Journal of Endocrinology, Metabolism and Diabetes of South Africa 2022; 27(2):83–92
https://doi.org/10.1080/16089677.2022.2048470

JEMDSA
ISSN 1608-9677 EISSN 2220-1009

ARTICLE

Face validity and content assessment of a diabetes nutrition education DVD for low literacy adults living with diabetes: a mixed-method study

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Aim: A study was undertaken to assess the face validity and content correctness of a diabetes nutrition education (DNE)-DVD developed for low literacy adults living with diabetes.
Setting: The study was undertaken in the city of Tshwane Municipality, Gauteng province.
Participants: Adults living with diabetes ($n = 73$, 18–65 years) attending a tertiary hospital diabetes outpatient clinic and 18 health professionals (HPs) with expertise in diabetes from three healthcare-related organisations were included.
Methods: A mixed-methods approach was used. Quantitative data were collected from patients ($n = 63$) using a Likert scale questionnaire, and from HPs using 'Yes/No' and Likert-scale questions. Qualitative data were collected using three focus-group discussions with patients ($n = 10$) and comments from HPs.
Results: Quantitative results indicated that patients perceived the visuals to be clear, appealing, culturally appropriate, contained familiar images and aided in their understanding of diabetes. Both patients and HPs found the language, length and layout of the DVD to be suitable. The HPs perceived the content to be accurate and concise. The qualitative data supported the quantitative findings. Participants perceived the DNE-DVD to be useful for patients and families, and provided suggestions for improving the DVD.
Conclusion: Quantitative and qualitative results agreed that the face validity and content correctness of the DNE-DVD was appropriate. Improving the DNE-DVD could further enhance its utility and effectiveness for the target population.

Keywords: assessment, content correctness, diabetes nutrition education, DVD, face validity, low literacy

Introduction

Diabetes mellitus is a global health problem with significant negative health and economic impacts.[1] Although a chronic disease, diabetes can be managed by making healthy lifestyle choices including diet and exercise, with or without medication.[2]

Continuous diabetes self-management education (DSME) aims to furnish people with the correct information to improve self-care capabilities for managing their condition.[3,4] This information includes the latest treatment strategies and technological advances, as well as the complications and consequences of not managing diabetes appropriately.[2,5] Medical nutrition therapy (MNT) is a key aspect of DSME provided by nutrition-dietetic health professionals (HPs).[4] Medical nutrition therapy focuses on dietary planning aimed at preventing hypo- and hyperglycaemia and other metabolic abnormalities, which can lead to further complications. This type of therapy is usually tailored to the individual and considers factors such as comorbidities, diabetes complications and personal goals such as weight management and physical activity.[3,4] Diabetes nutrition education (DNE) can also be presented to groups of people living with diabetes (PLD) to help them make informed decisions regarding dietary self-care.[6]

Health-promoting education, including nutrition education, can be delivered to patients using different modalities. These include face-to-face education, use of written materials such as pamphlets and use of multimedia such as audio-visual digital education materials.[4,7] In many settings, DNE is mainly provided in the form of written materials.[7] Written materials such as pamphlets and posters can be taken home where PLD can access the information when – or as often as – needed, and the information can be accessed by other household members.[7,8] Technological advances have also increased the popularity of multimedia education materials including videos and DVDs.[9,10] Appropriate multimedia including videos and DVDs are particularly useful for communicating information to patients with low reading ability because of engaging more senses.[11,12] Visual information can be modified to increase uptake for individuals with low literacy levels,[8,11] and can reach a comparatively large audience in a short space of time.[11]

Whether written or digital, developers of patient education materials for PLD need to consider certain aspects to deliver effective resources. These aspects include literacy level, graphics used, layout, cultural applicability and content that is accurate, relevant and easy to understand.[7, 9]

Given that few PLD experience structured DSME,[3] multimedia resources such as DVDs are promising because PLD can be educated in groups and individually. Individually tailored DNE programmes are not always feasible in public healthcare settings due to limited resources, and time and group education can reduce costs. Video-based education has been shown to be preferred to print among new mothers[12] and more appreciated than text delivery among adults participating in a weight-prevention programme.[13] In the latter, video-based education was also found to be the most effective.[13] Among adult PLD, video-based education was shown to be acceptable and to improve knowledge[14] and health literacy.[15] In South Africa, there is limited information on using multimedia for DSME at

all levels of care. To fill this gap, we developed a DNE-DVD targeting adult PLD with low literacy levels (considered lower than secondary level of education in this study), attending public health facilities in South Africa. Patients attending these facilities often have long waiting times and we reasoned that patients could watch the DNE-DVD while waiting to consult with a health professional (HPs).

Using non-empirical methods, we developed the DNE-DVD in two phases. In phase 1, we reviewed the literature to identify guidelines for developing and producing the DNE-DVD. In phase 2, we produced the DNE-DVD following the identified guidelines. The literature review highlighted the importance of appropriate cognitive load when developing the DVD for the target population. We reduced the cognitive load by using simple language and layout, using common words, clear short sentences, using visuals, using a low-pitch human voice, medium to slow pace and keeping the presentation short.[10,16–19] We followed these guidelines while ensuring relevance and accuracy of content[7,9,19] to develop an English DNE-DVD with the help of experts in digital media production. The content of the DNE-DVD was based on previous content developed for people with type 2 diabetes mellitus (T2DM) in South Africa.[20]

After developing patient education materials, it is important to assess whether the material is appropriate for the target group before providing the material to patients.[21,22] In this study, we assessed the characteristics and face validity of the developed DNE-DVD for use by adult PLD with low literacy. The DNE-DVD was also evaluated by an expert panel of HPs specialising in diabetes care. We specifically asked patients and HPs to assess the clarity and comprehensibility of the content and to rate their perceptions of DVD length, layout, pace, visuals, language and text, and content correctness.

Methods

Participants and setting

Participants included adult male and female PLD (T1DM and T2DM) and HPs. We used convenience sampling to recruit patients and purposive sampling to recruit HPs. Patients were eligible if they were older than 18 and younger than 65 years and could speak English. We included all willing patients irrespective of education level due to the challenges of recruiting patients without a high school education. The researcher (DK) personally recruited patients while they were attending their medical appointments at a diabetes outpatient clinic of a tertiary teaching hospital in Tshwane, Gauteng province, South Africa. The hospital is a public sector institution serving mainly uninsured and low-income patients.[23]

We recruited HPs with knowledge of diabetes management, including DSME, from three settings including the Departments of Dietetics and Internal Medicine at the same hospital where patients were recruited, the Department of Human Nutrition (University of Pretoria (UP)) and Diabetes Care Centurion (Centurion branch of the Centres for Diabetes Excellence [CDE]), in Gauteng province.

Ethical approval was received (information blinded for peer review and available at the editorial office). All participants signed informed consent before data were collected.

Study design

The study used a mixed-method, concurrent, equal status, cross-sectional design in which quantitative and qualitative data were collected.[24,25] Quantitative data were collected using closed- and open-ended self-administered questionnaires. Qualitative data were collected using focus-group discussions (FGDs) and comments given by HPs. Nutrition experts from the Department of Human Nutrition (UP) checked the content validity of all the questionnaires.

Data collection

Data were collected between November 2018 and August 2019. Sixty-three patients viewed the DNE-DVD and immediately completed a closed-ended questionnaire in a consultation room before their scheduled appointment. The questionnaire consisted of 13 questions related to the text, pictures, video and literacy level of the DNE-DVD. The questionnaire was completed by rating the questions from 1 to 5 (1 = lowest value, 5 = highest value) on a Likert type scale. The participants expressed their degree of agreement with the questions (1 = no agreement, 5 = complete agreement).

Qualitative data were obtained during three FGDs including 10 patients in total. Patients participated in the FGDs immediately after viewing the DNE-DVD. The FGDs were held in a quiet room in the outpatient clinic of the lung department of the hospital. The FGDs lasted about 30 minutes. An experienced FGDs facilitator guided the discussion using a semi-structured interview schedule while the researcher took notes. Patients were also asked which language they preferred for communication and for use in the DNE-DVD.

Each HP received a copy of the DNE-DVD to view at a convenient time, and completed the self-administered questionnaire consisting of two sections. The first section had 24 'Yes/No' questions with a space provided for comments. The questions pertained to the content, visuals, layout, length and pace used in the DNE-DVD. The second section had 16 rating questions adapted from the Mobile Application Rating Scale (MARS).[26] The questions related to the quality of the DNE-DVD. Each characteristic was scored from 1 to 5 (1 = lowest value, 5 = highest value) on a Likert-type scale.

Data management and analysis

Quantitative data were captured on Excel spreadsheets (Microsoft Corp, Redmond, WA, USA) and analysed using descriptive statistics. For the patient group, quantitative data were analysed for the whole group as well as a comparison between patients with and without a high school qualification. We tested between-group differences using Student's t-test, where $p < 0.05$ for a two-tailed test was deemed significant.

The FGD data were transcribed verbatim. All qualitative data (patients and HPs) were analysed using the five steps of thematic framework approach as described by Rabiee.[27] In the first step, familiarisation, we repeatedly read all the FGD transcripts, notes and comments from the HPs until we were acquainted with the data.[27] In the next step, identifying themes, we identified the thematic framework including concepts, ideas and themes. We identified the themes in relation to the stated aims and objectives of the study.[27] In the third step, indexing, data were analysed to identify supporting quotes while comparing groups. In the fourth step, charting, we arranged quotes according to themes, grouping similar quotes together.[27]

Finally, we mapped and interpreted the data. Quotes were interpreted individually and as a whole to investigate related concepts. Key terms were identified and their meaning within context determined. The frequency, extensiveness, intensity and specificity of responses to the investigated issue were used to interpret the data from the participants' perspective.[27]

Results

Participant characteristics

Of the 100 eligible patients, 73 (T1DM and T2DM; 47 women) participated. Twenty-seven patients declined (20 were not interested and 7 feared missing their place in the appointment queue). The mean age of participants was 54 years (±12.9) and mean diabetes duration 15±9.7 years. Nearly half of the patients were black ($n = 34$; 46.5%), and the remainder were white ($n = 22$; 30.0%), coloured ($n = 9$; 12.3%) and Indian ($n = 6$; 8.2%). Most participants (89.1%) were on insulin (48.0% insulin only; 41.1% combination of insulin and an oral hypoglycaemic) and had at least high school education ($n = 69$, 65.8%) of whom few ($n = 11$, 15%) had post-high school education. About half (50.7%) were married. Most of the participants (80.8%) had received previous diabetes education, mainly from HPs. Comorbidities reported include high blood pressure (56.1%), high cholesterol (30.1%) and heart disease (23.3%).

Eighteen HPs (19 dietitians, 4 doctors and 4 diabetes educators) participated. The HPs' average years of work experience was 7.4 years.

DNE-DVD assessment

The results are presented in two main categories, namely qualitative and quantitative.

Quantitative results

The quantitative results of the patients ($N = 63$) are summarised in Table 1. The mean score for the 12 questions was 4.1±0.3 out of 5 and the mode 5. Only question 4 scored less than 4. Questions 2, 3 and 8 (visual impact) were scored > 4.2 out of 5, indicating that the participants felt that the visuals in the DNE-DVD were striking.

The results comparing participants without high school education (LEL, $n = 14$) and those with at least high school education (HEL, $n = 49$) are presented in Table 2. Only on a few questions ($n = 5$, 42%) did HEL participants score significantly higher than LEL participants. These five questions all had a mean score of > 3 out of 5 for both groups, indicating a score of at least 60%.

Patients listed a variety of language preferences for communication and for the delivery of the DNE-DVD (Table 3). Few (8.2%) patients would prefer English as the language for communication, about a third Afrikaans (35.6%), and the rest (56.4% for all combined) in their specific home languages, of which Northern Sotho had the highest proportion of participants (13.7%). The same trend was seen in the language preferred for the DNE-DVD translation, except that for the specific home languages iziZulu had the highest proportion of participants (14.3%) followed by Northern Sotho (12.7%). It is notable that over half the participants indicated that English was their second preferred language of communication.

Health professionals scored the DNE-DVD by responding either 'Yes' and 'No' to a series of closed-ended questions (Table 4). The questions were arranged into themes, namely (i) visuals (Q1–11), (ii) layout (Q12–14), (iii) length and pace (Q15–16), and (iv) content (Q17–24). Health professionals scored nearly three-quarters ($n = 17$; 71%) of the questions as 'Yes' responses. The content theme (Q17–24) had the highest mean score (89.5%), while the length and pace theme scored the lowest (68.3%). All the HPs responded 'Yes' to questions 5, 8, 10, 17, 18 and 24. Only four questions scored below 50% for 'Yes' with question 6 scoring the lowest (39%) (Table 4).

Health professionals were also asked to rate the quality of the DNE-DVD (Table 5). The mean score for all the questions was 4.1±0.35, and 4 was the most frequent (mode) rating in just over half of the 16 questions ($n = 9$; 56.3%). Health professionals scored the layout, visuals and the quality of the DNE-DVD as 4 out of 5 (mode, questions 5, 6, 7, 8 and 13). Comprehensiveness of the information (questions 2 and 9) had a mean score of 4.4 (±0.78 and ±0.61, respectively). Content appropriateness for target audience (question 3) and correctness (questions 11, 12 and 14) had a mean score > 3.5 and > 4.0, respectively. The overall rating of the DNE-DVD (question 16) was 3.7±0.57. The high mean score for question 15 (4.3±0,49) shows the HPs would recommend the DNE-DVD to relevant beneficiaries.

Qualitative results

The qualitative data were organised into four main themes, namely visuals, layout, length and content. Health professionals mainly discussed the shortcomings of the DNE-DVD and gave recommendations. The themes and sub-themes are presented in Table 6. The results are supported by participants' quotes. Patient quotes are presented by indicating the group number, the participant number and the number of participants per group (Gr1P2/5 – the group number is 1 and the participant is number 2 out of 5 participants in the group).

Visuals

We identified six sub-themes in the visual theme. The first sub-theme related to visibility, clarity and visual appeal. Patients found the visuals to be simple, clear, appealing and visible. For example, 'I think the pictures are well done. We see what we must eat and how much we can eat' (Gr2P1/4). Patients gave positive feedback on the use of colours in the DNE-DVD as indicated by the quote, 'The colours are very easy to see about what is right' (Gr2P3/4).

The second sub-theme revealed whether patients gained a better understanding of diabetes. Patients mentioned that the visuals helped them to understand diabetes better. Patients were able to recall some of the content they learnt from watching the DNE-DVD, for example, 'Your insulin is a problem. The cells are closed so it can't open. So the sugar is high' (Gr2P3/4).

The third sub-theme related to the retention of information. Patients felt that the visuals helped them to recall information, especially when combined with audio material. 'The pictures actually is better because what you see you tend to remember' (Gr3P1/3). The patients also found the analogy of the 'lock and key' mechanism to describe insulin action very useful. 'Yes. It's the sugar that is high. And what causes it. Because the pancreas does not work well. When the keys from the pancreas must go open the cell, but they are not there, it won't work' (Gr1P1/3).

The fourth sub-theme concerned cultural appropriateness of the visuals. Patients felt that the visuals were culturally acceptable and accessible. 'The food that we saw in the pictures is

Table 1: Patients' assessment of the diabetes nutrition education (DNE)-DVD

Question:	Mode	Mean (SD)	Frequency							
			< 3		= 3		(= 4)		(= 5)	
			n	%	*n*	%	*n*	%	*n*	%
1. Is the DVD clear to understand?	4	4.3 (0.73)	2	3.2	4	6.3	30	47.6	27	42.9
2. Are the pictures easy to see?	5	4.3 (0.86)	2	3.2	8	12.7	24	38.1	29	46
3. Do you understand all the pictures in the DVD?	5	4.3 (0.76)	1	1.6	8	12.7	23	36.5	31	49.2
4. Did the DVD have enough pictures?	3	3.2 (0.67)	3	4.8	51	81	3	4.8	6	9.5
5. Is the text easy to understand?	5	4.2 (0.87)	4	6.3	7	11.1	26	41.3	26	41.3
6. Were there words that were too big to understand?	5	4.1 (0.99)	6	9.5	9	14.3	19	30.2	29	46
7. Can you understand all the language used?	5	4.1 (0.97)	5	7.9	8	12.7	23	36.5	27	42.9
8. Do the colours catch your attention?	5	4.2 (0.83)	1	1.6	13	20.6	19	30.2	30	47.6
9. Do you understand the message of the DVD?	5	4.1 (0.94)	5	7.9	9	14.3	22	34.9	27	42.9
10. Do the pictures make sense?	5	4.3 (0.74)	1	1.6	7	11.1	26	41.3	29	46
11. Do you understand diabetes better after watching the DVD?	5	4.0 (1.05)	5	7.9	14	22.2	20	31.7	24	38.1
12. Would you watch the DVD again to control your diabetes better?	5	4.2 (0.99)	5	7.9	4	6.3	25	39.7	29	46
Overall mean (SD)		**4.1 (0.3)**								
1 = lowest rating value						**5 = highest rating value**				

Table 2: Patients' ratings of the diabetes nutrition education DVD (DNE-DVD) by level of education

Question	Mode		Mean (SD)		*p*-value
	LEL	HEL	LEL (*n* = 14)	HEL (*n* = 49)	
1. Is the DVD clear to understand?	4	4	3.85 (±1.03)	4.16 (±0.45)	0.06
2. Are the pictures easy to see?	5	4	3.64 (±1.22)	4.19 (±0.60)	0.03
3. Do you understand all the pictures in the DVD?	5	4	3.80 (±1.03)	4.23 (±0.56)	0.05
4. Did the DVD have enough pictures?	3	3	3.07 (±0.48)	3.26 (±0.73)	0.35
5. Is the text easy to understand?	4	4	3.71 (±1.14)	4.00 (±0.68)	0.08
6. Were there words that were too big to understand?	2	4	3.07 (±0.99)	4.22 (±0.80)	0.0001
7. Can you understand all the language used?	4	4	3.14 (±1.09)	4.06 (±0.73)	0.001
8. Do the colours catch your attention?	3	4	3.71 (±0.86)	4.06 (±0.81)	0.01
9. Do you understand the message of the DVD?	2	4	3.42 (±1.28)	3.97 (±0.66)	0.02
10. Do the pictures make sense?	5	4	3.92 (±0.99)	4.16 (±0.58)	0.09
11. Do you understand diabetes better after watching the DVD?	5	4	3.57 (±1.16)	3.68 (±0.98)	0.15
12. Would you watch the DVD again to control your diabetes better?	4	4	4.14 (±0.78)	3.94 (±1.15)	0.75
1 – lowest rating value	**5 – highest rating value**		LEL = lower education level (none or primary school)	HEL = higher education level (high school or higher education)	

Table 3: Patient participants' language preference for communication ($N = 73$) and DNE-DVD delivery ($N = 63$)

Preferred language	First language *n* (%)	Second language *n* (%)	For DNE-DVD *n* (%)
Afrikaans	26 (35.6)	13 (17.8)	24 (38.1)
IziZulu	5 (6.9)	7 (9.6)	9 (14.3)
Northern Sotho	10 (13.7)	3 (4.1)	8 (12.7)
English	6 (8.2)	42 (57.5)	5 (7.9)
Tswana	4 (5.5)	4 (5.5)	4 (6.3)
Ndebele	8 (11.0)	1 (1.4)	3 (4.8)
Other (Portuguese, French, Swazi, Tsonga, Sepedi, Sotho, Xhosa, Venda)	14 (19.3)	3 (4.1)	10 (13.7)

always in the market, four seasons a year and we can choose, they are affordable and there are many we can buy' (Gr1P1/3). Health professionals felt that more culturally accepted food visuals were needed, including affordable food choices for people of lower socio-economic status. 'The food and activities shown are not appropriate for all people, people of lower socio-economic status may not find it feasible' (HP15Di).

The fifth and sixth sub-themes were related to deficiencies observed in the visuals. In sub-theme five, HPs felt that there was inadequate communication of portion sizes, location of injection sites and anatomical location of the pancreas and stomach. 'Portion sizes are difficult to determine' (HP15Di) 'The visuals are helpful however not always the only options, for example, the stomach is the most common injection site but not the only' (HP13Do). 'If a patient does not know what a stomach/pancreas looks like (shape, etc.) they will not be able to identify it without further explanation' (HP2Di). For

Table 4: Health professionals' perceptions of the diabetes nutrition education (DNE)-DVD ($N = 18$)

Theme	Yes/No Questions	Yes		No	
		n	%	*n*	%
Visuals	1. Can the visuals be interpreted literally?	10	56	8	44
	2. Would people with diabetes be able to relate to the visuals used?	14	78	4	22
	3. Are the visuals used culturally appropriate?	9	50	9	50
	4. Do the visuals clearly portray the desired behaviours people with diabetes should have?	17	94	1	4
	5. Do the visuals break down desired actions into simple concepts?	18	100	0	0
	6. Can the visuals be interpreted without understanding the language used?	7	39	11	61
	7. Are the messages portrayed in the visuals used clear and simple?	17	94	1	6
	8. Did the visuals capture your attention?	18	100	0	0
	9. Does the DVD use minimal visual search? In other words, are the visuals easy to identify?	15	83	3	17
	10. Do the visual cues used (arrows, increased font size or boldness) draw attention to important information?	18	100	0	0
	11. Are the colours used appropriate for emphasising information?	15	83	3	17
Layout	12. Does the layout contain too many visuals or text in each scene?	8	44	10	56
	13. Does the information present have a flow that is easy to follow?	13	72	5	28
	14. Will the style used allow viewers to learn efficiently?	16	89	2	11
Length and pace	15. Does the DVD keep your attention until the end?	12	67	6	33
	16. Is the pace used suitable for individuals with lower literacy levels?	16	89	2	11
Content	17. Is the information used up to date?	18	100	0	0
	18. Is the language used simple enough to understand but not so simple as to miss the point?	18	100	0	0
	19. Is the nutrition education DVD free of errors?	17	94	1	6
	20. Does the content of the DVD align with diabetes treatment goals?	17	94	1	6
	21. Is the DVD content relevant to the interests of type 1 and type 2 diabetes patients?	16	89	2	11
	22. Will the DVD be able to accommodate the needs of individuals with low literacy levels?	16	89	2	11
	23. Will the DVD be appropriate in all diabetes outpatient clinics?	9	50	9	50
	24. Can the DVD to be used make a difference on behavioural changes?	18	100	0	0
	Overall frequency	14,5	81,4	3,3	18,5

sub-theme six, HPs felt that the DNE-DVD would not be understandable without the audio material. 'Visuals can be interpreted; however, sound is required to explain the actions required or explain concepts' (HP8Do).

Layout

The layout theme contained three sub-themes. The first sub-theme dealt with the flow of information from one topic to the next. Patients indicated that they felt the flow of information was appropriate, 'It was flowing. The reason why it takes you from one part to another. Like we say from discovery of diabetes into treatment and then into maintaining' (Gr3P1/3). The last two sub-themes were related to concerns of HPs. The HPs indicated that some slides contained too many visuals, 'In some slides the number of images can be too much. It's still understandable but can be hard to see on smaller screen' (HP9Di). Some HPs also felt that the DNE-DVD ended too abruptly and needed a conclusion. 'Perhaps needs a conclusion or contact your health professional if … .' (HP3Di).

Length

The participants were satisfied with the length when viewed as three separate sections. Patients noted that they could remain focused until the end of the DNE-DVD. 'For me the time is very good because it's not that long … Before you get tired everything is still fresh' (Gr3P1/3). 'The video as a whole is long but when looking at each section it is easier to maintain focus' (HP15Di).

Content

The content theme contained four sub-themes. Concerning the language used, the patient participants felt the language was simple to understand. 'Simple language is used' (Gr2P3/4). Regarding the simplicity of the content, both participating groups reported that the DNE-DVD content was simple enough for primary school scholars, but HPs raised concerns that viewers who did not understand English would struggle to understand the content. 'No, it is really easy to understand what is taught' (Gr2P1/4). 'Most of the information yes, think there will be information lost for those who do not understand English' (HP4Di). The patients felt that the DNE-DVD was informative and helped them to understand diabetes better. 'It is very educational for people with diabetes. A lot of people need to know about diabetes' (Gr3P3/3). Regarding the utility of the DNE-DVD at clinics, the patients recommended that all patients should view the DNE-DVD. 'I think it is important to see this video. Because you will find some people in the family will dish up food and what they dish up is not healthy and can teach them' (Gr2P2/4). The HPs also felt that it would be better if patients could view the DNE-DVD with audio. 'In clinics without audio it can be harder to convey the message. Some sections rely on audio for explanations' (HP9Di).

Discussion

In this study, we assessed the face validity and content correctness of a DNE-DVD developed for adults living with diabetes in the public healthcare sector. Key persons involved in diabetes management, namely adult PLD and HPs, participated in the

Table 5: Video quality rating by health professionals ($N = 18$)

Questions	Mode	Mean (SD)	Frequency 3		Frequency 4		Frequency 5	
			n	%	*n*	%	*n*	%
1. Is the DVD fun/entertaining/interesting to use? Does it use any strategies to increase engagement through entertainment?	3	3.6 (0.78)	10	56	5	28	3	17
2. Does it provide all necessary information required for a diabetes nutrition education DVD?	5	4.4 (0.78)	3	17	5	28	10	56
3. Is the DVD content (visuals information, language, design) appropriate for the target audience?	4	3.9 (0.64)	4	22	11	61	3	17
4. How easy is it to learn how to use the DVD?	5	4.4 (0.78)	3	17	5	28	10	56
5. Is moving between scenes logical/accurate/appropriate/ uninterrupted; are all scenes necessary?	4	4.1 (0.68)	3	17	10	56	5	28
6. Are the arrangements and sizes of images appropriate?	4	4.3 (0.67)	2	11	9	50	7	39
7. How high is the quality/resolution of graphics used for the DVD?	4	3.7 (0.49)	6	33	12	67	0	0
8. How good does the DVD look?	3	3.5 (0.62)	10	56	7	39	1	6
9. Does the DVD contain information desired to educate people with diabetes?	4	4.4 (0.61)	1	6	9	50	8	44
10. Does the DVD have specific, measurable and achievable goals?	3	3.7 (0.69)	8	44	8	44	2	11
11. Is the DVD content correct, well written, and relevant to the goal/topic of the DVD?	4	4.3 (0.67)	2	11	9	50	7	39
12. Is the information provided within the scope of the DVD; and is the information comprehensive but concise?	5	4.5 (0.62)	1	6	7	39	10	56
13. Are visual explanations of concepts through images/videos clear, logical, correct?	4	3.9 (0.64)	4	22	11	61	3	17
14. Has the DVD been created based on an accurate scientific source?	5	4.4 (0.7)	2	11	7	39	9	50
15. Would you recommend this DVD to people who might benefit from it?	4	4.3 (0.49)	0	0	12	67	6	33
16. What is your overall star rating of the DVD?	4	3.7 (0.57)	6	33	11	61	1	6
Overall mean (SD)		4.1 (0.35)						
1 = inadequate	3 = adequate	5 = excellent						

study. Overall, participants were positive towards the DNE-DVD, especially in terms of visual impact, simplicity, cultural appropriateness and flow. Importantly, participants gave suggestions for improving or making the DNE-DVD more useful, including the ability of the video to be viewed in a setting where the audio can be heard. This could possibly limit its utility in a busy outpatient clinic. This problem, however, could be overcome by having visuals only with subtitles of the content per screen.

A particular strength of the DNE-DVD was its simplicity. We developed the DNE-DVD to convey complex concepts in a simple manner. We used the 'lock and key' analogy to explain insulin's mechanism of action, and how it relates to diabetes.[28] Other studies have found visuals and analogies to be useful in explaining complex concepts.[19,28,29] Analogies can effectively communicate health concepts that may be difficult to explain or understand.[28,30] The DNE-DVD also relied on the use of colours and visual cues, which may also have promoted retention and impact of information. The video was developed using simple words and language structures. We tried to improve the cultural appropriateness of the visuals by including cultural foods. Incorporating cultural foods in education materials has been found to significantly improve the overall health and control of diabetes.[29,31] The use of culturally and socioeconomically appropriate images is important to allow the viewer to relate to the education material.[10,29,32] Allowing the viewer to relate to the content can increase the effectiveness of the education material and draw attention to important information.[10] A large effort was also made to improve the coherence of the content of the DVD. We tried to organise the information logically, to improve retention of information. Using an appropriate layout enhances the visibility of important text, pictures and concepts and reduces time spent searching for information.[29,33,34]

Although the visuals were positively perceived, HPs mentioned some potential shortcomings. Health professionals mentioned that certain information needed to be conveyed in a better or clearer manner. For example, portion size of foods, injection sites and the anatomical relationship between the pancreas and stomach. Showing the correct portion sizes is essential for preventing uncertainty and misinterpretation surrounding how much food to eat, which is an important consideration for diabetic patients.[29,35] HPs also mentioned that cultural appropriateness could be enhanced by including more affordable and readily available food choices. Including affordable food options may help to improve dietary adherence.[31,32] Patients also mentioned that initiatives such as growing one's own foods in home gardens should be promoted, or perhaps included in future video resources. Importantly, we developed the script and images in this DNE-DVD to provide fundamental information without unnecessary information, to increase impact.[36] The inclusion of a conclusion and contact details as suggested by HPs would aid in recall of essential information and allow viewers to reach out if they have questions.[33]

Table 6: Themes and sub-themes identified with participants' supporting quotes

Theme	Sub-theme	Participant quotes
Visuals	Visibility, clarity and visual appeal	Everything was good in the pictures' (Gr1P2/3) 'I think the pictures are well done. We see what we must eat and how much we can eat' (Gr2P1/4) 'It's clear what we need to eat. You don't need to take away, it's clear as it is' (Gr3P3/3) 'The colours are very easy to see about what is right' (Gr2P3/4)
	Ability to improve understanding of diabetes	'It actually illustrated why and gives an indication of what could cause diabetes and why. So actually, it makes it easier to make that link' (Gr3P1/3) 'Yes. It's the sugar that is high. And what causes it. Because the pancreas does not work well. When the keys from the pancreas must go open the cell, but they are not there, it won't work' (Gr1P1/3) 'Your insulin is a problem. The cells are closed so it can't open. So the sugar is high' (Gr2P3/4)
	Retention of information	'The pictures for me and the voice help a lot. Because sometime what you hear and see it helps you remember' (Gr3P1/3) 'Yes, because it shows you what it is. Like tiredness, there is a tired person. If someone gets hurt, they show there is a sore on the feet and eyesight you can see as well. So, it was visible' (Gr2P4/4) 'The pictures actually is better because what you see you tend to remember. It's clear and shows you the fruits, the vegetables, the meat, actually everything is very clear' (Gr3P1/3) 'Yes. It's the sugar that is high. And what causes it. Because the pancreas does not work well. When the key of pancreas must go open it won't work' (Gr1P1/3)
	Cultural appropriateness and food appropriateness	'I think what is used is the best that you can have' (Gr1P2/3) 'The food that we saw in the pictures is always in the market, four seasons a year and we can choose, they are affordable and there are many we can buy. But unfortunately, some of us we are far from the big shops where we can get all these fresh vegetables like that. And it will help us very much more if we can plant in our own gardens' (Gr1P1/3) 'Everything is actually something that we have. Like food that we normally buy like vegetables and fruits now and then, even not every day but sometimes. There is something that we all like' (Gr3P1/3) 'Can add more culturally accepted foods such as organ meats, chicken feet, etc.' (HP4Di) 'Activities and foods not necessarily over the SES spectrum or cultural' (HP6Di) 'The food and activities shown are not appropriate for all people, people of lower socioeconomic status may not find it feasible' (HP15Di) 'The food used may be unaffordable to people seeking medical care from government institutions' (HP10Di)
	Deficiency in visuals to adequately communicate some concepts (food portion sizes, location of organs or injection sites)	'Portion sizes are difficult to determine' (HP15Di) 'The visuals are helpful; however, not always the only options, for example, the stomach is the most common injection site but not the only. Also, people may have insulin pumps' (HP13Do) 'If a patient does not know what a stomach/pancreas looks like (shape, etc.) they will not be able to identify it without further explanation' (HP2Di) 'Visuals should be adapted to indicate portion sizes, the food shown is not in relation to actual sizes, for example the strawberry is almost the same size as the apple' (HP16Do) 'May be easier using a glucometer with digital values instead of a dial' (HP13Do)
	Visuals not understandable without verbal explanations	'Visuals can be interpreted; however, sound is required to explain the actions required or explain concepts' (HP8Do) ' … but occasionally the visuals can seem a little ambiguous without the accompanying speech when it comes to the do or don't repeated images' (HP9Di) 'Lower literate people may have difficulty following the spoken information especially if they do not speak English' (HP15Di)
Layout	Information flowed between topics and ease in following	'It was flowing. The reason why it takes you from one part to another. Like we say from discovery of diabetes into treatment and then into maintaining' (Gr3P1/3) 'Yes, you could follow it. It was easy and straightforward' (Gr1P2/3) 'Layout is acceptable as is' (HP4Di)
	Excess images on slides	'In some slides the number of images can be too much. It's still understandable but can be hard to see on smaller screen' (HP9Di) 'Some of the sections contain too many whilst others are appropriate' (HP11Ed) 'Not all sections contain the same amount of images, some have too many' (HP13Do)
	Presentation problems	'It ends abruptly' (HP3Di) 'Perhaps needs a conclusion or contact your health professional is … ' (HP3Di) 'Recommendation to contact your doctor would be a good way to end it' (HP17Ed)
Length	Perceived length of DNE-DVD and ability to maintain focus	'No, it is not too long and not too short' (Gr1P3/3) 'The video as a whole is long but when looking at each section it is easier to maintain focus' (HP15Di) 'Think there should be presented in 10-minute intervals at each appointment or presentation' (HP4Di) 'For me the time is very good because it's not that long. I used to give Sunday school and learned that 20 minutes is the maximum time for them to not get tired. Even for adults, it's the same. The time for the video is very good because you don't even get tired. Before you get tired everything is still fresh' (Gr3P1/3)

(*Continued*)

Table 6: Continued.

Theme	Sub-theme	Participant quotes
Content	Language simplicity	'The language is just right' (Gr1P3/3) 'They were very clear' (Gr1P2/3) 'Simple language is used' (Gr2P3/4)
	Primary school scholar comprehension	'Yes, they will understand' (Gr2P3/4) 'No, it is really easy to understand what is taught' (Gr2P1/4) 'We do understand. It is actually very clear. We speak it daily. It is not big words. The grammar was nice' (Gr3P1/3) 'Most of the information yes, think there will be information lost for those who do not understand English' (HP4Di) 'Very dependent on the patient's literacy level. Older patients will struggle to follow as well as patients who don't understand English' (HP2Di)
	Informative	'The concept teaches you how to control diabetes. And it is very educational, types of food we have to eat, different types of food and fruits' (Gr2P4/4) 'It is very informative. Because it helps you to understand why the sugar goes high. It helped to understand what causes it. What type of food cause you[r] sugar to goes high' (Gr3P1/3) 'It is very educational for people with diabetes. A lot of people need to know about diabetes. So, it is very educational' (Gr3P3/3) 'It's very education and tells you how much to eat. A fist full of starch and veg and palm of your hand for meat. And the description on the video itself, with the differences, it clearly tells you' (Gr2P4/4)
	Usefulness of DNE-DVD implementation at clinics	'I think it is important to see this video. Because you will find some people in the family will dish up food and what they dish up is not healthy and can teach them' (Gr2P2/4) 'I think actually this video all diabetes clinics should use to educate their patients about this' (Gr3P3/3) 'Will not be appropriate if there is a lack of facilities to display the DVD' (HP2Di) 'In clinics without audio it can be harder to convey the message. Some sections rely on audio for explanations' (HP9Di) 'Will not be suitable in clinics where patients have a short waiting period. Would be better where patients have a long time to watch' (HP15Di) 'As long as the DVD can be played with sound, otherwise patients will not understand' (HP17Ed)

The impact of the DNE-DVD also relied heavily on the audio component. Patients felt that the voiceover was useful but not essential, while HPs felt that the voiceover was important for understanding.[33] Combining visual and sound components may result in improved knowledge, which can lead to positive behavioural changes.[37,38] Combining visuals and audio may also be more effective for people whose preferred language is not English.[39] Considering multiple languages is important for multicultural communities, such as the one where this study was conducted. Therefore, the participants' suggestion that the video be translated into other languages is an important consideration. The multiple languages of the study patients, with no dominant preferred language, makes this a challenge. However, our results seem to suggest IziZulu, Afrikaans and Northern Sotho would be the most appropriate languages into which to translate the DNE-DVD, because they were the most preferred. These three languages are the main languages of communication at home in the Gauteng province (not necessarily mother tongue) according to the 2011 provincial profile report.[40] The English version would still be important given that it was the second most preferred language of communication.

Patients felt that the DVD was short enough that they could focus until the end of the DVD. Some HPs felt that the DNE-DVD was too long and would not be suitable for environments where there is a short waiting period, such as private healthcare practices. However, the DNE-DVD was developed for PLD in the public healthcare sector. People with low literacy levels have been reported to concentrate for eight minutes before losing focus when viewing low literacy education materials.[10,33] In this study, the whole DNE-DVD was approximately 17 minutes long, and was intentionally split into three sections, the longest being about 6 minutes. Each section has a complete message (theme) and can be viewed independently. We did not inform the HPs about the latter, which may have led to the idea that the video was too long. In public healthcare facilities, waiting times are often long, further improving the utility of the video in clinical settings.

Concerning content, HPs indicated that the information provided was correct, well written and relevant to the audience, and based on accurate scientific sources. Providing accurate information to individuals with low literacy levels is essential as they may struggle to differentiate between reliable information sources.[9, 16] HPs felt that DNE-DVD could create awareness and that they would recommend the DNE-DVD to patients. Patients found the content informative and mentioned that they would re-watch the DNE-DVD to improve their diabetes self-management, like the findings of another study.[35] Patients also felt that family members and caregivers could benefit from viewing the DNE-DVD. Patients may not be solely responsible for their healthcare,[35,37,41] so allowing family members or caregivers to view the DNE-DVD could improve the patient's adherence to prescribed medical and nutritional treatment.[41] Social support is important in diabetes care and is positively correlated with adherence to diabetes management.[41–45] Social support may include encouraging patients to make healthy decisions about their diet and doing exercise, as well as assisting with administering medication.[41]

In public healthcare settings, HPs are often pressed for time and struggle to provide thorough patient education.[38,46] This DNE-DVD may alleviate some of this burden, because after watching the DNE-DVD patients should have enough background information to allow them to ask questions and save HPs' time as

they do not need to provide all the information during appointments.[38,46,47] Patients may also prefer clinics where they receive treatment as the best place to access information.[38]

This study has several strengths. The data were obtained from two relevant stakeholder groups, namely adult PLD and an expert panel consisting of HPs who had working knowledge of managing diabetes. By including expert knowledge, we enhanced the credibility of the product. The study used a mixed-method approach where the qualitative results complemented the quantitative results, allowing a more thorough assessment of the utility of the DNE-DVD. The mixed-method approach allowed triangulation of data sources. This study was limited by the fact that most participants had a high school level education, and we did not assess literacy. Although the participants were asked to assess the suitability of the DNE-DVD for people with primary school education, we cannot guarantee that this was the case. However, our results – including those comparing patients with at least high school education and those without high school education – suggest that the DNE-DVD is likely with some adjustments to be suitable for a low literacy audience.

Conclusion

Both patients and HPs agreed that the DNE-DVD was suitable for PLD with low literacy in terms of visual appeal, layout, pace, language used and ability to understand. The content was simple and easy to follow. The HPs found the content to be correct, accurate and appropriate for diabetes education. These results indicate that the identified guidelines were successfully applied in the development of the DNE-DVD. By assessing the face validity and content, we identified action points that would improve the DNE-DVD. These improvements include adding more affordable culturally specific foods and healthcare contact information, providing a conclusion and translating the DNE-DVD to local languages. This could possibly improve the DNE-DVD effectiveness and benefit DSME in public healthcare settings.

Acknowledgements – The authors greatly appreciate the health professionals and patients who participated in the study. They would like to thank Dr Cheryl Tosh for her assistance with editing the manuscript.

Disclosure statement – No potential conflict of interest was reported by the authors.

Funding – The authors reported there is no funding associated with the work featured in this article.

Ethical approval – Ethical approval was obtained from the Faculty of Health Sciences Research Ethics Committee University of Pretoria (reference no. NAS: Temp2018-00527).

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Received: 8-12-2021 Accepted: 28-02-2022