Questions from Promotion Response Modeling Webinar 2015-09-16

PMSA
PHARMACEUTICAL MANAGEMENT SCIENCE ASSOCIATION

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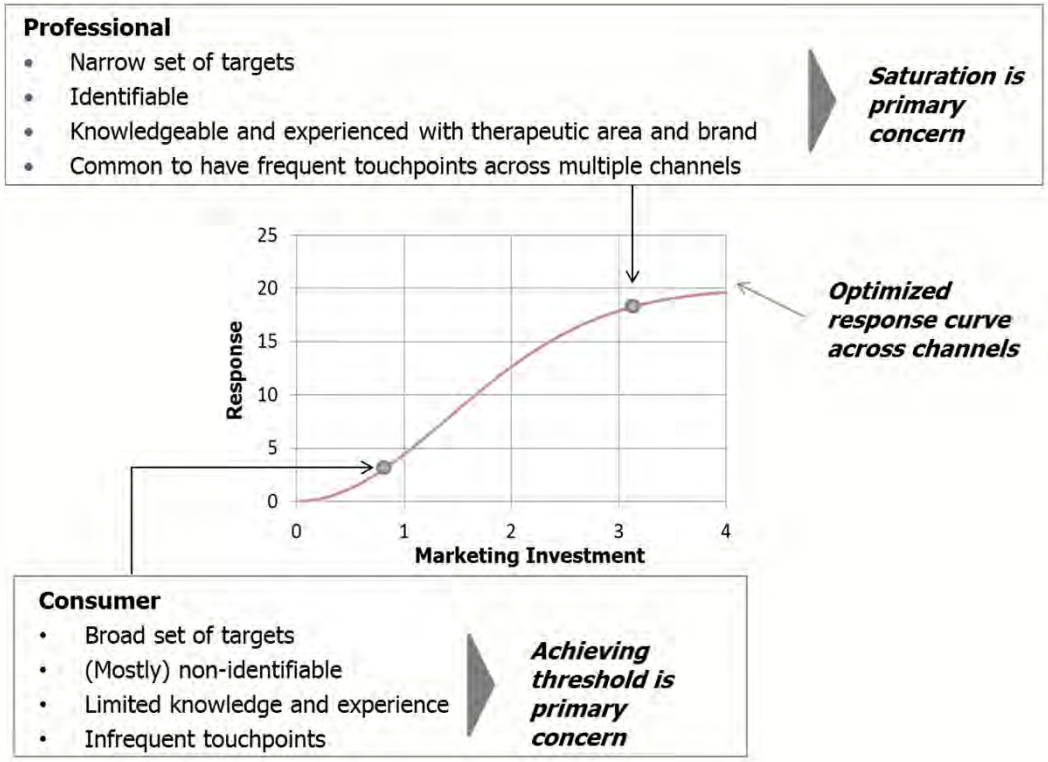
AXTRIA
INGENIOUS INSIGHTS

1. Can the lead indicators and lag indicators be easily analyzed in the same equation? If yes, what accuracy levels can be expected by putting all tactics into the mix?

- Not absolutely sure what you mean by “lead indicators” and “lag indicators”. Generally, we think of data from earlier months (both LHS and RHS variables) as being “leading indicators” of a sort . . . but they enter the equations as lagged variables.
- If you propose analyzing multiple LHS variables together simultaneously in a system of equations (usually called a “structured equation” model), yes, that’s absolutely possible . . . but it gets complex very quickly, and would take a whole seminar series by itself to cover it. I’m not going to attempt it here.
- If you just mean adding multiple channels of promotion on the RHS, e.g., rep calls, speaker programs, DTC, etc., yes, that can be done as well. We do it quite often, although I don’t want to call it “routine”. Exactly how you choose to set up that equation, and what interactions among effects you want to consider, can vary from one context to the next. How you set up the RHS of your model will control what effects you can, and cannot see or measure.
- Usually, when including multiple channels, overall fit quality will improve (mathematically, it has to), but the additional channels will (usually) have lower statistical significance(individually than a high-impact channel like rep calls.

2. Can we assume 'diminishing return' in DTC channels? Like TV channel?

- All promotional channels will face diminishing returns if you push their levels high enough . . . to say otherwise is equivalent to saying that the market for this product is infinite. However, over the range that we actually operate at, we may not put out enough promotion to see that "curving over" of the response curve.
- Generally, any campaign that depends of frequency or sheer volume of messages delivered will tend to show a "threshold effect" (an S-shaped curve) . . . You need to touch the campaign targets often enough to get above their response threshold. This certainly includes most or all DTC programs.



- So, bottom line . . . we expect to see an "S-shaped" response for most TV programs, but we also expect them to flatten eventually. Page 23 of the original presentation touches on this.

3. I am new in this space but I want to learn more. Are there any resources you could recommend for a beginner to delve more into this field? (1 of 2)

- Well, this is going to be a bit embarrassing. I learned most of this long ago, by "apprenticeship" with Robert Brown and Malcolm Langman (two pioneers in this industry) . . . and that was after 15 years prior experience in mathematical modeling. I'm not really sure where to point you for current resources.
- Having a strong background in statistics (some master's level coursework) seems important (but not absolutely critical) to understanding the theoretical underpinnings of this modeling. You can get that from any one of hundreds of textbooks . . . I really have no preferences.
- A good treatment of this specific category of modeling is here:
  - Amazon: http://www.amazon.com/Market-Response-Models-International-Quantitative/dp/1402073682
  - Google Books: https://books.google.com/books?id=nYDbBwAAQBAJ&dq=isbn:1402073682

  But it helps to have a basic level of statistical familiarity before starting this one.

3. I am new in this space but I want to learn more. Are there any resources you could recommend for a beginner to delve more into this field? (2 of 2)

- The SAS Institute puts out a great deal of material on various models (all using their software, of course, but you don't have to). Some of what they put out will probably vary from the approaches we've been describing, but there is a lot of related material worth looking into. Example here: http://support.sas.com/rnd/app/ets/papers/PromotionalAnalysis.pdf This one is worth reading, and there are some elements in common with the approach we've described, but it also differs in many ways.

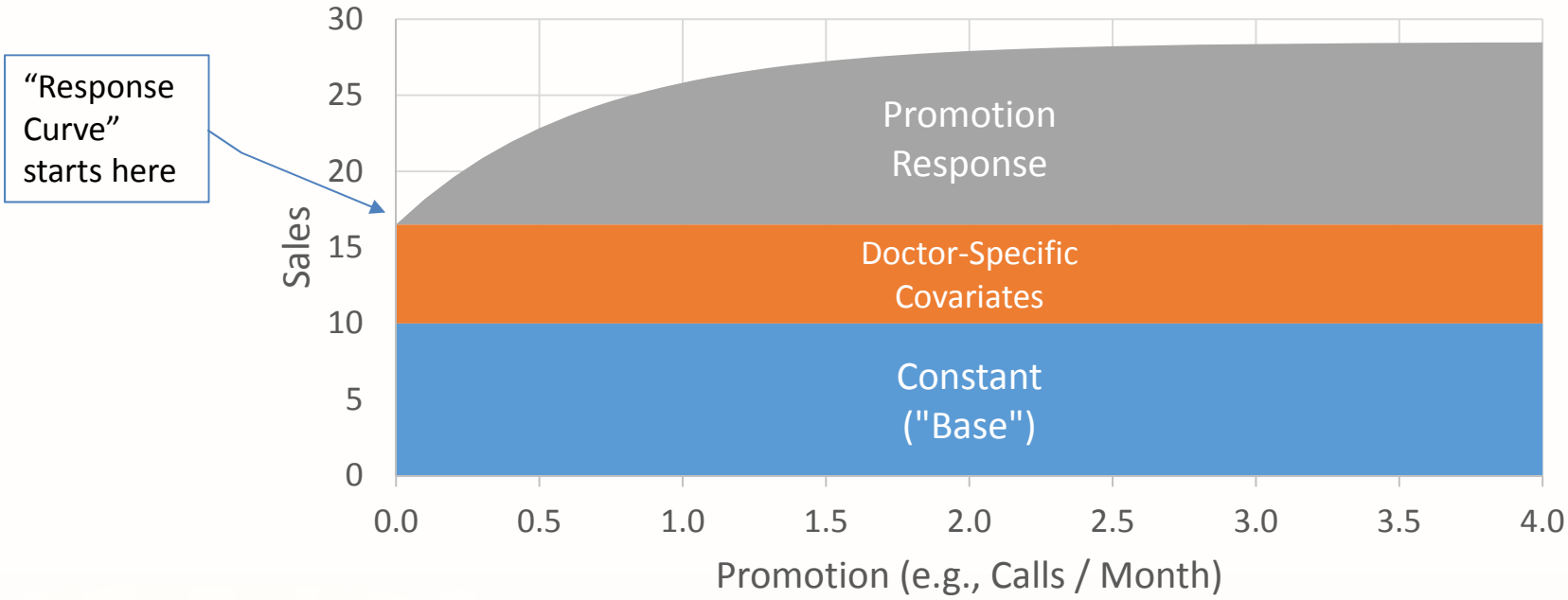
- A very solid introduction to the range of Pharma applications is here: http://www.kellogg.northwestern.edu/faculty/zoltners/htm/pdfs/interfaces_zands.pdf

  Although written in 2001, it has held up remarkably well over time. We assign it to all new hires, but they don't usually fully understand it until after they've been through our internal training coursework.

- We've generally found that no academic curriculum truly prepares people for this work, and have developed our own internal training system. We can provide this coursework as a service to interested client groups, if needed. But be warned . . . there are ***lots*** of homework assignments.

4. If all response curves start from the original (i.e., Expectation of Y when X is zero = 0), then why do we include a constant on the RHS when constructing the model?

- The response curve starting from the origin (0,0) is a convenience, and is technically correct only if we are looking at ***just*** the promotional impact component of the response model.
- A more realistic and "complete" graphical representation of the entire response model we described would be:



5. How should you account for promotion across multiple channels? i.e. finding the optimal spending across multiple channels rather than just one. (1 of 4)

- There are ***lots*** of ways to tackle this, with some pretty complicated issues arising quickly. Most of the issues come up because however you choose to represent the multiple channels in your model, you are making implicit or explicit statements about what kind of interaction effects (among channels) you will represent (in the model), and this will have implications for how you do optimization.
- For instance, even the simple modeling choice we used in our main presentation:

Equation form: **NRx =** a0 + auto-regressive terms + other covariates

+ A*(1 - Exp(-C*(PDE + c1*PDE1 + c2*PDE2 + c3*PDE3 + c4*PDE4)))

treats the lagged promotion (PDE1, PDE2, etc.) as interacting with current promotion (represented by PDE). In fact, because we place them in the same exponential argument, we allow them to "substitute for" current promotion at the exchange rate determined by the c1, c2, etc. coefficients.

5. How should you account for promotion across multiple channels? i.e. finding the optimal spending across multiple channels rather than just one. (2 of 4)

- There are multiple possible approaches to modeling multiple channels, each with their own implications about interactions.
- By far, the simplest (and most often used) approach is to put each channel into a "separable and additive" model component, with no interaction.

Equation form: **NRx =** a0 + auto-regressive terms + other covariates

$$+ A_{PDE}*(1 - \text{Exp}(-C_{PDE}*(\text{PDE + optional lag terms})))$$

$$+ A_{channel1}*(1 - \text{Exp}(-C_{channel1}*(\text{units of Channel 1})))$$

$$+ A_{channel2}*(1 - \text{Exp}(-C_{channel2}*(\text{units of Channel 2})))$$

+ etc.

- This approach has the benefit (and downside) of assuming no interaction. Each channel can be optimized independently, and the optimal solution of any one channel does not depend on the value of the others. While probably not truly correct, it is certainly a major step forward over not considering other channels at all, and is relatively simple to work with.

5. How should you account for promotion across multiple channels? i.e. finding the optimal spending across multiple channels rather than just one. (3 of 4)

- A more complex approach is to put the data variables from one (or more) promotional channels into the same exponent (or logarithmic) term. In effect, this formulation assumes that the channels are potentially substitutive for each other.

Equation form: **NRx =** a0 + auto-regressive terms + other covariates

$$+ A_{combined} * (1 - Exp(-C_{PDE} * (PDE + \text{optional lag terms}) - C_{channel1} * (\text{units of Channel 1}) - C_{channel2} * (\text{units of Channel 2})))$$

- This version assumes full interaction and substitutability of the channels. In the version above, 1 "unit" of promotion via Channel 1 is equal to $C_{channel1} / C_{PDE}$ PDE units
- Optimization of all channels on this model is fairly difficult (although not impossible). Real-world applications tend to get solved by simulating across a narrow range of actually practical spending levels, rather than running full multi-variate optimization software (although that can be done, too).

5. How should you account for promotion across multiple channels? i.e. finding the optimal spending across multiple channels rather than just one. (4 of 4)

- Yet another way is to allow promotion on one channel to affect the asymptote of the response model for some other channel, in effect, capturing a “multiplicative” (not substitutive) interaction.

Equation form: **NRx =** a0 + auto-regressive terms + other covariates

$$+ A(1 + A_{DTC}*\text{DTC GRP}) *(1 - \text{Exp}(-C_{PDE}*(\text{PDE + optional lag terms})))$$

- This approach is most effectively used when the second channel (DTC, in this example) actually impacts another stakeholder (the consumer, not the physician) in the overall prescribing decision.
- This model also creates significant interaction effects, and complicates optimization.
- Alas, in the true, real world, it is likely that all three kinds of effects (independent, substitutive, and multiplicative) are present at the same time.

6. Who was the first to do Promotion Response Modeling? What year did that begin?

- Actually, I don't know exactly. The pioneers of this (that I know about) in Pharma were Prabhakant Sinha and Andris Zoltners (founders of ZS Associates) and Malcolm Langman and Robert Brown (founders of Health Products Research, (where I learned to do this.))
- All four of these gentlemen were working on problems of this sort as far back as the 1980's, although the best data available then were aggregate account-level data (equivalent to IMS DDD or Symphony non-retail data today).
- The modeling described in our presentation really became possible in the mid 1990's with the advent of physician-level monthly Rx data (IMS Xponent, and other products from competitors).
- There have been a great many enhancements of data now available (notably, the coming of APLD), but none have yet changed the fundamentals in a really universally-accepted way. However, hundreds of important ancillary analyses have become possible from the improved data.

7. These are all SFE related.. Could David share the new trends on HCP affinity modeling approaches, how non personal promotion channels are best analyzed for field use (1 of 2)

- Too big a topic! (And, I'm not sure I'm the best person to cover it.)
- A few (almost random) thoughts:
  - Most "affinity" scoring systems are initially interested in establishing a doctor's willingness to participate in a specific channel, i.e., does he see reps? Does he open e-mails and/or click-through on links? Does he participate in online forums such as WebMD or Medscape?
  - Some systems may likewise track a physician's interests in particular message variations (Safety? Efficacy? Patient convenience?), typically by observing their participation in programs with specific messages, and/or using rep data collection from mobile devices
  - Actual measurement of specific ***impact*** (i.e., changes in Rx volume) from different channels and different message content usually proceeds along the "promotion response modeling" discussed in Question 5, above

7. These are all SFE related.. Could David share the new trends on HCP affinity modeling approaches, how non personal promotion channels are best analyzed for field use (2 of 2)

- A few more (almost random) thoughts:
  - Finally, “Campaign Management” is the art (and science) of turning information gained from physician-level affinity scores and impact estimates into an actual campaign plan, with specific recommended messages, frequency of contact points (across multiple channels: rep visit, e-mail, direct mail, invitation to event, etc.), sequencing of those messages.
  - Campaign Management is a fairly mature field in consumer-oriented direct mail campaigns . . . the philosophy of A/B testing has been in use for a long time. It is still a relatively young art for Pharma, with its specific LMR limitations and physician audience. There will be a lot of advancement (and expanded applications) of this in Pharma over the next 5 years.