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Patient preferences for facility-based management of hypertension and diabetes in rural Uganda: a discrete choice experiment

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ABSTRACT

Objective To explore how respondents with common chronic conditions—hypertension (HTN) and diabetes mellitus (DM)—make healthcare-seeking decisions.

Setting Three health facilities in Nakaseke District, Uganda.

Design Discrete choice experiment (DCE).

Participants 496 adults with HTN and/or DM.

Main outcome measures Willingness to pay for changes in DCE attributes: getting to the facility, interactions with healthcare providers, availability of medicines for condition, patient peer-support groups; and education at the facility.

Results Respondents were willing to pay more to attend facilities that offer peer-support groups, friendly healthcare providers with low staff turnover and greater availabilities of medicines. Specifically, we found the average respondent was willing to pay an additional 77 121 Ugandan shillings (UGX) for facilities with peer-support groups over facilities with none; and 49 282 UGX for 1 month of medicine over none, all other things being equal. However, respondents would have to compensated to accept facilities that were further away or offered health education. Specifically, the average respondent would have to be paid 3929 UGX to be willing to accept each additional kilometre they would have to travel to the facilities, all other things being equal. Similarly, the average respondent would have to be paid 60 402 UGX to accept facilities with some health education, all other things being equal.

Conclusions Our findings revealed significant preferences for health facilities based on the availability of medicines, costs of treatment and interactions with healthcare providers. Understanding patient preferences can inform intervention design to optimise healthcare service delivery for patients with HTN and DM in rural Uganda and other low-resource settings.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study systematically designed and disseminated a discrete choice experiment (DCE) with a team of experts in accordance with good practice standards.
⇒ We described three attributes by more than one feature, such as 'getting to the facility' which is described in terms of the costs of transportation and distance. This limits our ability to understand how each of these features contributes to the stated preference.
⇒ There could be bias during the selection of attributes and attribute levels to be included in the DCE which resulted in the exclusion of four tentative attributes from the DCE.

INTRODUCTION

Non-communicable diseases (NCDs) account for 33% of deaths in Uganda.[1] By 2030, the NCD burden is projected to surpass communicable diseases as the leading cause of death in sub-Saharan Africa.[2] Hypertension (HTN) and diabetes mellitus (DM) are among the most common NCDs and prevalence of both conditions is expected to continue to grow over the next decade.[3] The prevalence of HTN and DM among Ugandan adults is approximately 26.4% and 1.4%, respectively, according to two studies using a nationally representative sample.[3 4] Both HTN and DM share highly morbid downstream complications, such as cardiovascular disease (CVD) and chronic kidney disease, if inadequately managed. In sub-Saharan Africa, HTN is the most important contributor to CVD risk[5 6] and DM is associated with a higher rate of morbidity and mortality than in any other region.[7]

There are numerous, well-documented barriers in East Africa along the continuum

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of chronic care delivery for these increasingly common NCDs, including at the levels of public policy, clinical infrastructure, access to medicines and provider and patient education.[8 9] An area that remains understudied, and which represents a major knowledge gap in designing patient-centred NCD service delivery in East Africa, is that of patient preferences for how and where they receive their chronic disease care. Many factors can influence preferences for patients' management of their NCDs, which has been shown to influence the likelihood of patient attrition in outpatient clinics.[10]

Patient preferences for care of HIV, which has become a chronic condition owing to years of focused attention expanding antiretroviral therapy (ART) access and longitudinal HIV care,[8] have been well studied and can serve as a starting point for understanding patient preferences for NCD management. Patients living with HIV in low-income and middle-income countries (LMICs) have demonstrated a variety of preferences, including preferring certain kinds of providers, free or low-cost services, receiving more ART at each visit with fewer subsequent visits required and health facility-based services.[11 12] These preferences may influence how patients with NCDs choose to manage their conditions. However, the preferences of patients living with HIV may not be generalisable to those of patients with NCDs, as indicated by stark differences in the service delivery and experiences of these two patient populations. Unlike ARTs for HIV, which are widely available, the availability and affordability of NCD medicines are often highly variable[8 13] and represent a major access barrier.[14] In the Ugandan private sector, where NCD medicines are more consistently available than the public sector, the average monthly out-of-pocket cost for HTN and DM medicines is not affordable for most Ugandans.[8] Furthermore, facility-based health education and peer support are not as well developed for NCDs as they are for HIV, resulting in variable health education practices and availability of peer groups between facilities.[15] As patients with NCDs experience important differences in care-seeking compared with those with HIV, it is important to understand their preferences specific to their experiences in order to make patient-centred improvements in NCD service delivery.

Determining how people make decisions about their NCD management is essential to understanding where to focus efforts to enhance health service delivery for patients with NCDs. Discrete choice experiments (DCE) offer a way to examine healthcare-related decision-making by clarifying patient preferences.[11 16–18] In a DCE, respondents are presented with two or more 'choice sets' or scenario depictions. Each choice set is defined by 'attributes' or characteristics of potential importance to the respondent. Attributes are chosen from the literature, formative research and/or local expertise. For example, attributes may include characteristics, such as patient-provider concordance, distance to care or cost of care.[11 12] Respondents choose between combinations of these choice sets, each with slight variations in the 'level' of each attribute, such as range, size or quantity. For instance, for the attribute distance to care, respondents are shown different lengths of distance to care as options in different scenarios.[11] Based on selections made by respondents, proclivity towards particular attributes and attribute levels guides researchers in identifying which factors predominantly contribute to decision-making. Conjoint analysis is a similar method used for ranking among patient choices which has been used extensively and can inform good practices for use of DCEs. We developed a DCE for rural-dwelling Ugandan adults with HTN and/or DM to understand factors these patients prioritise when seeking care for the management of these conditions.[19] We focused on a rural setting as rural-dwelling residents likely encounter distinct barriers and factors that influence preferences for care management compared with urban settings. We hypothesised that the cost of treatment and availability of medicines would be among the factors that influence patients' experience engaging in care for NCD management.

METHODS

Study site

We conducted this study in Nakaseke District, a rural district approximately 120 kilometres north of Kampala, the Ugandan capital city. Our study sites were three health facilities that offer integrated NCD clinics: Nakaseke Hospital, Semuto Health Centre IV and Life Care Center. Semuto Health Centre and Nakaseke Hospital are public sector health facilities while Life Care Center is a private-not-for-profit health centre based at the African Community Center for Social Sustainability. These healthcare facilities have specialised clinics for patients with DM and/or HTN that patients attend each month. There, they receive health check-ups, education, medication prescriptions and medication dispensing at the clinic-based pharmacy. Approximately 75, 10 and 15 patients attend Nakaseke Hospital, Semuto Health Centre IV and Life Care Center, respectively, each week for specialised NCD care.[20]

Participant sampling

The target population in this study was adults seeking care for HTN and/or DM at any of the study sites. Respondents were identified at these facilities on NCD clinical days and recruited to participate. Inclusion criteria were: age >18 years, diagnosis of HTN and/or DM and willingness to participate in this cross-sectional survey-based study. In a DCE, precision increases as a function of the inverse square root of the sample size, with an initial significant improvement that plateaus beyond a sample size of 300.[21] Based on the literature, a sample size of 500 reflects increased convergence in precision between studies with different measurement errors.[21] A target of 498 was therefore selected as this would enable us to equally split the administration of each of the three

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DCE versions. Respondents were sampled proportionally according to patient population size of each health facility's NCD clinic.

Patient and public involvement

Interviews with patients from the target population guided development of the DCE.

Attribute selection

The process of generating the DCE included: formative work, attribute selection, attribute level selection, DCE design selection, determination of attribute level combinations and assessment and enhancement of tool comprehensibility. To select attributes for the DCE, we interviewed 18 adults with HTN and/or DM seeking care at participating clinical sites in rural Nakaseke District. This sample size was deemed adequate as it achieved thematic saturation.[22] The interview guide was informed by previous literature that identified factors influential to patient decision-making in other settings as well as by local expertise of our team. The guide covered three main areas: accessing care, accessing medicines and relationships with healthcare providers. Interviews were conducted in Luganda by a single research assistant, then transcribed and translated into English. A directed coding approach was used to code the transcripts and identify attributes and their appropriate levels to be included in the DCE. Directed coding analysis is performed when there is a pre-existing direction about what the researcher is looking for in the qualitative data.[23] This approach allowed three coders (BDN, AKT and SEGM), to identify potential DCE attributes. A multidisciplinary team of experts in public health, medicine, anthropology and NCDs from Makerere University, New York University and Yale University gathered to discuss 10 tentative attributes that emerged from the qualitative data.

The nominal group technique was used to reach a consensus on which attributes would be included in the final DCE tool.[24] In the nominal group technique, experts discussed pros and cons of including each tentative attribute in the DCE and rank-ordered them. The rank-order was discussed and a final re-ranking was performed. Ranking of attributes for inclusion in the DCE took into account the potential for amenability to intervention development and the potential for impact on patients' experience of their care based on interview results. The team reached a consensus on six attributes: (1) getting to the facility; (2) interactions with healthcare providers; (3) availability of medicines for my condition; (4) costs of treatment; (5) patient peer-support groups; and (6) education at the facility. We excluded the use of herbal medicines, range of treatments, perceived quality of care and waiting time because they were felt to be represented by one of the other six priority attributes, unamenable to intervention or ambiguous in interpretation based on interview data.

Attribute levels were determined by the ranges of each attribute that were described by respondents in in-depth interviews. To ensure that we presented a realistic range of attribute levels, we verified the ranges reported in interviews with members of the team who are healthcare workers in the district where the research was based. Some attribute levels describe aspirational, rather than currently realistic, options. An example is 'I receive more than a month's worth of medicine from the facility pharmacy' which is an attribute level within the 'Availability of Medicines for My Condition' attribute. Though not widely offered, dispensing greater than 1 month's supply of medicines is a patient-centred approach increasingly used in differentiated service delivery for HIV care in LMICs.[25] While this option is not currently available for patients with NCDs in Uganda, we included it as an attribute level because of the research team's interest in future expansion of differentiated service delivery models into NCD care in Uganda. Consistent with the Conjoint Analysis Good Practice Checklist, we avoided presenting attribute levels as ranges and limited each attribute to a maximum of four attribute levels.[26] Final attributes and attribute levels arising from this process are shown in figure 1. A brief description of attributes and attribute levels follows:

1. Getting to the facility: describes the distance one would need to travel or the transport cost for travel to reach a hypothetical health facility. Distance was felt to be important for patients who choose to walk to the health facility, while the travel cost was expected to be important for those who use public transport.
2. Interactions with healthcare providers: describes perceived staff turnover and the attitude patients could expect to encounter when interacting with staff at a health facility.
3. Availability of medicines for my condition: describes the amount (in terms of days' worth) of prescribed medicines patients could expect to be dispensed from the health facility pharmacy.
4. Costs of treatment: describes the average monthly amount that patients could expect to pay in Ugandan shillings (UGX) for services and medicines at the health facility (3500 UGX equals approximately US$1).
5. Patient peer-support groups: describes whether there are peer-led support groups available for patients to join at the health facility and their structure. This attribute is based on the current sporadic existence of such groups for patients with diabetes at some public hospitals.[14] In addition to peer support, patients commonly pay an optional fee to join the group and, in return, may receive financial support from the group in the form of medicines or health supplies when these are unavailable at the facility.
6. Education at the facility: describes the provision of facility-based educational health information relevant to their chronic condition(s).

DCE design

The DCE presented participants with two choice sets at a time. Each choice set included a single attribute level

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Attribute	Attribute Levels	Pictorial Representation
Getting to the Facility	I travel <2 km, can choose to walk or pay an average transport cost of 2,000 UGX	
	I travel 5 km, can choose to walk or pay an average transport cost of 5,000 UGX	
	I travel 10 km, can choose to walk or pay an average transport cost of 10,000 UGX	
	I travel 20 km, can choose to walk or pay an average transport cost of 20,000 UGX	
Interactions with Healthcare Providers	The staff at the health facility remain constant and I feel there is a strong level of friendliness in our relationship	
	The staff at the health facility sometimes change and I feel there is a basic level of friendliness in our relationship	
	The staff at the health facility often change and we have not developed a friendly relationship	
Availability of Medicines for my Condition	I receive more than a month's worth of all the prescribed medicine from the facility pharmacy	
	I receive a month's worth of all types of the prescribed medicines from the facility pharmacy	
	I receive some of the prescribed medicines from the facility pharmacy, but not all types or less than a month's worth of medicine	
	I receive none of the prescribed medicines from the facility pharmacy	
Costs of Treatment	Average monthly cost of 0 UGX for medicines and facility visits	
	Average monthly cost of 5,000 UGX for medicines and facility visits	
	Average monthly cost of 10,000 UGX for medicines and facility visits	
	Average monthly cost of 20, 000 UGX for medicines and facility visits	
Patient Peer Support Groups	There are patient support groups to join at the facility. In these groups, patients with the same conditions share about their experiences and if those who choose to pay 10,000 UGX per year, can receive some medicines and/or sugar testing strips in case of stockouts	
	There are no patient groups at the facility to join at these facilities. In these groups, patients with the same conditions share about their experiences and if those who choose to pay 10,000 UGX per year, can receive some medicines and/or sugar testing strips in case of stockouts	
Education at Facility	I receive a lot of education about hypertension and/or diabetes at the facility	
	I receive some education about hypertension and/or diabetes at the facility	
	I receive no education about hypertension and/or diabetes at the facility	

Figure 1 The attributes and their corresponding levels included in the discrete choice experiment (DCE). Six attributes each with two to four attribute levels were included in the DCE based on in-depth interview data, literature review and expert consultation. UGX, Ugandan shillings.

for each attribute. Collectively, a choice set was meant to represent a hypothetical health facility. Given the number of total possible combinations, we used a fractional factorial design to minimise the number of choice sets to which respondents would respond, thereby reducing the cognitive burden of the task.[26 27] To maximise the number of attribute level combinations, we created three different versions. Creating multiple versions of the tool is a strategy to increase the number of combinations presented to respondents, thereby increasing the coverage of hypothetical health scenarios evaluated.[11] This resulted in a total of 24 choice sets, with each participant only completing 8 choice sets. When deploying the DCE, we block-randomised distribution of the survey versions by study site to ensure adequate representation from each study site across all 24 choice sets.

The cognitively demanding nature of DCEs and limited education level of our target population raised concern for a high level of non-response. Therefore, we used a forced-decision design that did not present an opt-out option. In addition, to reduce cognitive burden on respondents, we included pictorial representations designed by a local artist. The inclusion of pictures to represent each attribute aids respondents and is particularly important in settings of variable literacy.[27] To optimise the combination of attribute levels, we used JMP V.15.[28] JMP creates a Bayesian D-optimal DCE design in the multinomial logit model. This approach takes into account commonsense assumptions about preferences within an attribute so that there were no choice sets created in which one hypothetical facility was predicted to be preferable to the other in terms of all attributes. The DCE was designed in accordance with International Society for Pharmacoeconomics and OutcomesResearch's (ISPOR) Good Practice Checklist.[26]

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DCE pre-testing

We pretested the DCE with seven respondents from our target population who were purposively selected to include representation of each disease condition and both sexes.[27] Pretest respondents were presented with eight choice sets and asked to freely express their rationale for making each selection. Respondents expressed understanding of the tasks being asked of them and could complete all choice sets without significant cognitive burden in an average of approximately 30–45 min. Therefore, no changes were made to the tool before administering it.

DCE administration

The DCE was administered in a quiet, private setting at each site on Android-based tablets and was presented in both English and Luganda. Trained research assistants guided respondents through the survey and DCE. Data collection was performed in August and September 2018. To ensure participant understanding regardless of literacy level, research assistants verbally led respondents through the DCE and read every attribute level description aloud for every choice set. Research assistants showed the tablet screen to the participant and pointed to the descriptions and corresponding pictorial representation as they explained each choice set. Research assistants were trained to read attribute levels directly as they appeared on the tablet to ensure consistency in the delivery of each choice set. The standard operating procedures for data collection are available in the Supplemental Information (online supplemental appendix A). We followed ISPOR Good Research Practices for Conjoint Analysis Task Force guidelines for Conjoint Analysis Applications in Health, a checklist, to ensure our methods met expert standards.[26]

Analysis

Stata (V.16) was used to clean and analyse the data. Respondents who completed the DCE were asked questions regarding demographic information along with completion of the DCE, including their age and sex. Single factor analysis of variance was performed to compare age and the number of medicines prescribed at their most recent clinical visit across the three patient condition groups (HTN only, DM only or HTN and DM). We performed Fisher's exact tests to compare sex and facility across the same three patient condition groups. The duration of treatment was excluded from analysis as respondents did not consistently provide units for the duration of treatment. The age and sex of respondents according to the survey version that were completed were also compared.

Mixed logit regression models were used to estimate the relative utility (preference) of each attribute level compared with a reference attribute level in this target population. For the main results of this paper, we estimated a model specification where all attribute variables except distance and cost were coded as dummy (categorical) variables. Distance and cost were coded as continuous linear variables. All attributes were entered as random effects in the regression to allow heterogeneity in participant responses. The advantage of this specification is that model coefficients can be easily used to quantify respondents' willingness to pay (WTP) for marginal changes in each attribute. We present WTP in units of UGX. For reference, US$1 equals approximately 3600 UGX. To explore potential causes of preference heterogeneity, we also estimated model specifications that included interactions by condition and interactions by facility.

In addition to our main analysis, we investigated whether our results were robust to different model specifications by re-estimating each of these three models using a specification where all attributed variables were coded as dummy variables. The advantage of such a specification is it allows us to quantify preferences for the attribute levels that were actually viewed by survey respondents. However, the disadvantage of this approach is it can make quantifying tradeoffs in a meaningful way more difficult. This is why we chose not to report these model coefficients as the main results of our analysis. These mixed logit regression results are reported in the supplementary materials as online supplemental appendix B.

All model specifications produced mean utility coefficients and SD estimates. Mean utility coefficients are considered relative preference weights within a given attribute compared with a reference attribute level. Larger values indicate more preferred attributes. SD estimates capture preference heterogeneity in the population, a possible indication of unmeasured factors influencing the strength and direction of preference.[16]

To assess model validity, we tested whether respondents exhibited straight lining or non-compensatory preferences. Straight lining is characterised by respondents always selecting the same alternative for each choice task (ie, always selected 'choice set 1' or 'choice set 2').[29] Checking the percentage of straight liners is useful because the probability that the more preferred hypothetical facility will always be the same choice set in all eight DCE questions is relatively small. Therefore, if a respondent always chooses choice set 1 (or choice set 2) for all eight DCE questions, this could suggest the respondent was not evaluating the alternatives carefully. If few respondents exhibit straight lining, this provides some evidence that respondents considered the alternatives carefully and provided quality answers.

Respondents with non-compensatory preferences are unwilling to accept a reduction in one desirable attribute in return for a sufficiently large compensating increase in another desirable attribute. Testing whether respondents exhibit this behaviour is important because choice experiments assume respondents are willing to make tradeoffs across attributes. One can test whether respondents have non-compensatory preferences by looking at the respondents' answers to each DCE question and seeing whether they always or nearly always chose the alternative with the better level of one attribute.[29] In this study, we test for non-compensatory preferences by calculating the

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Table 1 Demographics of respondents who participated in discrete choice experiments according to health condition

	DM-only (n=187)	HTN-only (n=202)	HTN/DM (n=107)	P value
Sex (%)				0.036†
Female	57.3	64.8	72	
Male	42.7	35.2	28	
Age (average ±SD)	53.4±14.8	57.5±15.8	58.8±12.1	0.005*
Number of prescribed medicines at last clinical visit (average ±SD)	2.3±1.2	2.2±0.9	4.6±1.4	<0.0001*
Facility (%)				
Life Care Center	5.4	26.7	1.9	<0.0001†
Nakaseke Hospital	81.3	49.5	85	
Semuto Health Centre	13.4	23.8	13.1	

Respondents with DM only, HTN only or both DM/HTN.
*Single factor analysis of variance.
†Fishers' exact test.
DM, diabetes mellitus ; HTN, hypertension.

percentage of respondents that chose the alternative with the better level of one attribute in at least seven of the eight choice tasks.

In addition to these model validity tests, we also attempted to estimate the predictive power of each model specification. Specifically, we excluded responses to a single choice task, then re-estimated each model specification using data collected from responses to the remaining choice tasks. Next, we used the re-estimated models to predict how respondents answered the excluded choice task. We include additional details on this test and its limitations in online supplemental appendix C1 and C2.

All results were reported using the Strengthening the Reporting of Observational Studies in Epidemiology cross-sectional reporting guidelines.[30]

RESULTS

Four hundred and ninety-six respondents across three health facilities completed the DCE, of which 343 (69%) were at Nakaseke Hospital, 87 (18%) were at Semuto Health Centre IV and 66 (13%) at Life Care Center. The mean age was 56 (±14) years and 312 (63%) were women. A sample size of 496 respondents is below the original goal of 498 due to constraints identifying additional unique respondents during the time of data collection. However, this sample size was deemed within appropriate range of our initial target and data collection was completed before analysis was conducted. The frequency of male and female respondents differed significantly among respondents according to health condition, such that female respondents accounted for greater than half of the respondents in each health condition group (p=0.036) (table 1). Age was shown to significantly differ according to health condition, such that respondents with DM only were younger on average (p=0.005) (table 1). Respondents with both HTN and DM on average were prescribed 4.6 medicines at their most recent clinical visit which was significantly greater than respondents with either DM or HTN. Overall, 188 (38%) of respondents had DM only, 203 (41%) had HTN only and 104 (21%) had both conditions. There were significantly more respondents with HTN at Life Care Center (82%) compared with Nakaseke Hospital (29%) or Semuto Health Centre IV (55%) (p<0.0001) (table 1). The Nakaseke Hospital sample consisted of significantly more patients with DM alone (44%) and comorbid HTN/DM (26%) compared with either Semuto Health Centre IV (29% and 16%, respectively) or Life Care Center (15% and 3%, respectively).

We prepared three versions of the survey each with 8 choice sets to increase the total number of presented choice sets to 24. Our 496 respondents were randomised across these versions. Table 2 reports the demographic characteristics for each version. All three versions are fairly balanced in terms of age and sex, though Version 2 has slightly fewer female respondents than Versions 1 or 3.

Table 2 Demographics of respondents who participated in discrete choice experiments according to survey version

Characteristic	Version 1	Version 2	Version 3	Total
Age				
Less than 25 years old	5.13	4.38	6.83	5.45
25–44 years old	17.95	18.75	17.39	18.03
45–64 years old	51.28	48.13	45.34	48.22
65 years old or older	25.64	28.75	30.43	28.3
Sex				
Female	65.66	58.79	66.06	63.51
Male	34.34	41.21	33.94	36.49

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Table 3 Mixed logit regression with all respondents were used to estimate the relative utility of each attribute level compared with a reference attribute level

	ß				SD	
Attribute	Mean	LB	UB	P value	Mean	P value
Peer groups: groups vs none	0.80	0.64	0.96	<0.01	0.06	0.68
Healthcare provider: change/unfriendly vs somewhat friendly	0.35	0.21	0.50	<0.01	0.03	0.68
Healthcare provider: constant/friendly vs somewhat friendly	0.35	0.13	0.56	<0.01	1.72	0.00
Amount of medicines available: <month vs none	0.41	0.24	0.59	<0.01	0.01	0.91
Amount of medicines available: 1 month vs none	0.51	0.36	0.66	<0.01	0.04	0.80
Amount of medicines available: >month vs none	0.53	0.20	0.87	<0.01	3.03	0.00
Distance to facility (per km)	−0.04	−0.05	−0.03	<0.01	0.00	0.78
Education: some vs none	−0.63	−0.77	−0.48	<0.01	0.03	0.80
Education: a lot vs none	−0.58	−0.77	−0.38	<0.01	0.97	0.00
Cost (per 10 000 UGX)	−0.10	−0.20	−0.01	0.03	0.14	0.34

All variables are coded as dichotomous categorical variables except cost and distance.
km, killometre; LB, lower bound; UB, upper bound; UGX, Ugandan shillings .

Patient peer-support groups

Respondents preferred health facilities with peer-support groups compared with facilities without peer-support groups (ß 0.80; 95% CI 0.64 to 0.96; p<0 .01) (table 3). Expressing this preference in terms of WTP, we found the average respondent was willing to pay 77 121 UGX per month for a facility that offered peer groups instead of none (table 4). Respondents with both DM and HTN demonstrated a greater preference for peer-support groups than respondents with only HTN (table 5). An interaction analysis revealed no significant preference differences between the patient peer-support group attribute and facility (table 6).

The finding that respondents preferred health facilities with peer-support groups was robust to changing our model specification in which all attributes were coded as categorical variables (online supplemental table B1). However, under this specification, there were no significant interactions between the patient peer-support group attribute and condition or facility (online supplemental table B2,B3).

Patient interactions with healthcare providers

Respondents demonstrated a preference for facilities with low staff turnover and healthcare providers with whom they have a friendly relationship (ß 0.35; 95% CI 0.21 to 0.50; p<0.01) and moderate staff turnover and somewhat friendly relationship (ß 0.35; 95% CI 0.13 to 0.56; p<0.01) compared with facilities with frequent turnover and providers with whom they do not have a friendly relationship (table 3). In monetary terms, we found the average respondent was willing to pay 34 189 UGX per month for a facility with moderate turnover and somewhat friendly healthcare providers over a facility with frequent turnover and unfriendly providers. The WTP for a facility with low turnover and friendly providers was not statistically significant (table 4). Respondents at Life Care Center demonstrated a greater preference for low

Table 4 Willingness to pay (WTP) per month for changes in individual attributes

Attribute	WTP (UGX per month)	Lower bound WTP (UGX per month)	Upper bound (UGX per month)
Peer groups: groups vs none	77 121	7002	147 239
Healthcare provider: somewhat friendly vs change/unfriendly	34 189	2806	65 571
Healthcare provider: constant/friendly vs change/unfriendly	33 263	−741	67 266
Amount of medicines available: <month vs none	39 796	3216	76 377
Amount of medicines available: 1 month vs none	49 282	2906	95 657
Amount of medicines available: >month vs none	51 481	−2693	105 655
Distance to facility (kms)	−3929	−7527	−332
Education: some vs none	−60 402	−117 942	−2863
Education: a lot vs none	−55 440	−115 667	4788

km, killometre; UGX, Ugandan shillings .

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Table 5 Mixed logit model including interactions for health condition

Attributes	ß				SD	
	Mean	LB	UB	P value	Mean	P value
Peer groups: groups vs none	0.82	0.58	1.05	<0.01	0.00	0.29
Healthcare provider: somewhat friendly vs change/unfriendly	0.47	0.25	0.68	0.21	0.02	0.16
Healthcare provider: constant/friendly vs change/unfriendly	0.27	−0.06	0.60	0.00	1.71	1.38
Amount of medicines available: <month vs none	0.40	0.13	0.68	0.00	0.04	0.22
Amount of medicines available: 1 month vs none	0.40	0.16	0.63	0.99	0.05	0.21
Amount of medicines available: >month vs none	0.34	−0.17	0.85	0.84	3.10	3.58
Distance (km)	−0.03	−0.04	−0.02	0.00	0.00	0.03
Education: some vs none	−0.54	−0.75	−0.33	0.00	0.10	0.09
Education: a lot vs none	−0.54	−0.82	−0.25	0.31	0.99	0.70
Costs of treatment (10 000 UGX)	−0.09	−0.24	0.05	0.00	0.27	0.00
Interaction with DM only						
(Peer groups: groups vs none) × DM only	−0.18	−0.50	0.14	0.27		
(Healthcare provider: somewhat friendly vs change/unfriendly) × DM only	−0.12	−0.42	0.18	0.44		
(Healthcare provider: constant/friendly vs change/unfriendly) × DM only	0.14	−0.33	0.62	0.55		
(Amount available: <month vs none) × DM only	0.04	−0.34	0.42	0.84		
(Amount available: 1 month vs none) × DM only	0.07	−0.26	0.40	0.68		
(Amount available: >month vs none) × DM only	0.39	−0.36	1.14	0.31		
(Distance: (km)) × DM only	−0.01	−0.03	0.01	0.57		
(Education: some vs none) × DM only	−0.10	−0.38	0.19	0.51		
(Education: a lot vs none) × DM only	−0.03	−0.41	0.36	0.90		
(Costs of treatment (10 000 UGX)) × DM only	0.03	−0.17	0.24	0.75		
Interaction with DM and HTN						
(Peer groups: groups vs none) × DM and HTN	0.47	0.06	0.87	0.03		
(Healthcare provider: somewhat friendly vs change/unfriendly) × DM and HTN	−0.29	−0.67	0.09	0.13		
(Healthcare provider: constant/friendly vs change/unfriendly) × DM and HTN	0.09	−0.46	0.65	0.74		
(Amount available: <month vs none) × DM and HTN	0.10	−0.37	0.56	0.68		
(Amount available: 1 month vs none) × DM and HTN	0.60	0.17	1.04	0.01		
(Amount available: >month vs none) × DM and HTN	0.37	−0.52	1.26	0.41		
(Distance (km)) × DM and HTN	−0.04	−0.07	−0.02	0.00		
(Education: some vs None) × DM and HTN	−0.46	−0.84	−0.07	0.02		
(Education: a lot vs none) × DM and HTN	−0.01	−0.50	0.48	0.97		
(Costs of treatment (10 000 UGX)) × DM and HTN	−0.15	−0.41	0.11	0.26		

Relative utility was estimated for respondents with both DM and HTN and DM only compared to respondents with HTN only.
LB: lower bound, UB: upper bound
Indicates significant value.
DM, diabetes mellitus ; HTN, hypertension; km, killometre; UGX, Ugandan shillings .

staff turnover and friendly relationships with staff than respondents at Nakaseke Hospital (table 6). There was no significant interaction between the interactions with healthcare providers attribute and condition (table 5).

Our findings that patients prefer facilities with low turnover and friendly healthcare providers was robust to model specification (online supplemental table B1). So too was our finding that respondents at Life Care Center demonstrated a greater preference for friendly relationships with staff and low staff turnover than respondents at Nakaseke Hospital (online supplemental table B3).

Availability of medicines for condition

Respondents demonstrated a preference for less than a month's worth of medicine (ß 0.41; 95% CI 0.24 to 0.59; p<0.01), 1 month's worth of medicine (ß 0.51; 95% CI 036

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Table 6 Mixed logit model including facility interactions

Attributes	ß				SD	
	Mean	LB	UB	P value	Mean	P value
Peer groups: groups vs none	0.74	0.56	0.92	0	0	0.27
Healthcare provider: somewhat friendly vs change/unfriendly	0.29	0.12	0.45	0.14	0.01	0.16
Healthcare provider: constant/friendly vs change/unfriendly	0.37	0.11	0.63	0	1.72	2.06
Amount of medicines available: <month vs none	0.45	0.24	0.66	0	0.11	0.14
Amount of medicines available: 1 month vs none	0.47	0.3	0.65	1	0.04	0.35
Amount of medicines available: >month vs none	0.34	−0.04	0.71	0.87	3.02	3.53
Distance (km)	−0.04	−0.05	−0.03	0	0	0.02
Education: some vs none	−0.56	−0.72	−0.39	0	0.02	0.16
Education: a lot vs none	−0.56	−0.79	−0.34	0.83	0.83	1.12
Costs of treatment (10 000 UGX)	−0.08	−0.2	0.03	0.03	0.21	0
Interaction with Life Care Center (LCC)						
(Peer groups: groups vs none) × LCC	0.16	−0.28	0.6	0.47		
(Healthcare provider: somewhat friendly vs change/unfriendly) × LCC	0.61	0.19	1.02	0		
(Healthcare provider: constant/friendly vs change/unfriendly) × LCC	0.56	−0.07	1.19	0.08		
(Amount available: <month vs none) × LCC	0.39	−0.13	0.92	0.15		
(Amount available: 1 month vs none) × LCC	0.3	−0.15	0.76	0.19		
(Amount available: >month vs none) × LCC	0.64	−0.29	1.58	0.18		
(Distance (km)) × LCC	0.01	−0.02	0.03	0.56		
(Education: some vs none) × LCC	−0.1	−0.49	0.29	0.62		
(Education: a lot vs none) × LCC	0.17	−0.33	0.67	0.5		
(Costs of treatment (10 000 UGX)) × LCC	−0.21	−0.48	0.07	0.14		
Interaction with Semuto Health Centre IV (SHC)						
(Peer groups: groups vs none) × SHC	0.22	−0.16	0.61	0.25		
(Healthcare provider: somewhat friendly vs change/unfriendly) × SHC	0.07	−0.29	0.42	0.71		
(Healthcare provider: constant/friendly vs change/unfriendly) × SHC	−0.09	−0.65	0.47	0.75		
(Amount available:<month vs none) × SHC	−0.44	−0.89	0.01	0.06		
(Amount available: 1 month vs none) × SHC	0.01	−0.39	0.4	0.97		
(Amount available: >month vs none) × SHC	−0.19	−1.08	0.7	0.68		
(Distance (km)) × SHC	0	−0.03	0.02	0.75		
(Education: some vs none) × SHC	−0.28	−0.62	0.07	0.12		
(Education: a lot vs none) × SHC	−0.29	−0.76	0.17	0.22		
(Costs of treatment (10 000 UGX)) × SHC	−0.02	−0.27	0.22	0.85		

Relative utility was estimated for respondents sampled from Life Care Clinic (LCC) and SHC compared with Nakaseke Hospital.
LB: lower bound, UB: upper bound
DM, diabetes mellitus; HTN, hypertension; km, killometre; UGX, Ugandan shillings .

to 0.66; p<0.01), and more than 1 month's worth of medicine (ß 0.53; 95% CI 0.20 to 0.87; p<0. 01) compared with no medicine (table 3). Expressing these preferences in monetary terms, we found the average respondent was willing to pay 49 282 UGX to receive 1 month's worth of medicine over no medicine. Similarly, the average respondent was willing to pay 39 796 UGX for less than 1 month's worth of medicine over no medicine. The average WTP for more than 1 month's worth of medicine was 51 481 UGX, but this estimate was not statistically significant as the 95% CI included zero (table 5). Respondents with both HTN and DM demonstrate greater preference for a facility where 1 month of medication is available compared with those with only HTN (table 5).

However, our results differ slightly in each model specification. When distance and cost are coded as categorical variables, we found no significant preference for receiving no medicines compared with receiving less than

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a month's worth of medicine (ß −0.11; 95% CI −0.36 to 0.14; p=0.3710) (online supplemental table B1). Respondents preferred more than 1 month's worth of medicine (ß 1.15; 95% CI 0.89 to 1.41; p<0.001) and 1 month's worth of medicine (ß 1.31; 95% CI 1.09 to 1.54; p<0.001) compared with no medicine. Respondents with both HTN and DM demonstrated greater preference for a facility where 1 month of medicine is available compared with those with only HTN (Table B2). We also found respondents from Life Care Center demonstrated a greater preference for availability of medicines compared with Nakaseke Hospital (Table B3). Similarly, respondents from Semuto Health Centre IV demonstrated a lower preference for availability of medicines compared with Nakaseke Hospital (Table B3).

Getting to the facility

In the main results of our analysis, where distance was included as a single continuous variable, we found that respondents preferred travelling shorter distances (ß −0.04; 95% CI −0.05 to −0.03; p<0.01) (table 3). This preference is reflected in the negative WTP we estimated for distance. Specifically, we found the average respondent must be paid 3929 UGX per month to accept each additional kilometre (km) they must travel to the facility (table 4). Respondents with both DM and HTN demonstrated a greater preference for shorter distances than respondents with only HTN (table 5). There was no significant interaction between the getting to the facility attribute and facility (table 6).

However, these results were not robust to model specification. Specifically, in the model where cost and distance were included as a series of categorical variables, we found respondents preferred travelling 10 km over travelling 2 km (ß 0.53; 95% CI 0.34 to 0.72; p<0.01) and preferred travelling 5 km over 2 km (ß 0.66; 95% CI 0.35 to 0.97; p<0.01) (online supplemental table B1). However, there was no preference demonstrated between travelling 20 km compared with 2 km (ß 0.24; 95% CI −0.03 to –0.50; p=0.08). In this model specification there is significant heterogeneity noted in comparing 20 km to 2 km (SD 1.42, p<0.01) and when comparing 5 km to 2 km (SD 2.57, p<0.01). This heterogeneity does not appear to be linked to condition or facility as there was no significant difference in preferences when including interactions for these variables (online supplemental table B2,B3). To investigate what might be causing the direction of our results to change, we estimated a model specification where distance was included as a series of categorical variables (as in online supplemental table B1) and only cost was included as a linear continuous variable (as in table 3). Interestingly, in this specification, we found the direction on the coefficients still indicated that respondents preferred shorter distances.

Education at the facility

In the main results of our analysis, we found respondents disfavoured receiving some health education compared with none (ß −0.63; 95% CI −0.77 to −0.48; p<0.01). Similarly, we found respondents disfavoured receiving a lot of health education compared with none (ß −0.58; 95% CI −0.77 to −0.38; p<0.01) (table 3). These preferences are reflected in respondents needing to be compensated to receive health education. Specifically, the average respondent would need to be compensated 55 440 UGX per month to receive a lot of health education. The WTP for some education is not statistically different from zero (table 4).

It is worth noting that there was significant preference heterogeneity around education. Specifically, there was significant heterogeneity when comparing a lot of health education compared with none (SD 0.99, p<0.01). Interaction analysis shows that respondents with DM and HTN demonstrate less preference for health education compared with those with HTN only (table 5).

However, our results for respondent preferences toward education at the facility differ slightly in each model specification. Specifically, in the model where cost and distance are included as categorical variables, we found respondents disfavoured receiving some health education compared with none (ß −0.35; 95% CI −0.50 to −0.1; p<0.01), but there was no significant preference between receiving a lot of education compared with none (online supplemental table B1). In addition, there was no significant interaction between education and condition (online supplemental table B2). However, interaction analysis showed that respondents from Semuto Health Centre IV demonstrate less preference for health education compared with those from Nakaseke Hospital (online supplemental table B3).

Costs of treatment

Respondents demonstrated a preference for less costly treatment (ß −0.01 per 10 000 UGX; 95% CI −0.20 to −0.01; p=0.03) (table 3). There was no significant interaction between cost and condition or facility (tables 5 and 6).

The finding that respondents prefer less costly treatment is robust to model specification. Specifically, the greatest disutility value was seen when comparing 10 000 UGX to free treatment (ß −2.51; 95% CI −2.83 to −2.19; p<0.01). However, interaction analysis showed that respondents with both DM and HTN demonstrate greater disutility for paying 10 000 UGX to free treatment compared with respondents with only HTN (Table B2). There was no significant interaction between cost and facility (Table B3).

Model validity check

We found that only 1.6% of respondents (8 out of 496) exhibited straight lining in the survey (ie, always chose 'choice set 1' or 'choice set 2'). In a study of 55 health-related DCEs, the IQR for the percentage of straight-lining respondents was 1%–8%.[29] Similarly, we found that only 32.7% of respondents (162 out of 496) exhibited non-compensatory preferences (ie, always chose the

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option that either always had peer groups, the friendlier providers with lowest turnover, the greatest amount of medication available, the shortest distance, the least education or the lowest cost). In the aforementioned study, the IQR for the percentage of respondents exhibiting non-compensatory preferences was 11%–35%.[29] This suggests the interval validity of our study is consistent with other health-related DCEs.

DISCUSSION

In this study, we administered a DCE to evaluate patient preferences for HTN and DM management in rural Uganda. Our findings indicate that patients who are engaged in HTN and/or DM care in this setting have preferences for how they would like that care to be delivered, at least within the six attributes we tested. Specifically, the DCE results demonstrated preferences for travelling distances of 5 km and 10 km, preferring lower staff turnover and friendly providers, preferring at least 1 month or more of medications per visit, free treatment, peer-support groups at facilities and no health education.

Respondents preferred health facilities with peer-support groups compared with those without (table 3) and on average are willing to pay 77 121 UGX for a facility that offers peer groups compared with those without (table 4). In these groups, which have been sporadically established in Uganda and have typically focused on DM, respondents can choose to pay about 10 000 UGX and receive some medicines to supplement stockouts. As a group, they can also speak about their shared experience living with their condition and provide social support to one another.[20] Peer-support groups provide a well-established intervention associated with positive outcomes that has yet to be fully explored in the East African context.[20 31 32] These findings are consistent with our hypothesis that respondents would prefer peer-support groups regardless of their health condition or facility where they receive care.[20] While respondents significantly prefer peer-support groups, this lower value indicates that the presence of peer-support groups is less desirable compared with other attributes.

Kinder staff with lower rates of turnover were preferred by respondents and generally respondents indicated WTP more for these interactions with staff (tables 3 and 4). This finding indicates how important interactions with healthcare workers are for respondents in determining where to seek NCD care as has been demonstrated in HIV management.[11 33] This preference provides a promising opportunity for intervention given that educating healthcare workers on perceptions of care is actionable.[34] This represents an intervenable factor as it is relatively easy to measure patient experience of staff attitudes and interactions and has previously been demonstrated that improvement in the relationships between patients and staff is associated with patients perceiving that their disease management is less burdensome.[35]

Respondents indicated that they preferred greater medicine availability (table 3) and were willing to pay more for greater medicine availability (table 4). However, our analysis did indicate that this finding may not be fully robust to changes in model specification. Specifically, when cost and distance were coded as categorical variables, we found there was no statistically significant difference in preference for receiving less than a month's worth of medicine compared with no medicine. This is unexpected as we predicted that respondents would prefer receiving more medicines in a dose-dependent fashion. Specifically, we predicted that receiving more than a month of medicine would be the most desirable option and that receiving no medicines would be the least preferred option. Respondents may have indicated a month or more worth of medicines as preferred given this aligns with their monthly scheduled clinical visits. In our qualitative work, we found that respondents attending these clinics appreciate the convenience of receiving their medicines at the health facility as the cost of medicines is more affordable. However, if they must go elsewhere to purchase medicines, as might be the case if they received less than a month's worth of medicine, then the cost of medications may be higher.[20] These findings guide potential interventions as increasing the amount of medicines dispensed to respondents, which was previously shown to be significantly preferred for individuals with HIV, may be less desirable for NCD management.[11] Being able to consistently dispense 1 month's worth or more of medicine, such as through differentiated service delivery models, is likely to be more effective in improving respondents' experience managing their NCDs.[36]

It might be expected based on prior research in other conditions/settings that respondents would prefer to travel the least distance/time possible to receive care. In our study, the relationship between the strength of preference and distance differed based on model specification. We believe this changing direction of preferences under different model specifications could be due to correlation between distance and cost created by imposing this functional form on the cost variable. As a result, it is difficult to draw conclusions from these findings with any certainty. Given the high cost of transportation and the fact that distance is a widely accepted access barrier, we would speculate that patients would generally prefer to travel shorter distances to seek chronic care, should the quality of that care be improved in line with their other stated preferences.[37–40] However, literature suggests that distance can be viewed as a relative barrier for rural dwelling individuals, who might be willing to travel greater distances for higher quality care.[37 38] In light of the change in preference according to model specifications, additional work is required to evaluate how distance to the facility influences respondent preferences.

This study revealed that respondents prefer receiving no health education at the facility compared with receiving some, but no preference for receiving a lot of health education compared with none (table 3). The

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average participant is willing to pay 60 402 UGX for a facility that offers no education instead of some education or 55 440 UGX for a facility that offered no education instead of a lot (table 4).This finding is counterintuitive because we predicted that respondents would prefer receiving more health education in a dose-dependent manner.[41] Respondents' perception of health education may be related to the perceived knowledge level of the provider providing that education.[42] If respondents had a previous negative experience receiving education, they may be more likely to prefer receiving no health education in the future. However, if that were the case one would expect there to be a preference for no health education compared with a lot of education, but that is not seen here. This finding indicates that education may not be an important determining factor in where respondents would prefer to receive care. Due to inconsistency in the pattern of responses, education represents a less promising factor to intervene on to improve respondents' experience accessing healthcare in this context.

Lastly, within the costs of treatment attribute, respondents significantly preferred free monthly visits and medicines compared with all other cost options (table 3), consistent with previous findings.[11 14 43] This finding is important as it indicates that interventions targeting cost likely need to reduce costs to patients as much as feasibly possible as there is no indicated minimum cost that is acceptable. Another finding was that preference for free monthly treatment compared with paying 10 000 UGX monthly was the strongest compared with any other amount (online supplemental table B3). One might expect respondents to prefer to pay 5000 UGX compared with 10 000 UGX. However, it is surprising that respondents indicated a greater WTP 20 000 UGX compared with 10 000 UGX. Respondents who can afford to pay this much may perceive paying more as relating to greater quality in medicines and treatment, such as that offered through private healthcare.[44 45] Respondents with both HTN and DM demonstrate the greatest disutility for paying 10 000 UGX to free treatment compared with those with only HTN (Table B2). This finding could indicate that respondents with HTN and DM incur greater costs or have greater financial constraints related to their conditions, thereby making free treatment more preferred.

There are limitations to this study and the DCE tool that affect the conclusions that can be drawn from this data set. First, in defining the attribute 'getting to the facility' we attempted to encompass the features of transportation that impact people when attending health facilities. We created attribute levels that described both the distance that respondents have to travel and the cost if they were to pay for transport for that distance. As a result, while this attribute provides valuable information regarding distance respondents will travel, it does not elucidate the method by which respondents are travelling, either by walking or paying for transport. It is quite possible that respondents may differ in terms of how important facility distance is according to their mode of transport. In addition, the attribute 'interactions with healthcare providers' incorporates both staff turnover and kindness. Combining these features into a single attribute limits our interpretation of which factor describing 'interactions with healthcare providers' is driving their preference. This also resulted in limiting the combinations that were presented; we assumed that 'interactions with healthcare providers' could be described in these terms as negative, neutral or positive. However, this ignored the fact that staff turnover and friendliness do not necessarily relate to each other. As a result, respondents were not presented all possible combinations, such as a facility with friendly staff and high-staff turnover. Second, there could be bias in the method for selection of attributes and attribute levels to be included in the tool. As previously reported, the final attributes were selected from a list of tentative attributes through the nominal group technique and that we as a team agreed were actionable, such that an intervention could be implemented to address them. Consequently, four tentative attributes (use of herbal medicines, range of treatments, perceived quality of care and waiting time) revealed in the qualitative research were excluded from the DCE. We do not know how these attributes would compare to those included in the final DCE. While these are limitations in this study, strengths include the systematic selection of attributes to be included in the DCE and a large sample size. In addition, we had a team that was balanced by diversity in expertise, representative by gender and local content expertise which we also feel strengthened the quality of tool and contextualisation of results. These findings provide valuable insight into how respondents make decisions about seeking care for the management of HTN and DM in rural Uganda. It is essential to note that respondents were sampled from health facilities at which they receive care. Therefore, this study allows us to better understand the preferences for patients who are already engaged in care for their NCDs. However, it does not yield information on individuals living with HTN or DM in Nakaseke District who are not engaged in care. Patients engaged in care may differ in terms of their preferences for health facility from those not yet engaged in care. Therefore, we may use this information to improve the experience or engagement of patients who are already seeking management of their NCDs, but are unable to rely on these results to recruit patients to care.

An additional limitation of this study is that a dominance test was excluded from our design as we were concerned about the burden of the choice tasks given the number of attributes and attribute levels of our DCE. A dominance test adds an additional task for respondents to complete that does not yield information regarding respondents' preferences. While we recognise the limitation in excluding the dominance test, a review of 112 health-related DCE's found that only 25% included a dominance test, indicating that it is not a standard of practice in DCE design.[46] As a result, we looked at the frequency of 'straight-lining' in respondents' answers.

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Straight-lining, when a respondent always selects either option A or option B, indicates that a respondent may not be evaluating the options carefully. Our study showed only 2% of respondents engaged in straight-lining, which is consistent with the median percentage of straight-liners in health-related DCE studies.[29] The low number of straight-liners indicates that our respondents carefully considered their answers.

In summary, the purpose of this DCE was to better understand the preferences of respondents in rural Uganda with HTN and DM such that interventions could be designed with an end-user-centric approach to maximise impact on their experience managing their NCDs. Respondents indicated significant preferences for positive interactions with healthcare providers, amount of available medicines prescribed at each visit and free treatment with regard to their NCD management. Therefore, these factors may be promising targets for intervention to improve delivery of healthcare for the management of NCDs in rural Uganda.

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Contributors SEGM, JIS, MA-H contributed to concept development. SEGM, AKT, ARK performed data collection. SEGM, AKT, and BDN performed the qualitative analysis. SEGM, AKT, ARK, EHD, CN, TR, NLH, MA-H, RN, RK, CNK, IS, and JIS contributed to development of DCE tool. DG and BT-S performed statistical analysis and interpretation of results. DW performed additional and confirmatory statistical analysis, guided interpretation, and addressed reviewer comments. SEGM prepared the draft manuscript. All authors commented on the draft manuscript and approved the final manuscript for submission. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted. JIS is the guarantor for this work.

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Data availability statement Data are available upon reasonable request. All data requests should be submitted to the corresponding author for consideration. Access to anonymised data may be granted following review. Data will be shared, with investigator support, after approval of a proposal, with a signed data access agreement.

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Supplemental

Appendix A: Standard Operating Procedure for DCE Administration [11])

Purpose

This SOP describes how to deliver the Discrete Choice Experiment (DCE) questionnaire in Nakaseke, Uganda on the Android tablet. This DCE aims to understand the factors that respondents take into consideration when obtaining medicines for hypertension and/or diabetes. This is a quantitative research methodology to measure the relative importance and trade-offs respondents will tolerate for particular health facility characteristics.

Scope

This SOP is applicable for all research assistants and data supervisors involved in DCE data collection.

Responsibilities

I. All research assistants involved in data collection are responsible for understanding and following the protocols outlined in this SOP.
II. The study coordinator is responsible for ensuring that all research assistants have access to this SOP, have been trained in accordance to this SOP and is available to answer any questions for clarification.

Procedures

Discrete Choice Experiments present respondents with two hypothetical health care facilities described in terms of 6 attributes. For each pair of facilities, respondents are asked to choose which one they would prefer. This DCE aims to understand how respondents decide where to obtain their medicines for hypertension and/or diabetes. The DCE will be administered to a sample of 300 to 500 respondents at three clinics: Nakaseke Hospital, Semuto Health Centre IV and Life Care Clinic. The number of respondents recruited from each clinic will be approximately proportional to the clinic size. There are 3 different versions of the DCE: A, B, and C. You will cycle through the different versions according to facility while leading respondents through DCE. Research assistants will be given a paper to mark down the number of each version he or she has facilitated at each health facility to ensure that each version is completed with approximately equal frequency at each site.

The eligibility criteria the for participation in the DCE are:

- Over the age of 18
- Diagnosed with hypertension and/or diabetes

The DCE tool is programmed in both English and Luganda. Both languages will be presented in the DCE.

The data manager has the responsibility of initiating the DCE surveys on Kobocollect and stopping data collection once 500 respondents have participated. The data manager will delete the DCE surveys from Kobocollect once 500 respondents have participated.

For the first question:

To begin, you will describe the choice task that is being asked of them and define each attribute and their meaning to the respondents before proceeding to the first choice set. This description is provided in the introduction to the tool that precedes the choice tasks.

Read the tool introduction in its entirety. Make sure the respondent understands that there will be 8 choice sets followed by demographic questions. Let the respondent ask any question about the DCE module and ensure that they understand what they are being asked to do.

Ensure the tablet is visible to the respondent at all times; they must be able to see what you are reading. If necessary, leave the tablet in the hand of the respondent as he or she contemplates the question and his or her answer. Then, take back the tablet and select the choice he or she has indicated.

The first column tells us the characteristics. Facility A is the left column. Facility B is the column on the right.

For each of the questions, make sure you read out both Facility A and B in the following way:

Example: "In Facility A, I receive more than a month's worth of your prescribed medicines from the facility pharmacy. The staff at the health facility sometimes change and I feel there is a basic level of friendliness in our relationship. I travel 10 km and can choose to walk or pay an average cost of 10 000 UGX. I pay an average monthly cost of 10 000 UGX for medicines and facility visits. There are no patient support groups to join at the facility. In these groups, respondents with the same conditions share about their experiences and those who choose to pay 10 000 UGX per year can receive some medicines and/or sugar testing strips in case of stockouts. I receive some education about diabetes at the facility"

As you read, make sure you point at every image so that the respondent understands how you are reading the graph.

Then ask: "Do you prefer going to Facility A or Facility B given the circumstances?"

Tap the selected answer and proceed to the next question.

Repeat the same process for each question. Be consistent with each choice set.

What you are allowed to do:

- Clarify the differences between the two facilities to the respondent. Example, if the respondent complains that the two facilities look the same, you are allowed to point out how they are different.
- You are allowed to repeat what each attribute means

What you are **not allowed** to do:

- Stop reading out the models. Every question needs to be read out as previously described in its entirety.
- Asking or framing questions in a different way than previously described.
- Suggesting what respondents should answer, highlighting or judging certain characteristics.

Appendix B. Additional Mixed Logit Regression Results

	ß				St. Dev.	
Attribute	Mean	LB	UB	p-Value	Mean	p-Value
Peer Groups: Groups vs None	0.27	0.07	0.46	0.01	0.03	0.82
Healthcare Provider: somewhat friendly vs. change/unfriendly	0.66	0.50	0.83	<0.01	0.03	0.85
Healthcare Provider: constant/friendly vs change/unfriendly	1.03	0.79	1.27	<0.01	0.12	0.35
Amount of Medicines Available: <month vs none	-0.11	-0.36	0.14	0.39	0.98	<0.01
Amount of Medicines Available: 1 month vs none	1.32	1.09	1.54	<0.01	0.86	<0.01
Amount of Medicines Available: >month vs none	1.13	0.88	1.39	<0.01	0.24	0.12
Distance: 5km vs 2km	0.66	0.35	0.97	<0.01	2.57	<0.01
Distance: 10km vs 2km	0.53	0.34	0.72	<0.01	0.17	0.17
Distance: 20 km vs 2km	0.24	-0.03	0.50	0.08	1.42	<0.01
Education: Some vs None	-0.35	-0.50	-0.19	<0.01	0.05	0.62
Education: A lot vs None	0.09	-0.11	0.29	0.38	0.58	<0.01
Costs of Treatment per month: 5000 vs 0 UGX	-0.83	-1.09	-0.56	<0.01	0.14	0.19
Costs of Treatment per month: 10,000 vs 0 UGX	-2.51	-2.83	-2.19	<0.01	0.06	0.62
Costs of Treatment per month: 20,000 vs 0 UGX	-1.13	-1.39	-0.87	<0.01	0.12	0.33

Table B1: Mixed logit regression with all respondents were used to estimate the relative utility of each attribute level compared to a reference attribute level. All variables are coded as dichotomous categorical variables.

	ß				St. Dev.	
Attributes	Mean	LB	UB	p-Value	Mean	p-Value
Peer Groups: Groups vs None	0.32	0.04	0.60	0.02	0.02	0.87
Healthcare Provider: somewhat friendly vs. change/unfriendly	0.74	0.49	0.99	0.00	0.05	0.70
Healthcare Provider: constant/friendly vs change/unfriendly	1.00	0.69	1.31	0.00	0.11	0.39
Amount of Medicines Available: <month vs none	-0.03	-0.38	0.33	0.88	0.99	0.00
Amount of Medicines Available: 1 month vs none	1.14	0.82	1.46	0.00	0.85	0.00
Amount of Medicines Available: >month vs none	1.02	0.67	1.37	0.00	0.23	0.15
Distance: 5km vs 2km	0.31	-0.15	0.77	0.19	2.61	0.00
Distance: 10km vs 2km	0.42	0.16	0.68	0.00	0.16	0.21
Distance: 20 km vs 2km	0.24	-0.13	0.62	0.21	1.45	0.00
Education: Some vs None	-0.21	-0.45	0.03	0.08	0.06	0.52
Education: A lot vs None	0.12	-0.17	0.42	0.41	0.59	0.00
Costs of Treatment: 5000 vs 0 UGX	-0.82	-1.19	-0.45	0.00	0.16	0.15
Costs of Treatment: 10,000 vs 0 UGX	-2.35	-2.77	-1.93	0.00	0.05	0.68
Costs of Treatment 20,000 vs 0 UGX	-1.06	-1.43	-0.70	0.00	0.07	0.63
Interaction with DM only						
(Peer Groups: Groups vs None) x DM only	-0.23	-0.60	0.14	0.22		
(Healthcare Provider: somewhat friendly vs. change/unfriendly) x DM only	-0.12	-0.46	0.23	0.52		
(Healthcare Provider: constant/friendly vs change/unfriendly) x DM only	0.04	-0.34	0.43	0.83		

(Amount Available: <month vs none) x DM only	-0.17	-0.67	0.33	0.51
(Amount Available: 1 month vs none) x DM only	0.10	-0.33	0.54	0.65
(Amount Available: >month vs none) x DM only	0.11	-0.34	0.57	0.63
(Distance: 5km vs 2km) x DM only	0.53	-0.15	1.20	0.13
(Distance: 10km vs 2km) x DM only	0.31	-0.06	0.68	0.10
(Distance: 20 km vs 2km) x DM only	0.13	-0.38	0.65	0.61
(Education: Some vs None) x DM only	-0.24	-0.57	0.10	0.16
(Education: A lot vs None) x DM only	-0.16	-0.58	0.26	0.45
(Costs of Treatment: 5000 vs 0 UGX) x DM only	0.02	-0.48	0.53	0.94
(Costs of Treatment: 10,000 vs 0 UGX) x DM only	-0.10	-0.65	0.44	0.71
(Costs of Treatment 20,000 vs 0 UGX) x DM only	0.00	-0.50	0.51	0.99
Interaction with DM and HTN				
(Peer Groups: Groups vs None) x DM and HTN	0.25	-0.21	0.70	0.29
(Healthcare Provider: somewhat friendly vs. change/unfriendly) x DM and HTN	-0.09	-0.52	0.34	0.69
(Healthcare Provider: constant/friendly vs change/unfriendly) x DM and HTN	0.16	-0.30	0.63	0.49
(Amount Available: <month vs none) x DM and HTN	-0.15	-0.77	0.48	0.65
(Amount Available: 1 month vs none) x DM and HTN	0.81	0.26	1.36	0.00*
(Amount Available: >month vs none) x DM and HTN	0.40	-0.17	0.96	0.17

(Distance: 5km vs 2km) x DM and HTN	0.70	-0.10	1.50	0.09
(Distance: 10km vs 2km) x DM and HTN	0.00	-0.45	0.46	1.00
(Distance: 20 km vs 2km) x DM and HTN	-0.24	-0.86	0.39	0.46
(Education: Some vs None) x DM and HTN	-0.23	-0.64	0.19	0.28
(Education: A lot vs None) x DM and HTN	0.18	-0.37	0.73	0.53
(Costs of Treatment: 5000 vs 0 UGX) x DM and HTN	-0.10	-0.73	0.53	0.75
(Costs of Treatment: 10,000 vs 0 UGX) x DM and HTN	-0.75	-1.44	-0.07	0.03*
(Costs of Treatment 20,000 vs 0 UGX) x DM and HTN	-0.43	-1.09	0.23	0.20

Table B2. Mixed Logit Model Including Interactions for Health Condition. Relative utility was estimated for respondents with both DM and HTN and DM only compared to respondents with HTN only. * Indicates significant value.

	ß				**St. Dev.**	
Attributes	**Mean**	**LB**	**UB**	**p-Value**	**Mean**	**p-Value**
Peer Groups: Groups vs None	0.13	-0.10	0.36	0.26	0.04	0.79
Healthcare Provider: somewhat friendly vs. change/unfriendly	0.54	0.35	0.74	0.00	0.03	0.82
Healthcare Provider: constant/friendly vs change/unfriendly	0.88	0.61	1.14	0.00	0.10	0.41
Amount of Medicines Available: <month vs none	-0.06	-0.35	0.23	0.69	1.02	0.00
Amount of Medicines Available: 1 month vs none	1.31	1.05	1.58	0.00	0.85	0.00
Amount of Medicines Available: >month vs none	1.18	0.89	1.48	0.00	0.22	0.14

Distance: 5km vs 2km	0.75	0.36	1.13	0.00	2.90	0.00
Distance: 10km vs 2km	0.65	0.43	0.88	0.00	0.19	0.13
Distance: 20 km vs 2km	0.28	-0.02	0.58	0.07	1.46	0.00
Education: Some vs None	-0.28	-0.47	-0.09	0.00	0.05	0.63
Education: A lot vs None	0.17	-0.06	0.41	0.15	0.44	0.00
Costs of Treatment: 5000 vs 0 UGX	-0.78	-1.09	-0.48	0.00	0.13	0.27
Costs of Treatment: 10,000 vs 0 UGX	-2.59	-2.95	-2.22	0.00	0.05	0.65
Costs of Treatment 20,000 vs 0 UGX	-1.06	-1.36	-0.76	0.00	0.12	0.35
Interaction with Life Care Centre (LCC)						
(Peer Groups: Groups vs None) x LCC	0.10	-0.49	0.69	0.73		
(Healthcare Provider: somewhat friendly vs. change/unfriendly) x LCC	0.78	0.25	1.30	0.00*		
(Healthcare Provider: constant/friendly vs change/unfriendly) x LCC	1.29	0.72	1.86	0.00*		
(Amount Available: <month vs none) x LCC	0.93	0.16	1.70	0.02*		
(Amount Available: 1 month vs none) x LCC	0.60	-0.06	1.27	0.08		
(Amount Available: >month vs none) x LCC	0.85	0.21	1.50	0.01*		
(Distance: 5km vs 2km) x LCC	-0.48	-1.57	0.62	0.39		
(Distance: 10km vs 2km) x LCC	-0.21	-0.71	0.29	0.41		
(Distance: 20 km vs 2km) x LCC	-0.04	-0.77	0.70	0.92		
(Education: Some vs None) x LCC	-0.25	-0.76	0.26	0.34		
(Education: A lot vs None) x LCC	0.34	-0.24	0.92	0.25		
(Costs of Treatment: 5000 vs 0 UGX) x LCC	1.12	0.39	1.86	0.00*		
(Costs of Treatment: 10,000 vs 0 UGX) x LCC	0.04	-0.53	0.61	0.89		
(Costs of Treatment 20,000 vs 0 UGX) x LCC	0.32	-0.32	0.96	0.32		
Interaction with Semuto Health Centre IV (SHC)						

(Peer Groups: Groups vs None) x SHC	0.29	-0.16	0.74	0.21
(Healthcare Provider: somewhat friendly vs. change/unfriendly) x SHC	0.22	-0.21	0.65	0.32
(Healthcare Provider: constant/friendly vs change/unfriendly) x SHC	0.00	-0.48	0.49	0.99
(Amount Available: <month vs none) x SHC	-0.77	-1.43	-0.11	0.02*
(Amount Available: 1 month vs none) x SHC	-0.03	-0.56	0.50	0.91
(Amount Available: >month vs none) x SHC	-0.70	-1.28	-0.12	0.02*
(Distance: 5km vs 2km) x SHC	-0.04	-0.90	0.82	0.93
(Distance: 10km vs 2km) x SHC	-0.06	-0.52	0.39	0.78
(Distance: 20 km vs 2km) x SHC	0.09	-0.57	0.75	0.80
(Education: Some vs None) x SHC	-0.44	-0.85	-0.04	0.03*
(Education: A lot vs None) x SHC	-0.75	-1.31	-0.18	0.01*
(Costs of Treatment: 5000 vs 0 UGX) x SHC	-0.14	-0.82	0.53	0.68
(Costs of Treatment: 10,000 vs 0 UGX) x SHC	0.01	-0.48	0.50	0.96
(Costs of Treatment 20,000 vs 0 UGX) x SHC	0.09	-0.44	0.62	0.75

Table B3. Mixed Logit Model including facility interactions. Relative utility was estimated for respondents sampled from Life Care Clinic (LCC) and Semuto Health Centre IV (SHC) compared to Nakaseke Hospital. * Indicates significant result.

Appendix C. Results of Predictive Validity Test

In the main analysis for this paper, we estimate two mixed logit model specifications using data collected from responses to 24 choice tasks that were included in the DCE design of this study. Specifically, we estimated one model where all variables were coded as dummy variables except distance and cost, which were coded as linear continuous variables. This is the model specification was used as the basis for the main results discussed in our paper. In addition, we also estimated a model where all variables were coded as dummy variables including distance and cost. This specification was included as a robustness check.

To test the predictive validity of these mixed logit models, we conducted the following analysis. First, we excluded one choice task, then re-estimated each model specification using data collected from responses to the remaining 23 choice tasks. We did this for all 24 choice tasks, results in 48 separate mixed logit models (one for each model specification). Next, we used the estimated models to predict respondent answers to the excluded choice task. We then compared the predicted answers to the observed answers to see if our predictions were correct or not. If the prediction was correct, we considered this a "hit". If the prediction was incorrect, we considered this a "miss". Lastly, we calculated the percentage of responses the model correctly predicted (i.e., the "hit rate"). This hit rate can range from 0% (i.e., no responses were correctly predicted) to 100% (i.e., all responses were correctly predicted).

Figure B1 provides a summary of hit rates for the model specification where distance and cost were coded as linear continuous variables (i.e., the main results of this paper). The hit rate for this model ranges from 5% to 83%. The average hit rate for this specification is 30%.

Figure B2 provides a similar summary of hit rates for the model specification where all variables were coded as dummy variables. The hit rate for this model ranges from 5% to 92%. The average hit rate for the model specification where all variables were coded as dummy variables is 39%.

This analysis is informative because it shows that the models being estimated can potentially have significant predictive power, depending on the choice task being excluded. However, we do believe there are limitations. First, we believe our study is the first to conduct this type of analysis, so it is difficult to say whether our average hit rate is lower than one would expect compared to the literature. Second, by excluding choice tasks, we are actually reducing the predictive power of the random utility models we estimate because we are estimating the model on a smaller subsample than we intended when planning this study. Ideally, the predictive power of the mixed logit models we estimated would be tested using a hold task that all respondents saw that would not need to be used in model estimation. Third, just because a mixed logit model has low predictive power does not necessarily mean it does not provide reliable information on the tradeoffs respondents are willing to make between attributes (the main focus of this study).

Figure B1. Prediction accuracy of model where distance and cost are coded as linear continuous variables

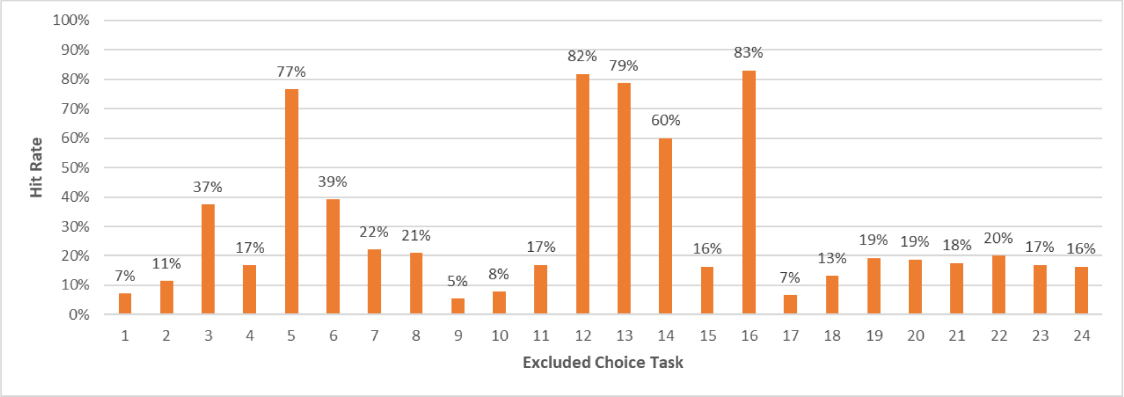

Figure B2. Prediction accuracy of model where all variables are coded as dummy variables