Expert Tools to Optimize Market Insights in Healthcare

Sawtooth Software Webinar

November 2020

Sawtooth Software

Agenda

- Challenges
- Choice models
  - Experiments
  - Cross-sectional analysis, e.g. patient chart studies, no experimental design
- Segmentation
  - Attitudinal/behavioral
  - Attitudinal/behavioral, influenced by a dependent variable
  - Attitudinal/behavioral, determined by a dependent variable
- Driver analysis

Challenges

- In healthcare we typically need to model complex decisions
  - Made by different kinds of deciders
  - For different types of patients
  - Often across different countries
  - Silver lining: the models we build in healthcare applications tend NOT to be that complex with respect to the number of attributes and levels we're building into our experiments
- Unfortunately, we usually have only very limited samples to work with
- All of the methods we discuss today are things we've done with much smaller sample sizes than the many hundreds that we typically use in consumer research
- We've also done stress tests to find out how accurate our methods can be at very small sample sizes and published these on our website

CHOICE EXPERIMENTS

Choice Experiments

- Best-Worst Scaling
  - MaxDiff
  - Best-Worst Case 2
- Choice-based conjoint experiments (CBC)
  - Choices
  - Allocations
- Situational choice experiments (SCE)
  - Using MNL
  - Using classification trees
- Combined/hybrid CBC/SCE experiments

MaxDiff Example

When considering a new drug for your rheumatoid arthritis, which of these statements would make you Most Likely, and which would make you Least Likely to ask your doctor about the new drug?

(1 of 10)

Most Likely		Least Likely
○	Drug Z addresses all your RA symptoms, not just one or two	○
○	Drug Z helps you get back on your feet so you can live life again	○
○	Drug Z is gentle on your body, and doesn't require regular kidney and liver monitoring.	○
○	Drug Z helps heal your body, not just mask the symptoms of RA	○

Click the 'Next' button to continue...

MaxDiff Uses

- MaxDiff is a general measurement technique, useful for importance measurement, message prioritization and even for psychometrics
- In healthcare research we most often see it used for
  - Importance measurement – though with smaller numbers of items two other methods take up less time and perform almost as well (constant sum for up to about 10 items and Q-sort for up to about 15 attributes)
  - Message prioritization research (see our previous webinar on messaging research)

Best-Worst Case 2 Example

Please consider the following drug profile for the treatment of hypertension. Which feature makes you most likely to prescribe, and which makes you least likely to prescribe?

(1 of 10)

Most Likely to Prescribe		Least Likely to Prescribe
○	Side effect: 36% of patients report abdominal discomfort/gastrointestinal issues	○
○	Efficacy: 78% of patients achieve a reduction in systolic pressure of 20mmHg or greater	○
○	Class: ACE Inhibitor	○
○	Interactions: Cannot be taken with diuretics	○

Click the 'Next' button to continue...

Best-Worst Case 2 Uses

- Best-worst conjoint, as it used to be called, is a lot easier for respondents than is choice-based conjoint (which can contain 2-7 times as much measurement error as best-worst case 2)
- As a result, best-worst case 2 is often used in place of choice-based conjoint for patient preference research, where patients might have to trade off the benefits and risks of therapeutic options
- Most often, however, we see best-worst case 2 being used for messaging research, as on the previous page – essentially it's a MaxDiff where we allow only one message per "theme" (efficacy, price, safety, MOA) to appear in each question

CBC

- Choice-based conjoint (CBC) is our go-to conjoint analysis for understanding decision-making – it's the gold standard in practice and in academic research on decision-making
- In addition to traditional discrete choice responses, several other varieties of CBC are common in healthcare research
  - Traditional discrete choice
  - Segment-specific discrete choices
  - Allocation
  - But be careful not to overwhelm respondents – doctors are smart, but that doesn't mean there aren't limits to how much they're willing to tax themselves with complicated questionnaires

CBC Example

Please consider your last hypertensive patient. Which drug would you be most likely to prescribe for this patient?

(1 of 12)

Efficacy: 78% of patients achieve a reduction in systolic pressure of 20mmHg or greater Side effect: 36% of patients report abdominal discomfort/gastrointestinal issues Interactions: Cannot be taken with diuretics Class: Alpha-2 Receptor Agonist Select	Efficacy: 93% of patients achieve a reduction in systolic pressure of 20mmHg or greater Side effect: 22% of patients report headaches Interactions: No known drug interactions Class: Calcium channel blocker Select	Efficacy: 86% of patients achieve a reduction in systolic pressure of 20mmHg or greater Side effect: 18% of patients report hypersomnia Interactions: Contraindicated for patients with Type 1 diabetes Class: ACE Inhibitor Select

NONE: I would use a different treatment option.

Select

CBC for Multiple Segments

Please consider the drugs shown below. Which drug would you be most likely to prescribe for each patient type?

	Drug X	**Drug Y**	**Drug Z**	
Efficacy	78% of patients achieve a reduction in systolic pressure of 20mmHg or greater	93% of patients achieve a reduction in systolic pressure of 20mmHg or greater	86% of patients achieve a reduction in systolic pressure of 20mmHg or greater	NONE: I would use a different treatment option.
Side Effect	36% of patients report abdominal discomfort / gastrointestinal issues	22% of patients report headaches	18% of patients report hypersomnia	
Interactions	Cannot be taken with diuretics	No known drug interactions	Contraindicated for patients with Type 1 diabetes	
Class	Alpha-2 Receptor Agonist	Calcium Channel Blocker	ACE Inhibitor	
40-49yo Male, no diabetes	○	○	○	○
50-64yo Female, Type II diabetes	○	○	○	○

Allocation CBC

Before answering the following questions, please pull the charts for your last 10 patients that presented with clinical hypertension. If the drugs shown below were the only drugs available to you to prescribe, how many out of the 10 patients would you treat with each drug?

(1 of 12)

Efficacy	78% of patients achieve a reduction in systolic pressure of 20mmHg or greater	93% of patients achieve a reduction in systolic pressure of 20mmHg or greater	86% of patients achieve a reduction in systolic pressure of 20mmHg or greater	NONE: I would use a different treatment option.
Side effect	36% of patients report abdominal discomfort / gastrointestinal issues	22% of patients report headaches	18% of patients report hypersomnia	
Interactions	Cannot be taken with diuretics	No known drug interactions	Contraindicated for patients with Type 1 diabetes	
Drug class	Alpha-2 Receptor Agonist	Calcium channel blocker	ACE Inhibitor	
	5 patients	1 patients	4 patients	0 patients

Total: 10 / 10

But Try to Avoid This!

If Product J had the characteristics below, which therapy would you prescribe to your next 10 patients of each type below. *Please make sure that your answers sum to 10 for each column.*

	Product J
Dosing	TID
Symptom relief (% of patients)	80%
Side effects (% of patients experience nausea)	45%
Drug interactions	Diuretics
Monthly price to patients	$100

	Male, under 45	Male, 45-64	Male, 65+	Female, under 45	Female, 45-64	Female, 65+
Product J						
Aspirin						
Verapamil						
Depakote						
Amoxicillin						
Diet and exercise changes						
Total						

Situational Choice Experiments

- Situational choice experiments (SCE) are different from conjoint experiments
- In a CBC, we model the choice of among some number T of therapies as a function of the differing features of each of the T therapies
- In SCE we model the choice of among the T therapies as a function of the characteristics of individual patients
- Technically, this involves a different kind of multinomial logit model, but all that happens behind the scenes and the output of an SCE is still an Excel-based choice simulator

Example of a SCE Question

If Product J had the characteristics below, which therapy would you prescribe to your next 10 patients of each type below. *Please make sure that your answers sum to 10 for each column.*

	Product J
Dosing	TID
Symptom relief (% of patients)	80%
Side effects (% of patients experience nausea)	45%
Drug interactions	Diuretics
Monthly price to patients	$100

For this patient, would you recommend . . .

[ ] Therapy X
[ ] Verapamil
[ ] Tylenol
[ ] Diet and Exercise

Combined CBC/SCE Experiments

- In our healthcare applications, we often create application-specific experiments that don’t even have names, because they combine features of CBC and SCE experiments
- These hybrid experiments vary in the structure of both the questions that go into them and the modeling that quantifies choices

Combined CBC-SCE Example

A newly diagnosed hypertensive patient presents themselves to you. Patient characteristics are as follows:

- Male
- 40-49 years old
- Not diabetic
- Family history of coronary artery disease

Which drug would you be most likely to prescribe for this patient?

(1 of 12)

Efficacy: 78% of patients achieve a reduction in systolic pressure of 20mmHg or greater Side effect: 36% of patients report abdominal discomfort / gastrointestinal issues Interactions: Cannot be taken with diuretics Class: Alpha-2 Receptor Agonist Select	Efficacy: 93% of patients achieve a reduction in systolic pressure of 20mmHg or greater Side effect: 22% of patients report headaches Interactions: No known drug interactions Class: Calcium channel blocker Select	Efficacy: 86% of patients achieve a reduction in systolic pressure of 20mmHg or greater Side effect: 18% of patients report hypersomnia Interactions: Contraindicated for patients with Type 1 diabetes Class: ACE Inhibitor Select	NONE: I would use a different treatment option. Select

CROSS-SECTIONAL CHOICE MODELS

Non-experiments

- Choice models have been around for longer than choice-experiments – i.e. we can run multinomial logit models on non-experimental data
  - Survey data – model brand used most often as a function of multiple attribute ratings on all the brands
  - Observational data – e.g. scanner panel data of grocery store purchases
  - Behavioral data
- The most common use in healthcare applications involves behavioral data gleaned from patient charts – the interviewer gets a nurse or an office manager to collect data on patient characteristics, patient health history and current therapy, then uses the patient characteristics, health history and treatment history to predict the current therapy decision

Patient Chart Studies

Patient A

- 44-49 year old male
- Complains of shortness of breath during moderate exercise
- Has a BMI > 45
- CMP & CBC results normal

For this patient, would you recommend . . .

[ ] Therapy X
[ ] Verapamil
[ ] Tylenol
[ ] Diet and Exercise

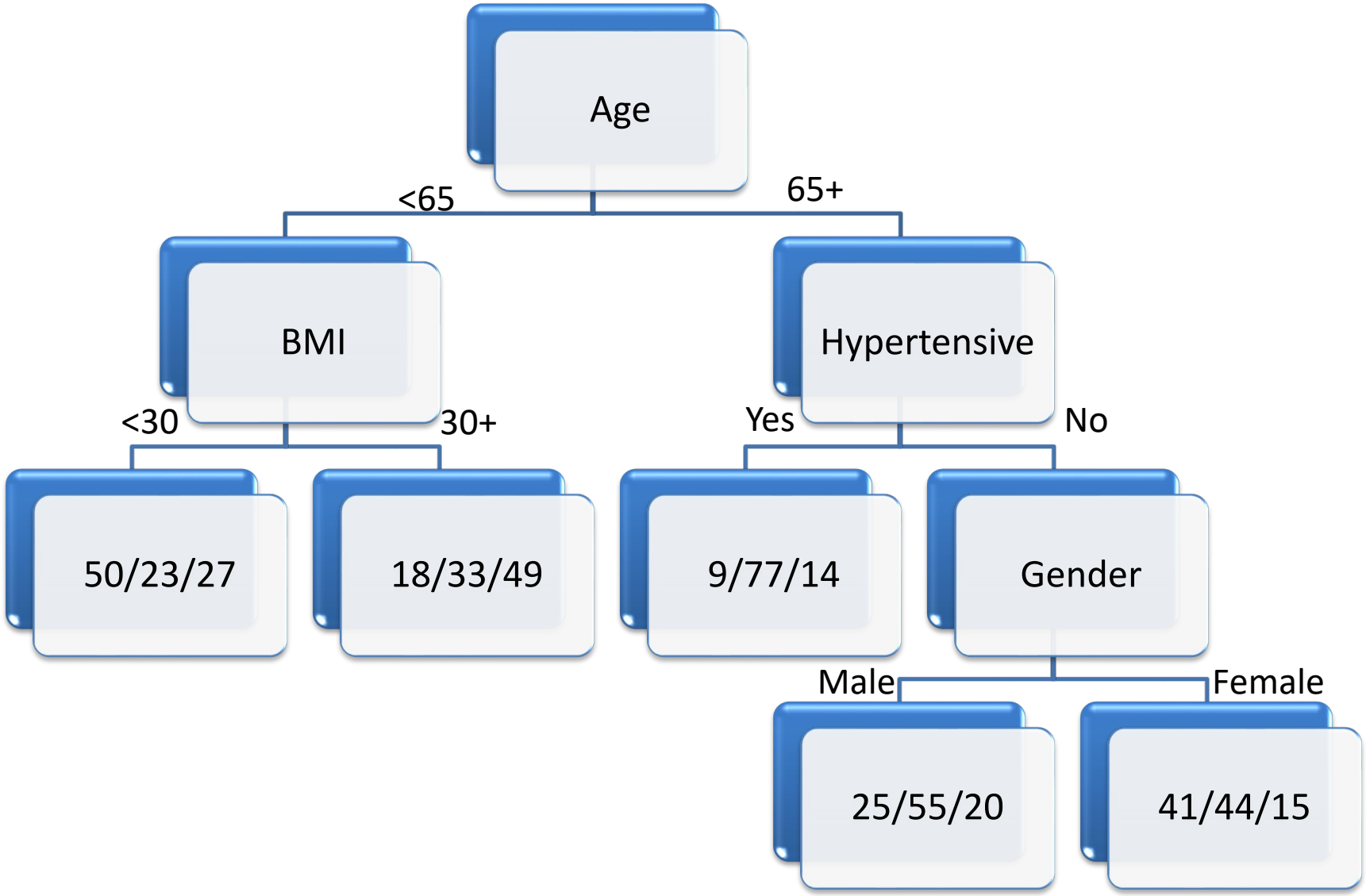
Choice Model from Patient Chart Data

	Therapy X	Verapamil	Tylenol	Diet and Exercise
Constant	1.44	2.68	-0.43	0.00
Male	1.24	-0.63	-2.11	0.00
Female	0.00	0.00	0.00	0.00
<45 years old	0.98	0.75	0.44	0.00
45-49 years old	-0.27	-1.11	0.32	0.00
50+ years old	0.00	0.00	0.00	0.00
BMI<30	0.45	0.03	0.97	0.00
BMI 30-45	0.33	-0.60	-1.43	0.00
BMI >45	0.00	0.00	0.00	0.00
Etc.	. . .	. . .	. . .	. . .

Patient Chart with Classification Tree Analysis

- Another analysis option for patient chart studies is called a “classification tree”
- Classification trees are commonly used in segmentation (more on this in a few minutes)
- But they’re also useful if we want to represent choices as a hierarchy of decisions

Example Classification Tree Analysis



SEGMENTATION

Segmentation

- Attitudinal/behavioral – unsupervised
  - Cluster analysis
  - Latent class analysis
- Attitudinal/behavioral influenced by a dependent variable – predictive segmentation
- Attitudinal/behavioral determined by a dependent variable – regression tree

Unsupervised Segmentation

- When to use cluster analysis
  - When your variables are all "arguably metric": counts, percents, binaries, rating scales or other ordered categorical data (I.e. none are unordered multicategory variables)
  - (Not relevant to healthcare research) Your sample size is very large (large samples take a long time to run in latent class)
  - Your sample size is very small – latent class analysis is a sample hog, and with the small sample sizes we often have in pharmaceutical research, your model can require more degrees of freedom than you have sample size to cover
- When to use latent class analysis
  - Whether or not any of your variables are unordered multi-category variables
  - When sample size isn't too small

Unsupervised Segmentation

- Make sure to use robust clustering techniques
  - Convergent k-means
  - Cluster ensembles
  - Partitioning around medoids (PAM)
  - Latent class analysis with many starting points

Predictive Segmentation

- We want to base our segmentation on attitudes or behaviors, but we want the resulting segments to differ with respect to some dependent variable
- Steps:
  - From a longer list of possible basis variables, find those that are significantly (or highly significantly) related to the dependent variable
    - Look at correlations for arguably metric variables
    - Look at ANOVA or crosstabs for unordered multi-category variables
  - Use only variables that significantly predict the dependent variable as basis variables in your segmentation

Supervised Segmentation

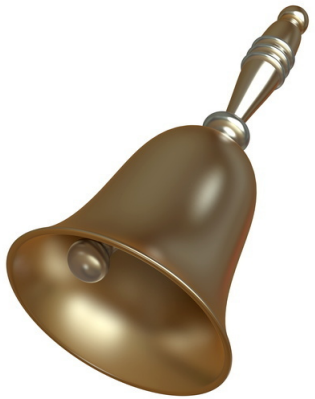
- We want to base our segmentation on attitudes or behaviors, but we want the resulting segments to be maximally discriminating with respect to some dependent variable
- Use a regression tree to create segments of respondents
  - Segments will be more different with respect to the dependent variable than with predictive segmentation
  - Segments will be identifiable with 100% certainty from the significant predictors in the tree

What About Factor Analysis?

- Factor analysis generates mutually uncorrelated factors, each composed of related attributes
- Factor analysis was developed for testing of psychometric theories
  - If a factor is real, items purported to measure it should load together on a factor - so we can use factor analysis to measure the validity of our conceptual model by verifying theory-driven constructs, e.g.
    - Risk aversion
    - Price sensitivity
    - Need for cognition
    - Conscientiousness
  - If an item is a good measure of a construct, it will load highly on the factor measuring that construct and not highly on any other factor - so we can use factor analysis to test the validity of our measurement model, too

Pet Peeve Bonus Slides!!

Extra! Extra! Extra!



What Factor Analysis Isn’t

- Factor analysis isn’t a garbage can into which we can toss a haphazard assortment of items, with no theorized factor structure, and then rely on the math to sort them out and turn them into valid and useful factors
- Alchemy isn’t real and this is not a picture of “pre-gold”

Factor Analysis Abuse

- If you treat factor analysis like a garbage can, you'll get a garbage result
  - Important items can “cross-load” on several factors and have their impact diluted – if you pick high loaders for subsequent inclusion in segmentation analysis, you will miss important cross-loaders
  - Important items may not load on any factors, because they don’t share as much variance with the other items as those other items do with each other

- Bottom line: unless you worked with a psychometrician to devise a scale to measure multiple factors, do not use factor analysis as a data pretreatment for segmentation
  - That's not what it's for
  - It's not something that works well

DRIVER ANALYSIS

Driver Analysis

- See our August 2020 webinar
- Bottom line
  - Classical methods like regression and correlation are badly flawed, and show serious defects when used on typical survey data
  - Modern methods work better
    - Averaging over orderings
    - Johnson's epsilon

Working With Us

- Sawtooth Analytics
  - Everything from full-service research consulting to “peek over your shoulder” to make sure you’re applying the methodology properly. Also training, data manipulation, model designs, custom code within Lighthouse Studio, etc.
  - analytics@sawtoothsoftware.com
- Sawtooth Software
  - Create, field, analyze, and report your own methodological project.
  - Software options include multiple conjoint methods, MaxDiff, latent class analysis, clustering, simulation engines, etc.
  - sales@sawtoothsoftware.com
- Other Software tools we mentioned include products like Latent Gold (Statistical Innovations), R (R-project.org), Tableau (Salesforce), SPSS (IBM), etc.

That’s it

QUESTIONS?

OR, FEEL FREE TO CONTACT ME LATER:
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