previous work on
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22 CKD using SAM (Tuot et al., 2013). As expected, readability (i.e. Flesch-Kincaid) was
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24 highly correlated with both suitability (i.e. SAM) (Tuot et al., 2013) and PEMAT
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26 understandability (Shoemaker et al., 2014).
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30 31 *Actionability* 32

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34 It is concerning that materials ostensibly designed to support patients to self-manage their
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36 CKD appear relatively poorly equipped to do so. Previous work exploring science-based
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38 nutrition messaging highlights the importance of both memorability and actionability –
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40 consumers need to be able to remember what they need to do, and actions should be easy and
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42 require minimal effort and attention (Ratner & Riis, 2014). It can be difficult and time-
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44 consuming for document developers to distil all the recommendations into a memorable and
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46 actionable message, and it is easy to overestimate how easy something is for someone else to
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48 do (Ratner & Riis, 2014). In the case of CKD lifestyle materials, this is complicated by the
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50 fact that the messages differ according to blood test results and stage of CKD, and are ideally
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52 tailored accordingly. Furthermore, advice to limit or avoid certain foods can be challenging to
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54 communicate effectively, because negatively worded statements are more likely to be
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3 recalled incorrectly (Wilson & Park, 2008). To properly test whether CKD lifestyle advice is
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5 actionable requires user-testing with the target audience. This would involve testing both that
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7 individuals can remember the message at key points (e.g. when food shopping or at meal
8
9 times), and that they feel confident of acting on it.
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11 12 *The importance of images*

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14 It is notable that “visuals/graphics” remains the most poorly rated domain, and some
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16 materials that otherwise rated well contained contradictions between images and text. Patients
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18 who did not read or understand the text might assume all foods pictured were suitable –
19
20 especially when suitable and unsuitable foods are in the same image. These were not the
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22 worst rated materials according to SAM and PEMAT. Visual aids may not necessarily be
23
24 more intuitive than text, and may in fact require instruction to ensure comprehension
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26 (Ancker, Senathirajah, Kukafka, & Starren, 2006). Documents should thus not rely on text to
27
28 detail situations when the visual message does not apply, bearing in mind that visual
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30 messages may be more powerful than written messages and can distract attention away from
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32 text (Houts et al., 2006). In this study we found pictures of healthy-looking foods high in
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34 potassium (e.g. orange juice, tomato, potato, banana) next to text about limiting potassium.
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36 An unskilled reader could easily miss the point that they should limit these foods, especially
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38 if they have been exposed to mainstream health messaging encouraging them to eat more
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40 fruit and vegetables. Pictures should illustrate desired behaviors, not things to avoid (Centers
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42 for Disease Control and Prevention, 2009). Pictorial information is easier for people to recall
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44 later (Ratner & Riis, 2014), and pictures linked to text can increase attention and recall of
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46 health information compared to text alone (Houts et al., 2006). The aforementioned material
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48 might be improved visually with the use of color coding or by clearly marking pictures of
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50 unsuitable foods with a cross or line through them to symbolize the written advice to limit
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52 these foods, and to support the use of symbols with captions. A better way would be to show
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3 pictures of (related) foods that people can eat freely (i.e. are not restricted). Because CKD
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5 dietary advice can be complex (Palmer et al., 2014) it is vital that the images within CKD
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7 patient materials reinforce rather than contradict or confuse the written messages about
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9 dietary intake. This is complicated by the fact that patients at different stages of CKD or with
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11 different CKD profiles may have quite different dietary restrictions, hence written
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13 information leaflets frequently recommend patients seek tailored advice from their doctor or
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15 renal dietician. For this reason it may be prudent to ensure that any images of people eating
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17 and drinking only portray foods that are appropriate for “all” CKD patients. This could be
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19 confirmed by user-testing with the intended audience. User-testing can also identify whether
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21 images are culturally appropriate.
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26 *Readability*

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29 Materials rated grade 5 or lower (according to the Flesch-Kincaid Grade Level) were
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31 associated with higher PEMAT domain scores, in contrast to materials with a too-high
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33 reading level (i.e. grade 9 and above) which scored lowest. One reason might be that authors
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35 who have simplified text to make the content “readable” may also have been more
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37 considerate of the reader when developing other aspects of the text. In other words, the
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39 readability of patient information materials may be a proxy for a patient-focused approach to
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41 document design.
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Limitations of this study

This study focused only on printed CKD information materials, which by definition excludes audiovisual, internet, and app-based materials. There may be more effective channels to deliver CKD lifestyle information to patients. Nevertheless, our study did include materials from major kidney-related organizations, including those whose mission is to support kidney patients.

A limitation of the SAM and PEMAT instruments is that a material can score very high on all domains (including “actionability”), yet still not provide clear advice about how to integrate the information into everyday life. For example, we reviewed separate factsheets for information on protein, sodium, potassium, and phosphorous – each of these scored quite highly on many SAM/PEMAT criteria, yet the information on one diet component in isolation is not sufficient to help a person with CKD to plan their diet. Furthermore, the SAM and PEMAT instruments do not consider who the document is written for, what the purpose of the document is, or whether the document contains all the relevant content. One approach that does take these factors into account is the Evaluative Linguistic Framework (Clerehan, Buchbinder, & Moodie, 2005), which considers key linguistic features in written document analysis. This is planned in our future work with CKD patient information materials.

Conclusion

The great challenge for CKD information providers and for providers of chronic disease self-management information more generally, is to create information that is general enough to apply to the target audience, yet specific enough to help people implement meaningful lifestyle changes. The poor use of actionability and images identified in this study represents missed opportunities for health educators to communicate effectively with patients. Ensuring

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3 that messages conveyed by images and text are consistent is an area that requires more
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5 attention.
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8 Publishers of patient information materials, or practitioners wishing to distribute materials to
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10 their patients, must be mindful of the information needs of their clients and tailor their
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12 communications accordingly. Our study suggests that they should focus in particular on
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14 actionability and carefully select visual aids, being mindful of clarity, contribution,
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16 contradiction, captions, and culture.
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Table 1: Characteristics of lifestyle focused materials aimed at people with CKD, stratified by responsible entity

Title	Year	Produced by	Funded /Supported by	Type [†]	Topic [‡]	Word Count	Image count
Government							
Eating Right for Kidney Health: Tips for People with Chronic Kidney Disease (CKD)	2011			F	D	603	3
How to read a food label: Tips for people with Chronic Kidney Disease (CKD)	2011			F	D	321	2
Phosphorus: Tips for people with chronic kidney disease (CKD)	2011	National Kidney Disease Education Program	National Institute of Health U.S. Department of Health and Human Services	F	D	347	6
Potassium: Tips for people with chronic kidney disease (CKD)	2011			F	D	307	3
Protein: Tips for people with chronic kidney disease (CKD)	2011			F	D	246	7
Sodium: Tips for people with Chronic Kidney Disease (CKD)	2011			F	D	300	4
Health Facilities							
Kidney Failure and Healthy Eating	2007	North West Dialysis Service	VIC Health	F	D	742	1
Healthy Living for people living with Kidney Disease	2011	Queen Elizabeth Hospital Birmingham	NHS Foundation Trust	B	S	364	0
Eating Out: A guide for Chronic Kidney Disease Patients	2009		AMGEN	B	D	705	17
Low Protein Diets & Renal Disease	2002	Renal Resource Centre	Renal Resource Centre /Kidney Health Australia;	F	D	711	3
Rehabilitation and Exercise for Renal Patients	2006		Janssen-Cilag	F	E	1612	11

[†]F=Factsheet (less than 5 standard (A4/Letter) pages); B=booklet (more than 5 pages)

[‡] D= diet (n=15); E=exercise (n=3); S=self-management (n=8)

UNK=unknown

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Title	Year	Produced by	Funded /Supported by	Type [§]	Topic ^{**}	Word Count	Image count
Not for Profit Organizations							
Living Well with Chronic Kidney Disease	2010	American Kidney Fund	American Kidney Fund /Nepro (Amgen)	B	S	3882	16
How to keep your kidneys healthy	2013	British Kidney Patient Association	British Kidney Patient Association /Class Health	F	S	521	0
Chronic Kidney Disease	UNK		Chronic Disease Prevention and Service Improvement Fund	F	S	136	8
Living with Reduced Kidney Function	2008	Kidney Health Australia	Genzyme Renal	B	S	2130	17
Looking After Yourself with Kidney Disease	2013		Kidney Health Australia	F	S	1674	6
Nutrition and Kidney Disease	2013		Kidney Health Australia	F	D	1032	2
You're in Charge	2012		Goodmedicine; AMGEN; Baxter	B	S	3123	11
Chronic Kidney Disease and Nutrition	UNK	Kidney Health New Zealand	Nutrition Services, Christchurch	B	D	1049	8
Following your treatment plan	2012	Medical Education Institute	Fresenius	B	S	4330	7
Staying active with kidney disease	2012		Fresenius	B	E	5611	27
Dining Out With Confidence: A guide for patients with Kidney Disease	2010		National Kidney Foundation	B	D	2367	19
Nutrition and Chronic Kidney Disease (Stages 1-4): Are you getting what you need?	2010	National Kidney Foundation	Council on Renal Nutrition; Partners in Education; United Resource Networks	B	D	2413	9
Staying Fit with Kidney Disease	2010		National Kidney Foundation	B	E	1495	10
Pharmaceutical Organizations							
Medicare's Preventive Care Services: Managing CKD stages 3 and 4 with Diet		Abbott Nutrition	Abbott Nutrition	B	D	849	7
Hyper = High, Phosphat = Phosphate, Aemia = Blood	2010	Shire Australia	Shire Australia	B	D	1146	19

§F=Factsheet (less than 5 standard (A4/Letter) pages); B=booklet (more than 5 pages)

** D= diet (n=15); E=exercise (n=3); S=self-management (n=8)

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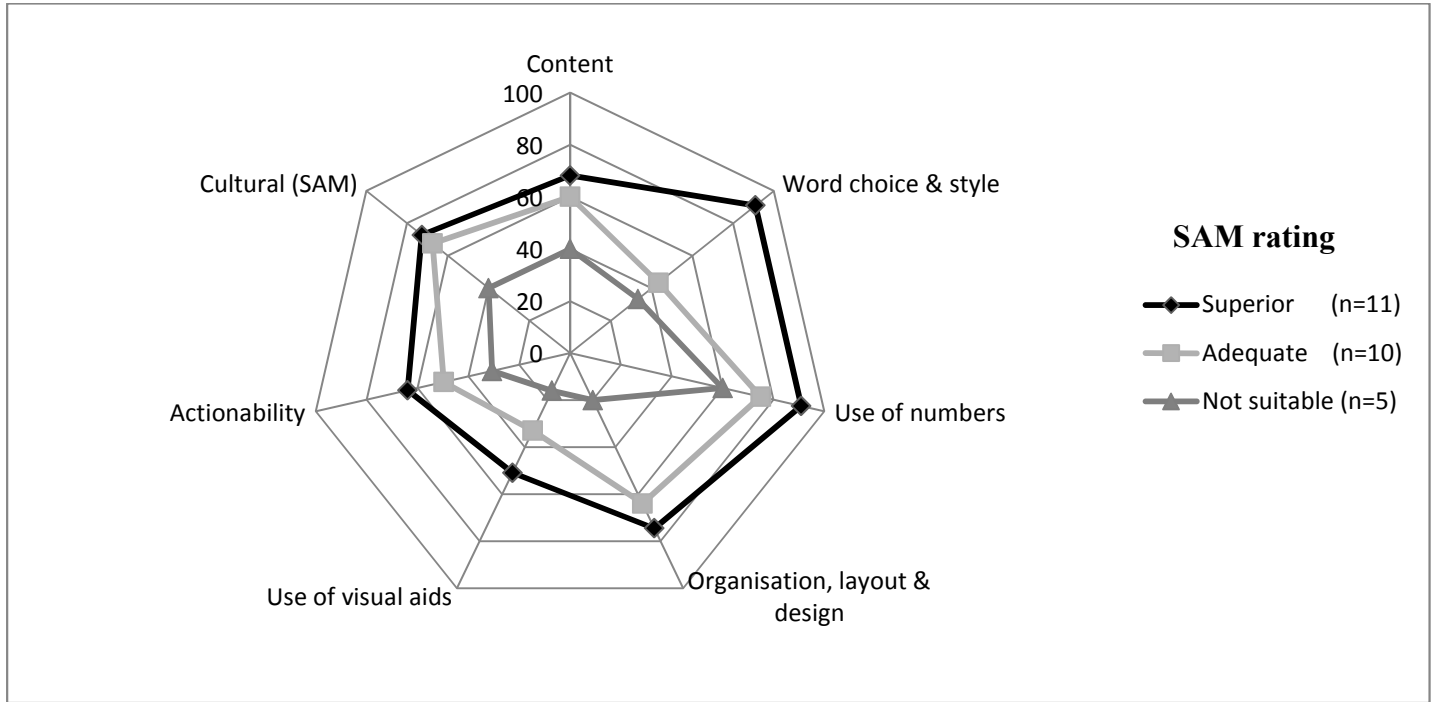
Table 2: 5C Image checklist analysis. Number of visual aids with each property, and number of materials that have at least one visual aid with this property.

	Clarity n(%)	Contribution n(%)	Contradiction n(%)	Caption n(%)
Visual aids(223)	199 (89)	96 (43)	5 (2)	52 (23)
Materials (24)	24 (100)	23 (96)	3 (13)	13 (54)

Clarity: Is it easy to see what it is?
 Contribution: Does it contribute or reinforce meaning in the document?
 Contradiction: Does this image contradict any message communicated in text?
 Caption: Is a caption present?
 Culture: Is the image culturally appropriate? (not assessed for this study)

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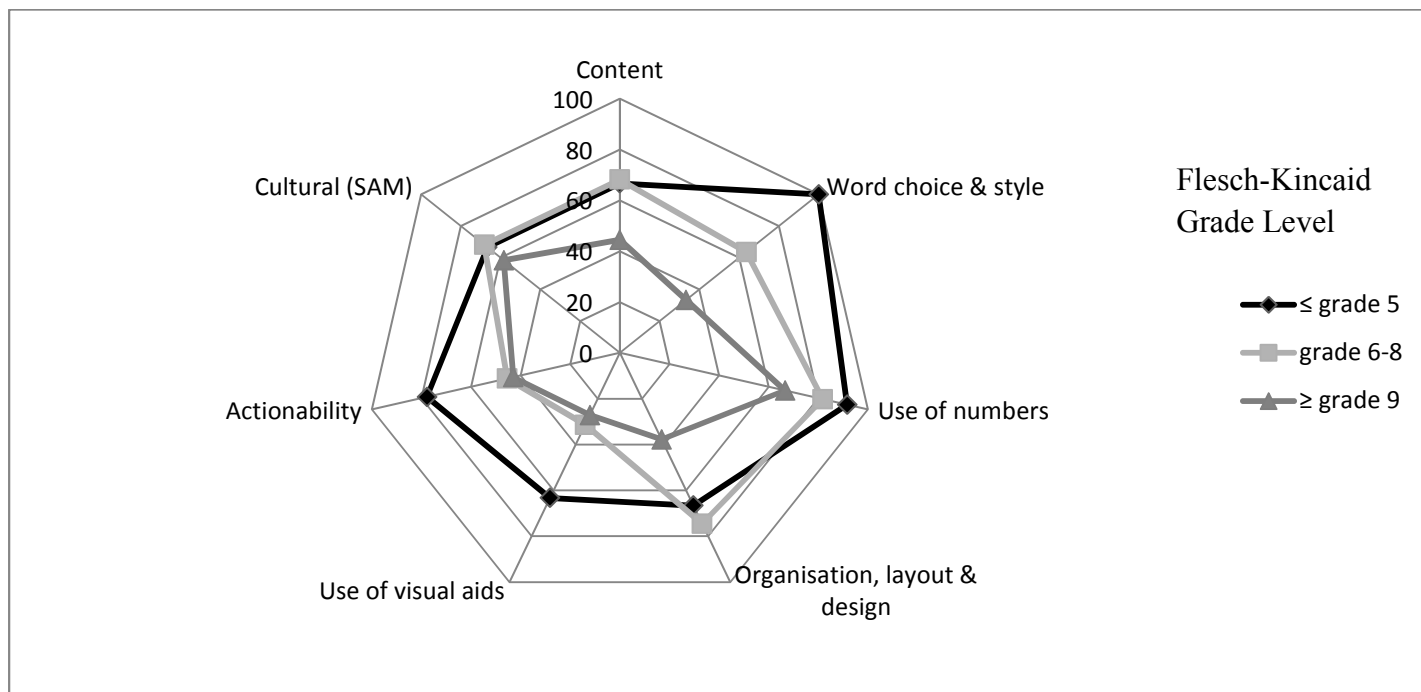
Figure 1: PEMAT subdomain scores (and SAM cultural appropriateness scores) for all information/education materials included in study. Materials are stratified by SAM rating (i.e. superior, adequate, not suitable) to illustrate where score separation occurred across domains.



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Figure 2: PEMAT subdomain scores (and SAM cultural appropriateness scores) stratified by Flesch-Kincaid Grade Level. Flesch-Kincaid Grade Level is used to demonstrate target (low literacy) reading level (\leq grade 5), “average” adult reading level (grade 8), and material pitched beyond the average reading age (\geq grade 9).



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Appendix 1: Domains and items for SAM and PEMAT mapped for similarity of intent

Domain	SAM	PEMAT
Content	1. CONTENT	CONTENT (1-2)
	(a) Purpose is evident	1. The material makes its purpose completely evident.
	(b) Content about behaviors	
	(c) Scope is limited	2. The material does not include information or content that distracts from its purpose.
	(d) Summary or review included	11. The material provides a summary.
Language	2. LITERACY DEMAND	WORD CHOICE & STYLE (3-5)
	(a) Reading grade level	
	(b) Writing style, active voice	5. The material uses the active voice.
	(c) Vocabulary uses common words	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.
	(d) Context is given first	
	(e) Learning aids via “road signs”	9. The material’s sections have informative headers.
Visuals/graphics	3. GRAPHICS	USE OF VISUAL AIDS (15-19)
	(a) Cover graphic shows purpose, is friendly, attracts attention	
	(b) Type of graphics - simple and familiar	15 The material uses visual aids whenever they could make content more easily understood (e.g., illustration of healthy portion size).
	(c) Relevance of illustrations (no distractions)	16 The material’s visual aids reinforce rather than distract from the content.
		18 The material uses illustrations and photographs that are clear and uncluttered.
	(d) List, tables, etc. explained	19 The material uses simple tables with short and clear row and column headings.
	(e) Captions used for graphics	17 The material’s visual aids have clear titles or captions.
Layout, typography & organization	4. LAYOUT AND TYPOGRAPHY	ORGANIZATION / LAYOUT & DESIGN (8-11, 12)
	(a) Layout factors: illustrations same page as txt; consistent layout/sequence; visual cues; white space; color supports message; line length; high contrast; low-gloss	10. The material presents information in a logical sequence.
	(b) Typography mixed case; 12pt, serifs, typographic cues, no all caps	12. The material uses visual cues (e.g., arrows, boxes, bullets, bold, larger font, highlighting) to draw attention to key points.
	(c) Subheads (“chunking”) used	8 The material breaks or “chunks”

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max 3-5 items per list information into short sections.

Cultural

6. CULTURAL APPROPRIATENESS

- (a) Match in logic, language, experience
- (b) Cultural image and examples

Numbers

USE OF NUMBERS (6-7)

- 6. Numbers appearing in the material are clear and easy to understand.
- 7 The material does not expect the user to perform calculations.

Actionability

5. LEARNING STIMULATION, MOTIVATION

- (a) Interaction used
- (b) Behaviors are modelled and specific
- (c) Motivation-self-efficacy complex topics are divided into small parts so readers can experience small successes in understanding or problem solving

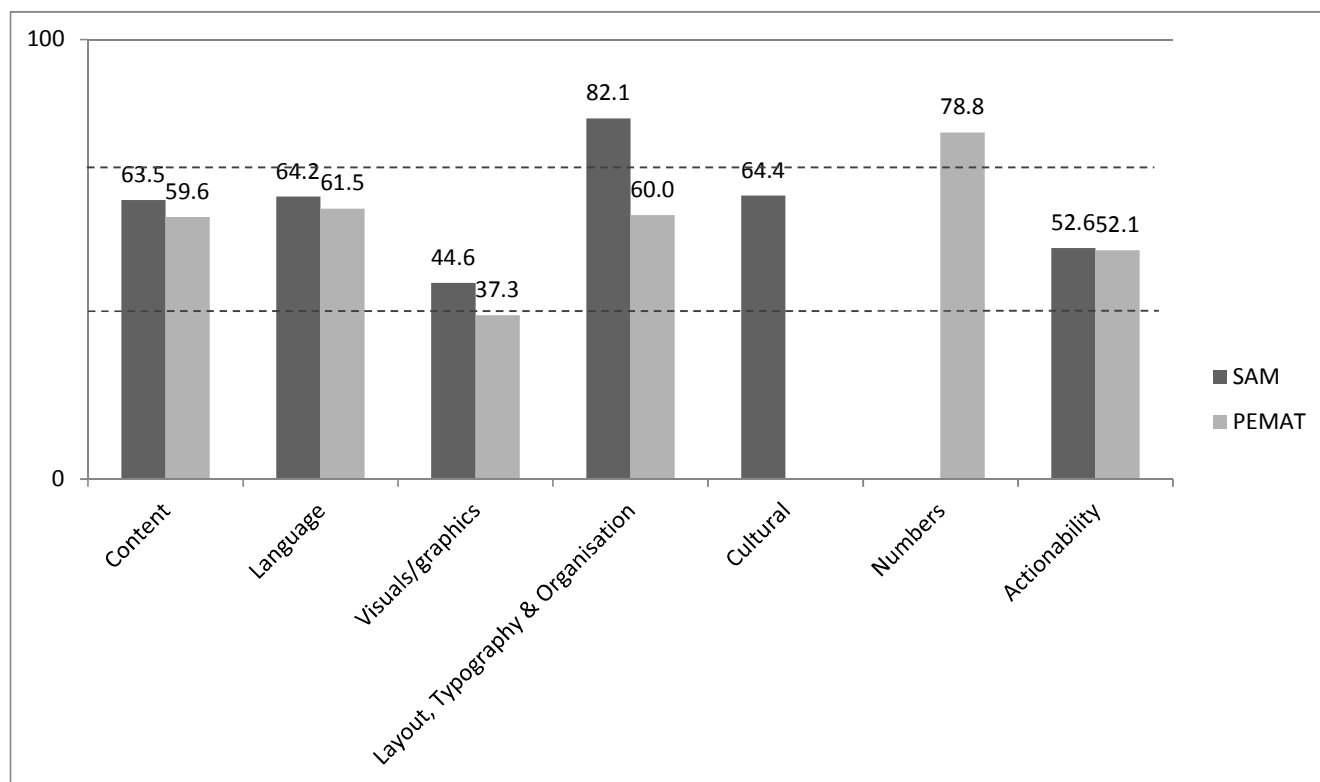
ACTIONABILITY (20-26)

- 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.

Color bands represent domains as they appear in the original instrument, and as they are reported in analyses. Table structure is guided by SAM.

Appendix 2: Comparison of SAM and PEMAT scores across subdomains.

Dashed lines indicate cut-off for “inadequate” (≤ 39) and “superior” (≥ 70) materials according to SAM criteria.



There is no PEMAT score for cultural as this subdomain does not exist in the PEMAT instrument. Similarly there is no SAM score for numbers as this subdomain does not exist in the SAM instrument.

Appendix 3: Ratings of all materials on all variables

Title	Understandability	Actionability	Suitability (SAM)	Readability (Flesch-Kincaid)	Image count	Clarity n(%)	Contradiction n(%)	Contribution n(%)	Caption n(%)
How to read a food label: Tips for people with Chronic Kidney Disease (CKD)	100	100	90	5.6	2	2 (100)	0	2 (100)	2 (100)
Staying active with kidney disease	71	100	93	5.8	27	27 (100)	0	20 (74)	18 (67)
Protein: Tips for people with chronic kidney disease (CKD)	76	83	69	5.4	7	7 (100)	0	1 (14)	0
Potassium: Tips for people with chronic kidney disease (CKD)	71	83	71	5.8	3	3 (100)	0	3 (100)	1 (33)
Sodium: Tips for people with Chronic Kidney Disease (CKD)	71	67	74	6.3	4	4 (100)	0	2 (50)	1 (25)
You're in Charge	50	67	64	9.3	11	9 (82)	0	5 (46)	4 (36)
Phosphorus: Tips for people with chronic kidney disease (CKD)	75	60	86	6.7	6	6 (100)	0	2 (33)	0
Following your treatment plan	63	60	80	7.3	7	7 (100)	0	1 (14.3)	0
Staying Fit with Kidney Disease	50	60	52	11.3	10	8 (80)	0	3 (30)	3 (30)
Living with Reduced Kidney Function	35	57	69	9.8	17	15 (88)	0	9 (53)	3 (18)
Living Well with Chronic Kidney Disease	82	50	73	6.2	16	15 (94)	1	10 (63)	6 (38)
Eating Right for Kidney Health: Tips for People with Chronic Kidney Disease (CKD)	82	50	77	5.2	3	3 (100)	0	3 (100)	0
Chronic Kidney Disease and Nutrition	71	50	68	7.7	8	8 (100)	2	5 (63)	1 (13)
Dining Out With Confidence: A guide for patients with	65	50	80	6.9	19	17 (90)	0	11 (58)	10 (53)

1	Kidney Disease									
2	Hyper = High, Phosphat =	59	50	55	8.2	19	15	2	3	0
3	Phosphate, Aemia = Blood						(79)		(16)	
4	Chronic Kidney Disease	57	50	83	4.4	8	5	0	3	0
5							(63)		(38)	
6	Looking After Yourself with	44	50	50	9.6	6	5	0	4	1
7	Kidney Disease						(83)		(67)	(17)
8	Healthy Living for people living	42	40	33	9.8	0	-	-	-	-
9	with Kidney Disease									
10	Nutrition and Kidney Disease	33	40	57	10.2	2	2	0	1	0
11							(100)		(50)	
12	Rehabilitation and Exercise for	31	40	20	12.1	11	10	0	3	0
13	Renal Patients						(91)		(27)	
14	How to keep your kidneys	15	40	36	7.6	0	-	-	-	-
15	healthy									
16	Nutrition and Chronic Kidney	65	33	84	7.3	9	8	0	2	1
17	Disease (Stages 1-4): Are						(89)		(22)	(11)
18	you getting what you need?									
19	Medicare's Preventive Care	53	33	39	9.4	7	7	0	1	1
20	Services: Managing CKD						(100)		(14)	(14)
21	stages 3 and 4 with Diet									
22	Eating Out: A guide for Chronic	56	20	59	8.4	17	14	0	0	0
23	Kidney Disease Patients						(82)			
24	Kidney Failure and Healthy	47	20	52	6.3	1	1	0	1	0
25	Eating						(100)		(100)	
26	Low Protein Diets & Renal	12	0	32	9.3	3	1	0	1	0
27	Disease						(33)		(33)	