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Development of a decision aid with cost information for heart failure medication in Singapore

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ABSTRACT

Objective: This study presents the development process of a heart failure (HF) medication decision aid (DA) specific to Singapore context, with the objective of promoting cost conversations.
Methods: Phase 1 was to create a DA prototype, where two HF clinicians were consulted on their input and needs. Phase 2 was pilot testing where the prototype was tested on HF patients and revised based on their feedback.
Results: The DA is a one-page poster that compares only two classes of HF medications. It encompasses seven attributes for comparison, including route of administration, treatment duration, frequency of use, hospitalization rate, survival rate, low blood pressure probability with personalized subsidized cost being the key attribute. A total of 48 patients participated in the pilot testing with only 2 patients (4.2 %) finding the DA difficult to understand. Almost all patients agreed that the DA provided greater clarity in the medication options.
Conclusion: By integrating the needs of both clinicians and patients and conducting user testing, we developed a novel HF medication DA. Patients found the tool easy to understand and acceptable.
Innovation: This innovative DA aims to improve cost conversations by providing tailored, concise, and locally relevant information for efficient use.

1. Introduction

Medication expenses have consistently risen every year [1-3]. In Singapore, the cost of medications has risen by over 30 % in the last two decades, as reflected by its consumer price index [1]. This increase is largely attributed to the introduction of newer, more effective, and patented agents. Heart failure (HF) affects a significant portion of the population in Singapore, with recent estimates indicating that over 4.5 % of adults are living with HF [4]. This condition requires lifelong management, often involving multiple medications, making the overall treatment cost a critical issue to consider.

Over the past decade, the introduction of newer HF medication such as angiotensin receptor neprilysin inhibitor (ARNI), has brought significant changes to the regimen [5,6] since the last breakthrough in the 1990s [7]. This novel medication has demonstrated superior outcomes, including a reduction in mortality and hospitalization rates [8], but is relatively expensive compared to older generation options [9]. In Singapore, the unsubsidized cost of ARNI stands at S$80–90 per month, which is approximately ten times higher than the cost of the next best alternative, angiotensin-converting enzyme inhibitor (ACEI), available for only S$6–10 per month. Adding to the challenge, government subsidies automatically deduct another 50 % off the cost of ACEI, whereas approval for ARNI subsidies is contingent on the patient's household income and necessitates an application process [10]. Even with the application approved, the subsidized expenses for ARNI still surpass that of ACEI. This raises questions about the extent to which Singapore patients are willing to select ARNI, given that a recent study in the United States suggested some patients may only be willing to pay an additional US$15 per month for ARNI over ACEI [11]. This situation prompts the need for clinicians to actively engage in medication cost discussion with patients to discuss personal priorities.

The use of a decision aid (DA) has been studied as an effective method to promote shared decision making [12] which can potentially promote cost discussion between patient and clinician [13]. DA is a tool designed to convey features of available medication options and their pros and cons. A Cochrane Systematic review has demonstrated that the use of a DA can enhance patients' understanding of medications due to its use of simple plain language [14]. Furthermore, it encourages active

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participation in the decision-making process, empowering patients to make choices that align with their values and goals [14]. To date, there is only one existing DA designed for the selection of HF medications [15]. However, the cost data in this DA is intricately tied to the complex billing system of the United States, rendering it unsuitable for use in the context of Singaporean patients. Additionally, there remains uncertainty as to whether this DA meets the needs of the local clinicians and patients who may wish to incorporate additional information relevant to the cultural nuances in Singapore. Consequently, the objective of this study is to develop and optimise a culturally tailored DA that aligns with the Singapore healthcare payment structure and is well accepted by HF patients, with the aim of improving medication related cost discussion between patient and clinician. This study is dedicated to outlining the systematic procedures involved in the development of this DA in comprehensive detail.

2. Methods

The development process was adapted from the International Patient Decision Aids Standards (IPDAS) [16] and targeted common cost discussion barriers such as lack of adequate cost information and insufficient time in clinic [17]. The research team utilized the IPDAS checklist [16] to guide the development process, employing a systematic approach with iterative reviews and regular communication with both patients and clinicians. This included scoping the objective of the DA, assessing needs of both patients and clinicians, and performing usability testing with end users.

The development of HF DA was done in 2 phases (Fig. 1). Phase 1 entailed the creation of a DA prototype based on clinician's input and needs. Phase 2 involved pilot testing the prototype DA on HF patients who provided feedback based on their needs. This study was approved by the domain specific review board from the National Healthcare Group Singapore and was in accordance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

2.1. Phase 1: creation of DA prototype

The development of the prototype DA took place from February to April 2022.

At the initial planning stage, two key aspects of the DA were determined by the research team, which included a PhD student, a public health professor, and three advisors specializing in implementation science, clinical research, and statistics. Firstly, it was decided that the DA would be a paper-based A3 size (29.7 × 42.0 cm) poster. The research team dismissed the idea of a digital-based DA (i.e. mobile application, website) due to concerns that presenting the DA on an unfamiliar platform might deter elderly HF patients from reading its entire content. This concern arose from a study by Doll et al. [18], where half of the enrolled participants were uncomfortable with tablet use and preferred the paper-based version. Secondly, the DA would contain information on ARNI and ACEI only. This is because both medications are strongly recommended in international guidelines, and patients may select one medication over the other [5,6]. In addition, the cost difference between the two medications is significant enough to influence decision-making where unsubsidized ARNI costs S$80–90 per month while ACEI costs only S$6–10 per month. The DA did not include additional HF medications to keep the comparison manageable.

A needs assessment was then conducted to gather input from an expert panel of two HF clinicians: one cardiologist and one clinical cardiology pharmacist, who were the key stakeholders in the HF clinic. Communication between the research team and the expert panel occurred through face-to-face and online group discussions. An initial face-to-face meeting was held to present the research idea to the expert panel. During this meeting, the panel also commented on the content and design of the DA. The meeting was audio recorded. Subsequently, the research team developed the initial DA version (Fig. 2) and distributed it to the expert panel via email for their feedback. The DA's relevance and accuracy were reviewed by the expert panel and revisions were made. A total of four rounds of biweekly email exchanges occurred between the research team and the expert panel before finalizing the prototype DA. A second in-person meeting was then held to present the finalized prototype to the expert panel before proceeding to phase 2. Valuable insights from the meetings and emails were summarized and documented.

2.2. Phase 2: pilot testing

Pilot testing took place from August 2022 to September 2022.

The prototype DA was tested for perceived ease of understanding, appropriateness of content, and acceptability by HF patients. Patient's needs were also elicited in the process. Recruitment took place at the HF clinic in Ng Teng Fong General Hospital. The inclusion criteria were patients aged 21 years or older, diagnosed with HF, and able to comprehend and communicate in English. There were no exclusion criteria. Eligible patients were approached for recruitment by the research team after they had registered for their clinic appointment. Consented patients were presented with the prototype DA. Following this, a questionnaire (Appendix A) containing multiple choice and open-ended questions was administered using Qualtrics (Provo, Utah, USA) application. All responses were inputted into an electronic tablet by the patients themselves. To examine comprehension of the DA, four knowledge questions were asked. Patients were also tasked to select their preferred medication and give their reasons. Their reasons were checked for logical consistency with their choices. Appropriateness and acceptability of DA content were determined with open-ended questions. The questionnaire was formulated by the research team and

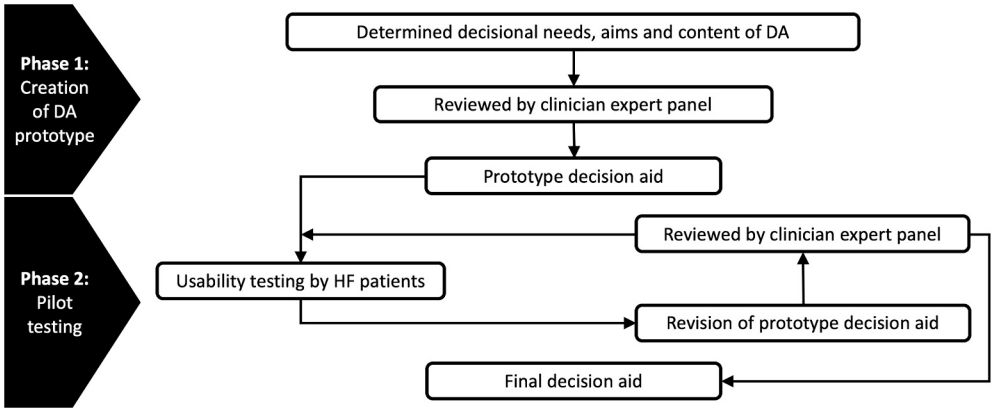

Fig. 1. Decision aid development process.

Initial version

Decision Aid

Introduction: As a patient with heart failure, you may be taking medications for your heart. The decision aid contains information of 2 medications which help to relax your blood vessel so your heart does not have to pump too strenuously. You only need to take one out of these 2 medications.

Medication	**Medication A** (Oral tablet)	**Medication B** (Oral tablet)
Frequency of use	Take 1 tablet **two times a day**	Take 1 tablet **one or two times a day** OR
Benefits (Hospitalization)	After taking medication A, **87** of 100 patients were not hospitalized for 2 years	After taking medication B, **84** of 100 patients were not hospitalized for 2 years
Side effect (Low blood pressure symptoms – Dizziness, tiredness, blurred vision)	After taking medication A for 2 years, **14** of 100 patients developed symptoms of low blood pressure	After taking medication B for 2 years, **10** of 100 patients developed symptoms of low blood pressure
Cost (After government subsidy)*	**S$42.00 per month** (Not Medisave claimable)	**S$0.75 - 3.00 per month** (Medisave claimable)

*Cost based on public hospital formulary after government subsidy, may not apply to private clinic or private hospital

Prototype decision aid

Decision Aid

The decision aid contains information of 2 medications which help your heart function better. You only need to take 1 of these 2 medications. The table below is for you to compare the 2 medications.

Medication		**Medication A** (Oral tablet)	**Medication B** (Oral tablet)
Frequency of use		**2 times a day**	**1 or 2 times a day**
Benefits (Not Hospitalized)		**87 of 100 patients** were **not hospitalized** over 2 years	**84 of 100 patients** were **not hospitalized** over 2 years
Benefits (Survival)		**83 of 100 patients** were **alive** at the end of 2 years	**80 of 100 patients** were **alive** at the end of 2 years
Side effects (Low blood pressure symptoms – Dizziness, tiredness, blurred vision)		**14 of 100 patients** developed **symptoms of low blood pressure** over 2 years	**10 of 100 patients** developed **symptoms of low blood pressure** over 2 years
Cost PG = Pioneer generation MG = Merderka generation		Medication A is **NOT Medisave claimable** Before subsidy **S$42.00 – 84.00 per month**	Medication B is **Medisave claimable** Before subsidy **S$3.00 – 6.00 per month**
Monthly household income	Package	After subsidy*	After subsidy
≤ $2000	PG	**S$5.25 – 10.50 per month**	**S$0.40 – 0.75 per month**
≤ $2000	MG	**S$7.90 – 15.75 per month**	**S$0.60 – 1.15 per month**
≤ $2000	–	**S$10.50 – 21.00 per month**	**S$0.75 – 1.50 per month**
$2001–2800	PG	**S$10.50 – 21.00 per month**	**S$0.75 – 1.50 per month**
$2001–2800	MG	**S$15.75 – 31.50 per month**	**S$1.15 – 2.25 per month**
$2001–2800	–	**S$21.00 – 42.00 per month**	**S$1.50 – 3.00 per month**
> $2800	PG	**No subsidies**	**S$0.75 – 1.50 per month**
> $2800	MG	**No subsidies**	**S$1.15 – 2.25 per month**
> $2800	–	**No subsidies**	**S$1.50 – 3.00 per month**

*Subsidy (Medication Assistance Fund) tier is assessed by medical social service based on capita household income and may not be approved for all applicants

Final decision aid

Decision Aid

The decision aid contains information of 2 medications which help your heart function better. You only need to take 1 of these 2 medications. The table below is for you to compare the 2 medications.

Medication		**Medication A** (Oral tablet)	**Medication B** (Oral tablet)
Frequency and duration of use		Take **2 times a day** for the rest of your life	Take **1 or 2 times a day** for the rest of your life
Benefits (Not Hospitalized)		**8.7 of 10 (87 of 100) patients** were **not hospitalized** over 2 years	**8.4 of 10 (84 of 100) patients** were **not hospitalized** over 2 years
Benefits (Survival)		**8.3 of 10 (83 of 100) patients** were **alive** at the end of 2 years	**8 of 10 (80 of 100) patients** were **alive** at the end of 2 years
Side effects (Low blood pressure symptoms – Dizziness, tiredness, blurred vision)		**8.6 of 10 (86 of 100) patients** did not have **symptoms of low blood pressure** over 2 years	**9 of 10 (90 of 100) patients** did not have **symptoms of low blood pressure** over 2 years
Cost PG = Pioneer generation MG = Merderka generation		Medication A is **NOT Medisave claimable** Before subsidy **S$42.00 – 84.00 per month**	Medication B is **Medisave claimable** Before subsidy **S$3.00 – 6.00 per month**
Monthly household income	Package	After subsidy*	After subsidy
≤ $2000	PG	**S$5.25 – 10.50 per month**	**S$0.40 – 0.75 per month**
≤ $2000	MG	**S$7.90 – 15.75 per month**	**S$0.60 – 1.15 per month**
≤ $2000	–	**S$10.50 – 21.00 per month**	**S$0.75 – 1.50 per month**
$2001–2800	PG	**S$10.50 – 21.00 per month**	**S$0.75 – 1.50 per month**
$2001–2800	MG	**S$15.75 – 31.50 per month**	**S$1.15 – 2.25 per month**
$2001–2800	–	**S$21.00 – 42.00 per month**	**S$1.50 – 3.00 per month**
> $2800	PG	**No subsidies**	**S$0.75 – 1.50 per month**
> $2800	MG	**No subsidies**	**S$1.15 – 2.25 per month**
> $2800	–	**No subsidies**	**S$1.50 – 3.00 per month**

*Subsidy (Medication Assistance Fund) tier is assessed by medical social service based on capita household income and may not be approved for all applicants

Fig. 2. Decision aid timeline.

pretested by two external volunteers who were not involved in the study to ensure comprehensibility. The questionnaire was found to be clear and understandable by the two volunteers, both aged more than 65 years old and diagnosed with heart disease.

For this pilot testing, an iterative process was adopted [19] where the testing was repeated for a total of 4 rounds. The DA was revised according to patient's feedback in each round. Revised DA was then reviewed by the expert panel before being tested in the next round by a new group of patients.

Quantitative data from multiple choice questions were summarized by descriptive statistics (i.e. Median, interquartile range, and percentages). Responses to open-ended questions were coded inductively based on similar themes and subsequently grouped into categories.

3. Results

3.1. Phase 1: creation of DA prototype

3.1.1. Phase 1 - expert panel feedback

The expert panel preferred the DA content to be concise and compact. The DA was intended to provide supplementary information in addition to what is usually discussed during the clinic encounter. Given the limited time available during clinic encounters, the DA must be informative without being excessively lengthy, as it could potentially prolong the duration of the clinic visit. It was decided that the length of DA should be kept within one page to avoid cognitive overload and to ensure adequate time for discussion.

Considering the resources available in the HF clinic, the DA was planned to be given to patients during the waiting time before their clinic consult where they would read it independently. This provided patients with time to digest the information and prepare any questions they might have. Patients should reflect on the medication they prefer and which feature holds the most significance for them. Subsequently, a discussion would occur with the clinician, and the clinician would prescribe the more suitable HF medication. Given that patients would read the DA on their own, a critical consideration in the DA design was to ensure that its content remained understandable for individuals of all ages and education levels.

3.1.2. Phase 1 - revision of DA content

The prototype DA comprised six medication attributes which included route of administration, frequency of use, two benefits: non-hospitalization rate and survival rate, low blood pressure side effect, and cost. These attributes were selected based on the expert panel's perspectives of common medication features discussed during decision making. A literature search was performed to collect up-to-date attribute information. The comparative non-hospitalization, survival, and side effect rates were obtained from the PARADIGM-HF trial [8]. The frequency of use and route of administration were extracted from the pharmaceutical companies' medication information leaflets. The cost was based on the hospital drug list. Icon array was added to attributes that contained probability data to improve comprehension [20].

Cost information is the key attribute and was added to encourage cost discussion [21]. Initial cost information presented prices before government subsidies, but this was deemed non-specific and significantly different from the final cost. Such information was unlikely to facilitate cost discussions. To improve on the cost information, all existing subsidies and coverage for both medications were considered. A total of nine subsidy bands were identified and they were based on the permutation of 3 categories of household incomes ($\leq$S$2000, S$2001–2800, and $>$ S$2800) and 3 age groups (Born before 1950, between 1950 and 1960, and after 1960) [22-25]. Although the content of cost information became lengthy, the improved accuracy was deemed important to facilitate more relevant and productive cost discussion.

There was deliberation about incorporating an additional attribute related to acute kidney injury as a result of both medications. However, this proposition was ultimately turned down. The reason is that differences in kidney injury between both medications were small and not statistically significant [8]. Furthermore, the concept of acute injury might be difficult for a layman to comprehend within a short time span and would require explanation to prevent misinterpretation. Finally, the inclusion of this attribute would have extended the length of the DA beyond one page, which was deemed undesirable.

The prototype DA can be viewed in Fig. 2.

3.2. Phase 2: pilot testing

3.2.1. Phase 2 - patient feedback

A total of 48 HF patients were recruited (12 patients per round over four rounds). Patient's characteristics can be found in Appendix B. A majority of 41 patients (85.4 %) answered all 4 knowledge questions correctly and only 2 patients (4.2 %) reported the DA was hard to understand. All patients were able to provide logical rationale in selecting a preferred medication, demonstrating the DA is easily comprehensible. Thirty-one patients (64.6 %) made their decisions by making trade-offs between multiple attributes including cost, benefits, and side effect (Appendix C).

In general, patients were receptive to using the DA (Appendix D). Almost all of them agreed that the DA provided greater clarity on the medication options and assisted them in making an informed decision. The icon array was found to be especially helpful to patients who were more visually inclined and had difficulty comprehending probability concepts. It was also observed that the DA stimulated patients to ask more questions regarding the information presented and provided opportunities for the research team to clarify any misunderstandings regarding the medication options. Additionally, many patients appreciated the inclusion of cost information in the DA, which would help manage their expectations. They praised this practice and hoped all clinicians would provide such information before medications were prescribed.

3.2.2. Phase 2 - revision of DA content

Patients commented on the presentation of the cost information. The DA displayed nine rows of cost information for various subsidy bands, each indicating a different subsidized cost. This setup led to some patients having difficulty finding the row that corresponded to their financial status. In response to this feedback, two changes were implemented. Firstly, alternate rows were given a grey background to improve visibility. Secondly, an extra tool (a black rectangle indicator) was added to highlight the correct row of information specific to each patient based on their subsidy band (Fig. 3).

Another feedback was on the lack of duration of treatment information. Several patients specifically requested this information, as it was a significant factor in their decision-making process. Patients reported if one medication only has to be taken for a short duration, then they could accept its higher cost. Consequently, the duration of treatment attribute was added to the DA.

Patients also complained that the stickman figures in the icon array were too small and too many to count. After the feedback, the icon array was reworked to reduce the number of stickman figures from 100 to 10 and the size of each stickman was increased. The probability data was also amended to align with the new icon array.

Changes were also made based on the research team's observations, as a few patients appeared slightly disoriented by the phrasing of the side effect attribute. All attributes were revised to include positive framing of information to avoid confusion. For example, side effect attribute was presented as “did not develop side effect” instead of “develop side effect” to match the positive framing of the benefit attributes (i.e. “being alive”, “not hospitalized”).

Lastly, patients requested for the DA to be available in other languages so a Chinese version is being prepared as the majority of local patients are Mandarin-speaking. Malay and Tamil versions may be

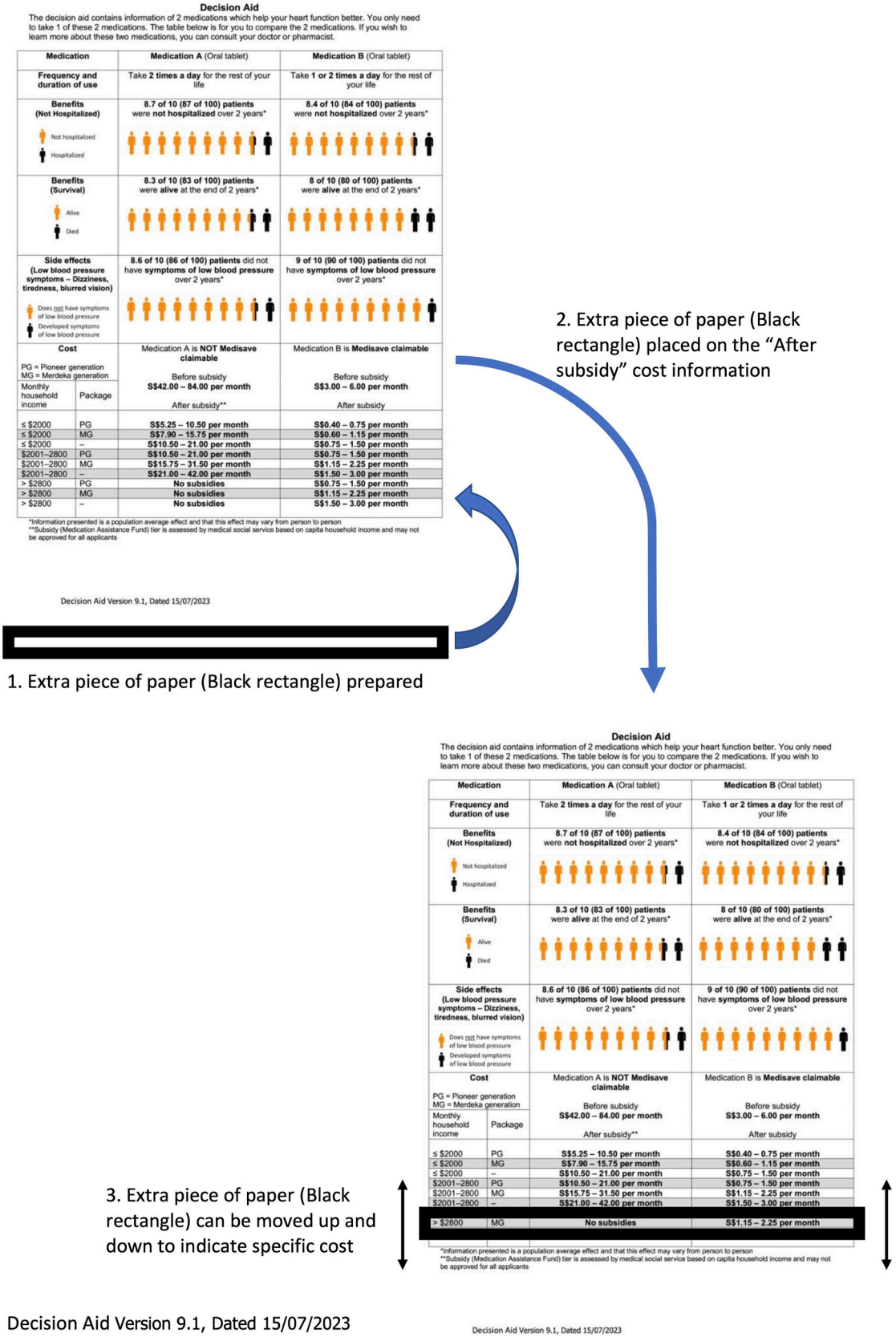

Fig. 3. Presentation of cost information in decision aid.

developed subsequently.

Patient's feedback during the pilot testing is found in Appendix E. The final DA can be viewed in Fig. 2.

4. Discussion and conclusion

4.1. Discussion

This study describes the systematic development of a DA designed to improve discussions about medication costs in outpatient HF clinic. Its content is based on the latest available evidence on the benefits, risks, and costs of ARNI and ACEI for HF treatment. Following pilot testing involving 48 patients, the research team observed high level of acceptance and good understanding of the DA. The creation of this tool was made possible through a collaborative approach, involving participation of both patients and clinicians at an early stage, as recommended by IPDAS [26].

The most challenging part of the development process was the selection of DA attributes. While MacDonald et al. [27] reported commonly preferred attributes in the literature, this DA did not incorporate all of them. Some decisions were made to ensure that the DA did not contain overwhelming information, remained understandable, and would not affect clinic consult time. The DA also did not incorporate every patient's request due to technical complexity and lack of data. For instance, some patients desired information on cure rates, but these data were unavailable in the literature. Other patients wanted to know all known side effects, but the research team deemed the request impractical since each medication has a great number of side effects, and including all of them in the DA could lead to unnecessary anxiety. Finally, patients enquired about the out-of-pocket cost which the DA could not provide. Although this is the most relevant cost information for patients, it is also the most challenging information to present. The existence of Medisave, a national medical savings account held by every Singaporean, poses a significant obstacle. It is important to note that Medisave savings can be used to offset patient's out-of-pocket costs. Since this saving account is managed by the Singapore government, accessing individual account for research is exceptionally complex, requiring both ministry authorization and patient's consent. The situation is complicated further by the fact that Medisave savings can be utilized for various healthcare activities, subjected to an annual withdrawal limit [28]. Consequently, patients who have already exhausted their Medisave quota early in the year would have to pay higher out-of-pocket costs in the latter half of the year. Given the unavailability of this data and the complexity of analysing individual Medisave profile on a paper-based DA, this study presented the next best alternative: medication cost after existing subsidies. This data is more reliable and less subject to frequent changes over time. To our knowledge, this DA is the first of its kind to incorporate tailored cost information on a paper-based platform.

This DA was developed in line with IPDAS collaboration criteria [16]. It successfully fulfilled several key criteria, such as clearly stating the context of the DA, providing balanced information on the positive and negative aspects of both medications and presenting the probabilities associated with various outcomes. Patients have also reported that the information is easy to comprehend. Most importantly, the development process included needs assessments involving clinicians and patients, in line with the development criteria. Some of the IPDAS criteria have been integrated into the DA's implementation process. For instance, the DA would be presented to the patient just before seeing the clinician, clinicians would then clarify patient's value and proceed to make a decision collaboratively. This eliminates the need to assess the patient's preferences and values twice—once when they read the DA and again during their discussion with the clinician. The tool has not undergone beta testing [26] in real life yet. Since this study is part of a larger research project that aims to incorporate DA use in Singapore healthcare, the tool will undergo field testing in an actual clinic to assess its effectiveness and potential for implementation. A randomized controlled trial will be carried out to compare the HF DA with standard care. This trial will investigate its impact on cost discussions, shared decision-making, and the overall quality of decisions.

There is one other HF medication DA developed by Dickert et al. [15] that also compared ARNI with ACEI. Several differences exist between this study's DA and Dickert's. One notable distinction lies in the compacted content presented within this one-page DA. This DA did not delve into details of the disease state, as patients in the HF clinic had already been diagnosed elsewhere and were already familiar with their condition. Another difference pertains to the administering workflow. In this case, the DA would be provided to patients during their brief wait before meeting with the clinician. Therefore, the DA's content was intentionally condensed to ensure patients have sufficient time to review the entire document. Additionally, this DA did not incorporate questions for patients to reflect on their values or provide a step-by-step guide to select a medication, as we already planned for clinicians to have a discussion with patients on their preferences during the clinic encounter. Lastly, the cost information reflected in this DA is specific to the Singapore healthcare system and is tailored to different patient. Considering these differences, this DA might be better tailored to patients seeking a quick and concise comparison of the two medications. Other countries could learn from this DA's design and implementation process, particularly those facing large patient loads, low health literacy patients, and high out-of-pocket expenses, as it could improve patients' expectations and understanding of their medications. Furthermore, this design and implementation process could be considered for comparison of other medications, interventions, and diagnostic tools across various disease states.

During the pilot testing, an interesting observation was made. Specifically, seven out of the 8 Malay patients were accompanied by more than one family member to their clinic appointments. When presented with the DA, these seven patients tended to discuss its content with their family members. Consequently, they had more questions about the two medications and provided more extensive feedback on the DA. In contrast, other patients typically reviewed the DA on their own and provided more straightforward comments. The research team recognizes this study is not powered to generalize such findings to a specific racial population. However, it raises an important consideration, which suggests that patients who prefer solitary decision-making might favor a more concise DA to simplify their decision process, while those with extensive family involvement might benefit from a more comprehensive and detailed DA. There is a need for further research to gain a deeper understanding of these preferences, some of which might be influenced by cultural differences.

One limitation of this study is that the tool was exclusively tested on outpatient patients and clinicians within one public government hospital. It remains uncertain whether similar needs and feedback will emerge in the inpatient, community, or private healthcare settings. To gather a more comprehensive range of feedback, the study encompassed patients from diverse demographic backgrounds to obtain their insights. Despite these efforts, future research should consider gathering feedback from the aforementioned settings to further enhance the tool. Another limitation of the DA is that it did not provide information on all aspects of both medications. As a result, patient's preference is only based on attributes presented in the DA and their choice might change if new attributes are introduced. The research team faced a dilemma regarding the balance between the potential cognitive burden of excessive information and risk of making a poor decision due to insufficient information. In the end, the research team chose not to alter the content of the DA but adjusted the administration strategy, introducing an additional layer of protection for patients to discuss their preferences with clinicians before their medication is prescribed. The expectation is that clinicians will be able to convince the patient if they consider patient's preference unjustified, ensuring that the final prescribed medication is appropriate and safe. Lastly, the expert panel for this DA consisted of

only two HF clinicians. This number is relatively small, as IPDAS recommends consulting a minimum of five healthcare professionals to gather their perspectives on the DA [19]. The research team deliberately limited the number of clinicians involved to ensure that the subsequent randomized controlled trial could mask participating clinicians from the primary objective of cost discussion, thereby minimizing potential Hawthorne biases. By keeping the expert panel small, the research team was able to preserve a larger pool of eligible clinicians for recruitment in the trial. Following the completion of the trial, a follow-up interview with the participating clinicians has been planned to further evaluate the DA.

4.2. Innovation

The escalating cost of medications underscores the importance of developing innovative interventions to improve medication related cost discussion between patients and clinicians. Several key challenges to discussion like the absence of transparent cost information and limited clinic time necessitate a novel approach.

This DA design addressed these challenges by incorporating individualized medication cost information, tailored to each patient's specific subsidy and financial situation. This localized approach ensures the aid is more useful, relevant, and personalized compared to existing DA. Additionally, unlike existing aids which can be lengthy, this DA was designed to fit on a single page. This brevity allows it to be easily understood and quickly reviewed by patients, thus enhancing its practicality in busy clinical settings. Furthermore, the DA content was constructed for patients to view independently before meeting the clinician. This strategy aims to improve comprehension by providing patients with more time to process the information, allowing for more efficient and focused consultations. These components collectively enhance the DA's effectiveness in facilitating meaningful cost discussions.

4.3. Conclusion

Following needs assessment involving clinicians and iterative user testing with HF patients, the first Singapore developed DA for HF medication was created. The user experience feedback indicated that the DA was positively received and well understood. The next step is to evaluate the DA using a randomized controlled trial. This novel DA will facilitate medication cost discussion between patients and clinicians while empowering patients to make more informed decisions between ARNI and ACEI options.

Patient identifiers

I confirm all patient identifiers have been removed or disguised so the patients described are not identifiable and cannot be identified through the details of the story.

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Data statement

The de-identified data generated and analysed in the study are available from the corresponding author on reasonable request.

IRB statement

This study was approved by the domain specific review board from the National Healthcare Group Singapore under study number: 2022/00281.

CRediT authorship contribution statement

Qianyu Shen: Writing – original draft, Visualization, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Dennis Chin Wee Chua:** Resources, Project administration, Methodology, Investigation. **Po Fun Chan:** Writing – review & editing, Validation, Resources, Methodology. **Hwee Lin Wee:** Writing – review & editing, Validation, Supervision, Methodology, Conceptualization.

Declaration of generative AI and AI-assisted technologies in the writing process

The authors did not use AI and AI-assisted technologies in the writing process.

Declaration of competing interest

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

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pecinn.2024.100342.

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