ESTIMATING PREFERENCES FOR MEDICAL DEVICES: DOES THE NUMBER OF PROFILE IN CHOICE EXPERIMENTS MATTER?

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ABSTRACT

Background: Most applications of choice-based conjoint analysis in health use choice tasks with two profiles, while marketing studies routinely use three or more. This study reports on a randomized trial comparing paired with triplet profile choice formats focused on hearing aids.
Methods: Respondents with hearing loss were drawn from a nationally representative cohort, completed identical surveys, and were randomized to choice tasks with two or three profiles. The primary outcomes of differences in estimated preferences were explored using t-tests, likelihood ratio tests, and analyses of individual-level models estimated with ordinary least squares.
Results: 500 respondents were recruited. 127 had no hearing loss, 28 had profound loss and 22 declined to participate and were not analyzed. Of the remaining 323 participants, 146 individuals were randomized to the pairs and 177 to triplets. Pairs and triplets produced identical rankings of attribute importance but homogeneity was rejected (P<0.0001). Pairs led to more variation, and were systematically biased toward the null because a third (32.2%) of respondents focused on only one attribute. This is in contrast to respondents in the triplet design who traded across all attributes.
Discussion: The number of profiles in choice tasks affects the results of conjoint analysis studies. Here triplets are preferred to pairs as they avoid non-trading and allow for more accurate estimation of preferences models.

BACKGROUND

- Marketing literature has long recommended using more than two profiles in choice experiments (e.g.: Sandor and Wendel 2002, DeShazo and Fermo 2002)
- Health experiments have traditionally used paired profiles
- In some of our current work, we have found a large number of participants who make choices only on one characteristic
  - This is otherwise called lexicographic decision making (Gilbride and Allenby 2004)
- Old way to handle the non-traders was to drop them, but more recently, other researchers in the field have argued against dropping these non-traders (Lancsar and Louviere 2006)

METHODS

- This study is part of a broader look at preferences for hearing aids
- 7 attributes derived from patient interviews

Table 1: Attributes and their levels.

Attribute	Definition	Levels	
Battery Changes	How often the aid's batteries need to be changed.	2 times a month	4 times per month
Water and Sweat Resistance	The hearing aid's capacity to withstand moisture from the ear and/or from the environment.	Somewhat water/ sweat resistance	Not so water/sweat resistance
Quiet Settings	Situations where there is only one source of sound, such as in one-on-one conversations	More effective for quiet settings	Somewhat effective for quite settings
Feedback Occurrence	The high-pitched squealing noise that a hearing aid can make	Feedback occurs 2 times a month	Feedback occurs 4 times a month
Cost	The amount of money patient spends when buying the hearing aid	$3,000	$5,000
Noisy	Situations where there are multiple sounds coming from multiple sources	More effective for noisy settings	Somewhat effective for noisy settings
Physical Comfort	How the hearing aid feels in the ear.	Rarely uncomfortable	Occasionally uncomfortable

METHODS

Figure 1. Example of the paired choice task

Hearing Aid Feature	Hearing Aid A	Hearing Aid B
Battery Changes	Four (4) times a month	Two (2) times a month
Water and sweat resistance	somewhat water / sweat resistant	not so water / sweat resistant
Quiet settings	somewhat effective for quiet settings	more effective for quiet settings
Feedback Occurrence	Feedback occurs four (4) times a month	Feedback occurs two (2) times a month
Purchase Cost	$ 5,000	$ 3,000
Noisy settings	somewhat effective for noisy settings	more effective for noisy settings
Physical comfort	occasionally uncomfortable	rarely uncomfortable

Design: Common to both designs:
- 7 attributes, all with two levels
- Order is randomized such that each card had an equal chance of showing up first

- Paired design: Orthogonal, 8 cards per respondent
- Triplet design:
  - D-efficient design generated with Sawtooth; 12 cards
  - Best of each triplet is asked; and sequentially best of the two left over is asked.

Analysis: Conditional logit for the paired and triplets, Rank-ordered logit for the fully ranked, and OLS for the individual utility models.

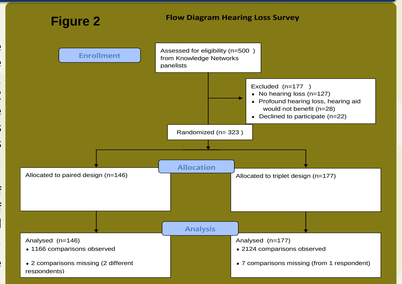
RESULTS

- Of the 500 recruited from the Knowledge Networks online panel, 127 had no hearing loss, 28 had profound loss and 22 declined to participate and were not analyzed. 146 individuals were randomized to the pairs and 177 to triplets.

- Between the number of respondents and the number of completed tasks, we analyzed almost 3300 comparisons.

- Recruitment results are shown in Figure 1.

Figure 2



RESULTS

Variable	Level	Paired Experiment (n=146)	Triplet Experiment (n=177)	P-values
Age, years (mean, SD)		62.9(13.3)	65.1 (12.2)	0.13 (t=-1.52)
Sex	Female	0.66	0.68	0.62
Education	Less than high school	0.04	0.12	0.07
	High school	0.38	0.32	(c2=7.1)
	Some college	0.27	0.28	
	Bachelor's degree or higher	0.31	0.28	
Income	0-$24999	0.21	0.18	0.52
	$25000-$49999	0.23	0.31	(c2=2.3)
	$50000-$99999	0.40	0.38	
	$100000 or more	0.16	0.14	
Race	White, non-Hispanic	0.77	0.90	0.024
	Black, non-Hispanic	0.04	0.02	(c2=11.2)
	Other, non-Hispanic	0.03	0.01	
	Hispanic	0.10	0.05	
Duration (median, range)	Minutes	11.5 (0-9958)	21 (7-5185)	p<0.000 (z=-8.536)

- The results in Figure 2 show that the paired and triplet design both produced the same rankings of relative attribute importance.
- All attributes were significant predictors of relative utility (p<0.001, cost: p<-.002) except for battery life which was not significant in the paired design.
- The significance improved in the triplet design to p<-0.001, battery p<0.002;.
- Most of the coefficients are more extreme for the triplet design. For example the most important attribute 'performance in noisy situations' has an odds ratio of 2.82 in the paired design and 4.63 in the triplet.
- In the fully ranked, the individuals under this design are over 5 times as likely to purchase a hearing aid that works better in noisy settings.
- Figure 3 shows that 32.2 % of the respondents made choices that were dominated by only one attribute in the paired design. 17.1 % of the respondents made choices that were purely dominated by the functionality in noisy environment attribute.

Figure 3

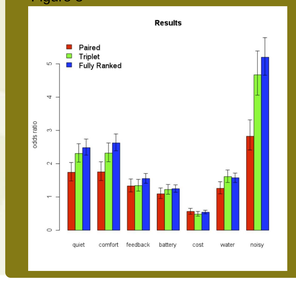
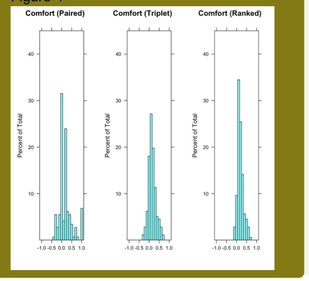


Figure 4



RESULTS

Table 3: Regression Results

Attribute	Profile Design: Paired Coefficients	Paired Odds Ratio	Triplet Coefficients	Triplet Odds Ratio	Fully Ranked Coefficient	Fully Ranked Odds Ratio
Quiet Settings	0.55***	1.74	0.83***	2.30	0.91***	2.48
	(0.08)		(0.06)		(0.05)	
Comfort	0.56***	1.75	0.84***	2.32	0.96***	2,62
	(0.08)		(0.06)		(0.05)	
Feedback	0.29***	1.33	0.29***	1.34	0.44***	1.55
	(0.07)		(0.07)		(0.05)	
Battery Life	0.09	1.09	0.20**	1.22	0.22***	1.24
	(0.07)		(0.06)		(0.05)	
Cost	-0.57***	0.56	-0.73***	0.48	-0.61***	0.54
	(0.08)		(0.07)		(0.05)	
Waterproof	0.23**	1.25	0.47***	1.61	0.45***	1.57
	(0.07)		(0.06)		(0.04)	
Noisy Settings	1.04***	2.82	1.54***	4.67	1.64***	5.19
	(0.08)		(0.07)		(0.05)	

Notes: Coefficients are significant at *p<0.05, **p<0.01, ***p<0.001.

DISCUSSION

- Conjoint experiments that force respondents to choose on more than one attribute yield more accurate utility estimations
- Figure 4 demonstrates the increase in efficiency with the triplet and fully ranked designs.
- Dominant (lexicographic) preferences disappear in triplet design
- With only two levels per attribute, triplet cards have one level of each attribute appearing twice on each choice set. This may lead to decreased lexicographic decision making.
- Conjoint designs in health care should include three cards
- This paper is available as an NBER working paper, #w17482:
- http://www.nber.org/papers/w17482

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