CONNECTED DATA AND THE USE OF SMARTPHONE ENABLED APPS IN MARKET RESEARCH TO UNDERSTAND HEALTH-RELATED BEHAVIOURS

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The rapid growth in smartphone usage offers healthcare market researchers a hugely useful new tool to understand better how patients and healthcare professionals actually behave on a day-to-day basis. A reliance on 'remembered' experiences alone can result in inaccuracies and 'in the moment' data from smartphones gives us a way to avoid these.

***Paul Mannu**, director at **Cello Health Insight**, outlines how the combination of two key paradigms are influencing how we think about our healthcare eco-system – and demonstrates through an important pilot study how combining 'experiential' recording, via a smartphone app, with more established 'remembered' reporting can provide a much more comprehensive and nuanced understanding of patient and/or HCP behaviour.*

There are two significant paradigms that are currently influencing our healthcare ecosystem: the use of mobile technologies driven by the rapid growth of electronic health based management systems (eHealth); and the insights from behavioural economics that are giving us a better understanding of our irrational unhealthy behaviours.

The combination of these two paradigms offers a distinct and unique opportunity to improve the accuracy and value of market research activities in clinical and marketing initiatives.

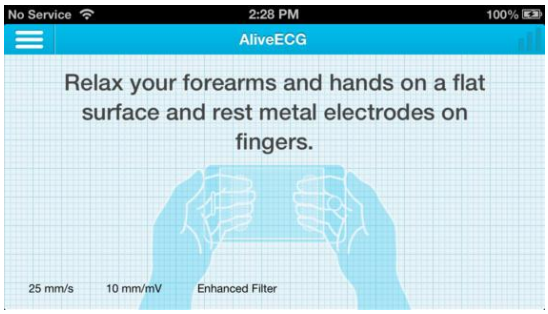
This rapid and growing interest in the use of mobile technologies to help support the practice of medicine and public health is often referred to as 'mHealth', a subset of the wider eHealth picture - itself estimated to be worth in the region of $160 billion dollars by 2015[1].

A recent estimate from Dublin-based firm Research and Markets indicates that mHealth is presently worth in the region of $9 billion globally, with a growth rate of 40% predicted over the next six years[2].

[1] GSMA, 2013
[2] Research and Markets, 2014

In addition to this, you cannot fail to have noticed constant media references to the development of the healthcare-related 'internet of things': external devices, wirelessly connected to mobile devices, that both record essential bodily signs and enable the transmission of that information to healthcare professionals.

All this presents evident cost and time savings to healthcare systems, with some estimating up to 35% of the cost of monitoring chronic conditions could be trimmed using mHealth[3]. Recent innovations include the 'Remotoscope©', giving the ability to remotely diagnose ear infections in children, and the ALIVE ECG©, which allows patients to monitor heart activity and remotely send details to their physician.



All in all it is estimated there are now 31,000 heath related apps in the marketplace[4].

The second paradigm, behavioural economics, is rooted in the belief that our ability to make rational decisions and objective judgments is seriously flawed.

This centres, among other areas, on the simple concept that we have two forms of thinking[5]:

- Type 1: largely 'thoughtless', emotional, and automatic
- Type 2: more considered, and using more of the higher centres of our brain, including our memory

It seems that most of the time, we tend to use our Type 1 approach which is largely effortless and often not under our conscious awareness. However, this type of thinking is subject to a large margin of error, often referred to as biases.

[3] PricewaterhouseCoopers, 2013
[4] mHealth watch, 2014 data
[5] Kahneman, Thinking Fast, Thinking Slow

Further, it would seem that our ability to judge our own 'past' behaviours using our higher faculties such as memory is subject to errors and biases. The scripts that we present to others may be influenced by many factors, including how recent significant events were, that can affect our judgments of the past – even (perhaps especially) the recent past.

Connected data

Mobile apps and their use in gathering data have introduced the concept of 'connected data'; information about the immediacy can be found, collected and transmitted 'in the moment'. Social media such as Twitter and Facebook has revolutionised our way of understanding what others are doing right now. They enable us to get closer to an actual event without relying on memory, and bring us closer to a sense of the immediacy of experience.

It is the fusion of the growing usage of mobile apps and learnings from behavioural economics that create the 'unique space' opportunity that mobile apps present for market research.

Within market research there is often a heavy reliance on the use of memory and perception to understand the influences that might impact on judgment and decision-making. For example, we frequently ask doctors to reflect on recent treatment and management strategies, or we ask patients to discuss the impact of a disease on their lives. Often these factors are incorporated in marketing, clinical or forecasting models.

The key question from a market research perspective is the extent to which we can rely on people's memory of events to understand their behaviours, as opposed to what they know and feel 'in the moment'.

Why is it important to understand the distinction? Is there a need to distinguish between the benefits of memory and perception, and those of actual experience – and the way these two influence the choices that healthcare professionals make about health technologies, and what people say about the impact of illness? Surely there is both a benefit in understanding both and knowing when to use two different types of 'self'.

The 'Experiencing' and 'Remembering' Self

Within the framework of behavioural economics, an undervalued yet important insight is the difference between our experiencing and remembering self, in particular, the way we evaluate our sense of health and well-being. This is a ongoing field of enquiry, once again drawn from the work of Professor Kahneman[6] and the evaluation and monitoring of public health and well-being.

Let's take a simple example to which we can all relate, to make the idea clear. Imagine you are on holiday and for the greater part of the week, all is bliss: the kids are happy and well-behaved; the sun is out; all is as you hoped it would be. But when it comes to paying the bill, there is a problem and you end up having a disagreement at the check-out desk that takes about 20 minutes to resolve.

This amounts to a very small part of what has been a glorious vacation. Were you measured moment to moment at consecutive periods during that week to monitor your happiness levels, this brief period would be unlikely to figure much, if at all. It has been suggested that 'a moment' can be defined neurologically as an approximate space of three seconds in time; over the space of a week this amounts to a total of 0.09% of holiday experience.

And yet, when you relate your holiday tales to your friends, you will probably talk about the billing mishap in detail, because it represents a 'peak and recent moment' (the most recent events tend to stick in the memory, especially if they involve a peak of stress or emotion) - which may indeed influence your decision about future trips to that destination - and also the way others will think about that destination.

This is often referred to as the 'peak end rule' and represents the post-cognitive rationalisation of our experience. Both reference points, the experiencing and remembering self, convey behavioural touch-points that are important to understand. The latter relate to behaviours influenced by actual experience and the former, the way we communicate that experience to others, which will clearly influence whether we, and others, take a similar trip in the future.

Now relate that example to the healthcare arena. Take the example of quality of life-related questionnaires that often focus on a two-week retrospective evaluation of factors of disease burden. As an example, the current SF36 (short form health

[6] Thinking Fast, Thinking Slow

survey), asks for an evaluation of mental and physical states over a period of two weeks. How influenced are these evaluations by the 'peak end rule'?

In market research we are frequently asked to assess current treatment and strategy behaviours to explore what physicians do and what influences their prescribing behaviour. It is not uncommon for a physician to be asked, "Can you tell me how many patients you have seen over the past two weeks with condition x". How accurate are these measures? Often they are used as key variables in forecasting models.

Similarly in patient research, patients and carers are often asked to talk about how the disease has impacted on their day to day life, from the perspective of looking back on the recent past. Again, how is their most recent past (i.e. how they felt yesterday), or the story they wish to say about their illness, influencing or biasing their evaluation of actual experience?

A potentially far-reaching and as yet undervalued benefit of smartphone apps in market research is the unique space they occupy to address and explore the apparent differences that exist between self-reports that are in the moment (the 'experiencing' self), and those in the past (the reflective or 'remembering' self).

In fact, marrying these two 'selves' represents a significant opportunity and challenge to two particular fields of enquiry: health-related quality of life measures to inform clinical research; market research and business intelligence to inform marketing initiatives and predicting future business opportunities.

So, how important is this? How different would the experiences reported by those two 'selves' be in reality? To find out, Cello Health Insight, the market research arm of Cello Health, conducted a pilot study incorporating our proprietary 'in the moment' smartphone app. The results were startling.

Crohn's Disease: a case study to understand the practical clinical and marketing healthcare Implications of the 'peak end rule' using a mobile app

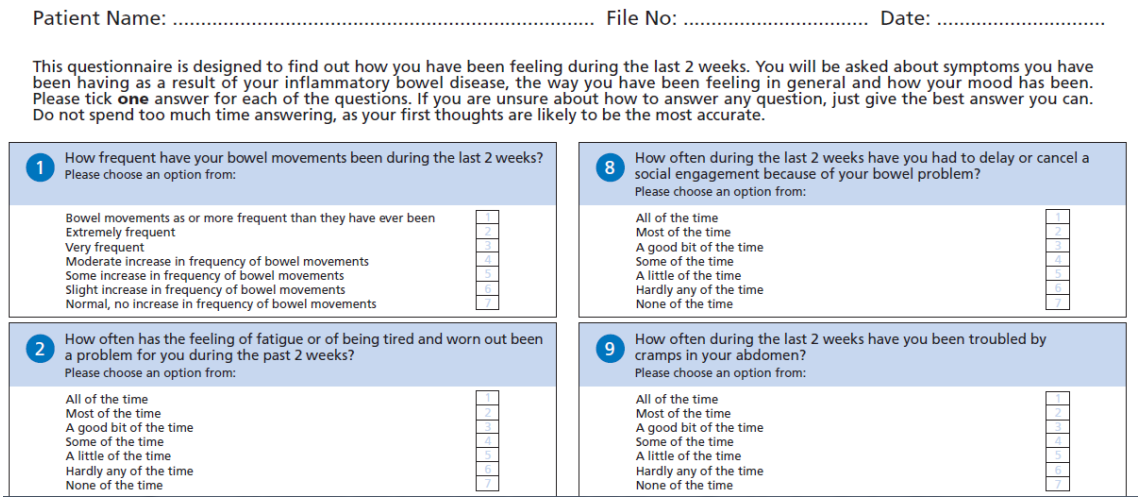
Crohn's Disease is a chronic, debilitating, inflammatory condition of a remitting relapsing nature. During a flare, patients can experience severe pain and fatigue[7], but there are also underlying daily symptoms that can affect quality of life during periods of remission, such as fatigue and abdominal pain[8]. These can often lead to wider social and emotional consequences that can affect relationships and work.

Within the existing literature, patients often comment on the lack of understanding of the condition among others and the associated stigmas attached to the illness[9]. It is also one of a number of conditions in which the advent of biologic therapies has had a significant impact.[10]

Alongside a number of other inflammatory related conditions, Crohn's shares the common symptoms of pain and fatigue. As with many studies that try to measure these factors, it is often difficult to create a sufficiently powered or ideal study to understand these latent constructs.

The majority of quality of life questionnaires related to measuring the impact of pain and fatigue in patients often ask the patient to estimate how they have felt over the past two weeks. This is particularly true of a number of specific factor or disease related questionnaires in Crohn's (e.g. the Fatigue inventory, IBD questionnaire). An example highlighted below.

[7] 'The quality of life in patients with Crohn's disease': Aliment Pharmacol Ther 2002; 16: 1603–1609
[8] 'The experience of fatigue in people with inflammatory bowel disease: an exploratory study': JAN, 2012
[9] 'A Qualitative Study of Youth Living With Crohn Disease'; General Nursing 2007;
[10] 'Efficacy and Safety of Tumour Necrosis Factor Antagonists in Crohn's Disease: Meta-Analysis of Placebo-Controlled Trials Clinical Gastroenterology and Hepatology 2008; 6;644-653



Patient Name: ..... File No: ..... Date: .....

This questionnaire is designed to find out how you have been feeling during the last 2 weeks. You will be asked about symptoms you have been having as a result of your inflammatory bowel disease, the way you have been feeling in general and how your mood has been. Please tick **one** answer for each of the questions. If you are unsure about how to answer any question, just give the best answer you can. Do not spend too much time answering, as your first thoughts are likely to be the most accurate.

1 How frequent have your bowel movements been during the last 2 weeks?
Please choose an option from:

- Bowel movements as or more frequent than they have ever been 1
- Extremely frequent 2
- Very frequent 3
- Moderate increase in frequency of bowel movements 4
- Some increase in frequency of bowel movements 5
- Slight increase in frequency of bowel movements 6
- Normal, no increase in frequency of bowel movements 7

2 How often has the feeling of fatigue or of being tired and worn out been a problem for you during the past 2 weeks?
Please choose an option from:

- All of the time 1
- Most of the time 2
- A good bit of the time 3
- Some of the time 4
- A little of the time 5
- Hardly any of the time 6
- None of the time 7

8 How often during the last 2 weeks have you had to delay or cancel a social engagement because of your bowel problem?
Please choose an option from:

- All of the time 1
- Most of the time 2
- A good bit of the time 3
- Some of the time 4
- A little of the time 5
- Hardly any of the time 6
- None of the time 7

9 How often during the last 2 weeks have you been troubled by cramps in your abdomen?
Please choose an option from:

- All of the time 1
- Most of the time 2
- A good bit of the time 3
- Some of the time 4
- A little of the time 5
- Hardly any of the time 6
- None of the time 7

Example Questions from the IBD Questionnaire

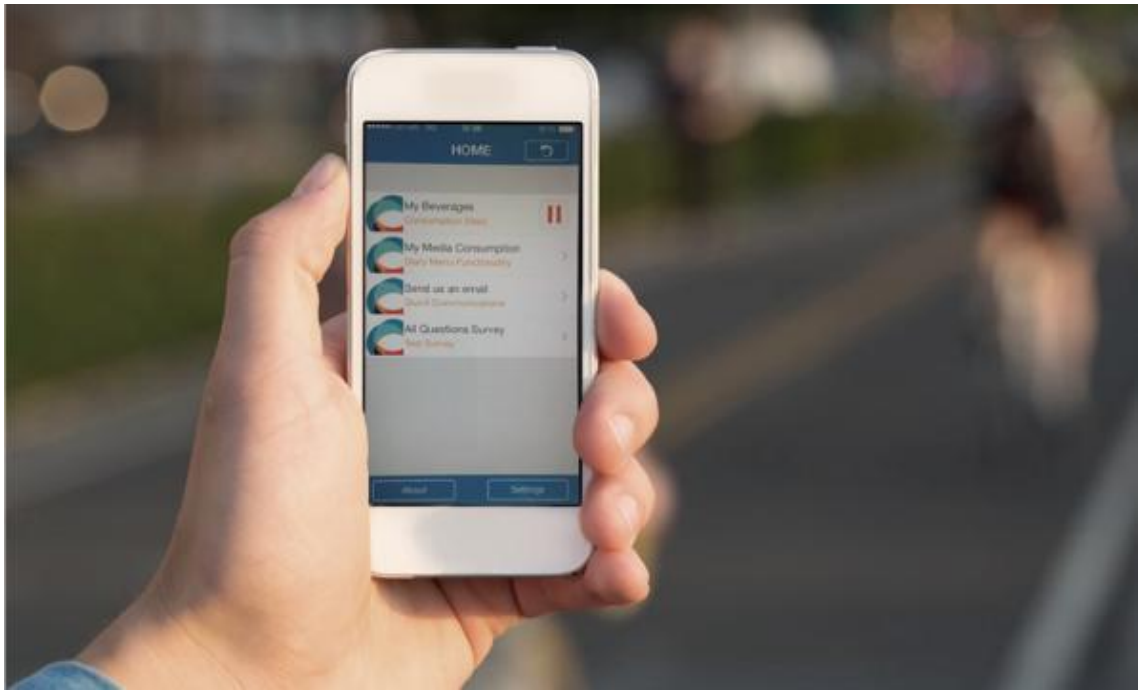
In view of the nature of these types of quality of life evaluations that ask people to remember a past event, the question behind the study was to determine whether there was any difference between self-reports of symptoms of Crohn's Disease based on the past two weeks (the 'remembering self') and being asked how they felt at up to three points in time on a daily basis for two weeks (the 'experiencing self'). A secondary consideration was to determine whether there was any difference between those on a biologic or not on a biologic treatment and whether there were any associations between factors (e.g. pain and feeling tired).

In terms of method, two stages of research were conducted. Qualitative research in the initial phase confirmed the extant literature and the focus on abdominal pain, fatigue (as manifest in terms of tiredness and lack of energy and lack of concentration), as well as stress. Other emotional and social factors around stigma also emerged which could have been included in the next stage, but the focus was to consider pain and a number of constructs of fatigue.

In the second phase of research, 20 respondents - 10 on a biologic and 10 on standard therapy - were asked to download the application after being fully informed about the nature of the study and in full compliance with ABPI, BHBIA and MRS codes of conduct related to market and online research.

Respondents simply downloaded the application on a smart enabled phone across an array of operating systems. Over a two week period, on three consecutive points each day during waking hours, they were asked to complete five simple questions that took on average less than two minutes to complete.

Such a smartphone app offers the researcher a variety of tools to encourage participation and enrich the data gathered. These may include simple questions using slide bars or choice criteria, taking photos, making short videos, audio commentaries alongside evaluating information and being part of online communities. An example of what that looks like is shown below.



The key advantage of using this approach is the closeness to the experience and the ability to respond without an interviewer or physical intermediary present. It allows for a rich source of understanding behaviours and attitudes that can be used in both a qualitative and quantitative manner. They represent a less post-cognitively rationalised response and engage more in the 'now' or 'moment'.

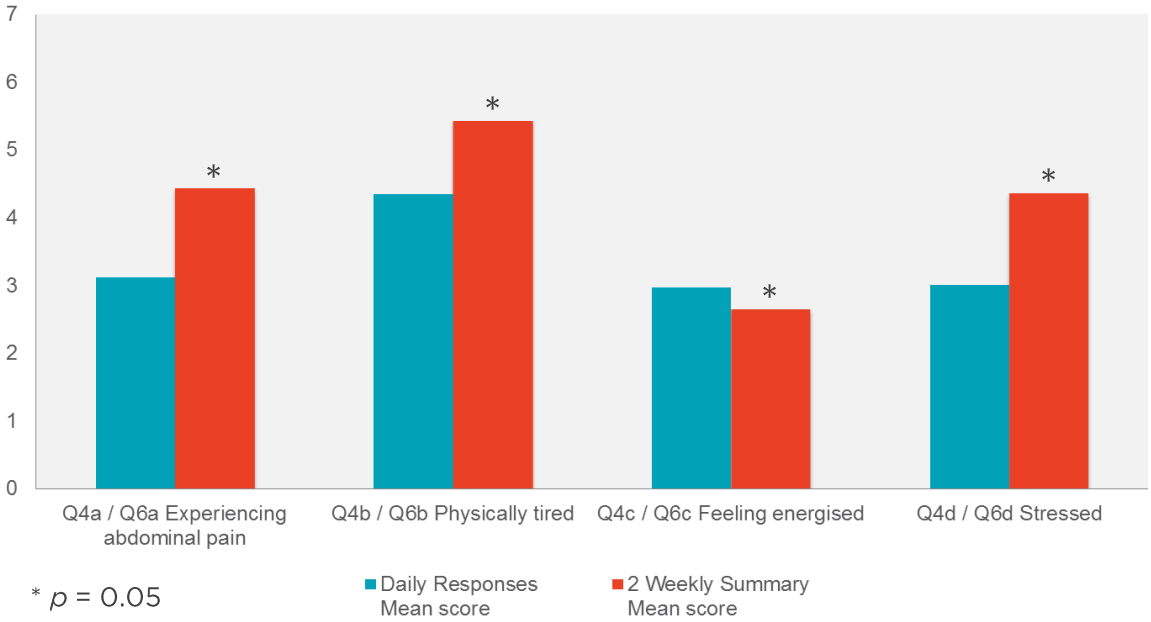
After two weeks the respondents were contacted and asked the same questions, but this time with the emphasis on recalling how they had felt over the same two-week period they had completed their moment-to-moment responses.

Even though there were only 20 respondents there was a potential input of over 4200 data points from five questions (590 data points were eventually completed). As a result, it was possible to conduct statistical comparison of means between the data points of the experiencing self and the one data point relating to what they remembered over two weeks.

So what did we find?

In short, within the context of abdominal pain, tiredness, concentration and stress what the participants remembered around these factors often exceeded their actual moment to moment experience.

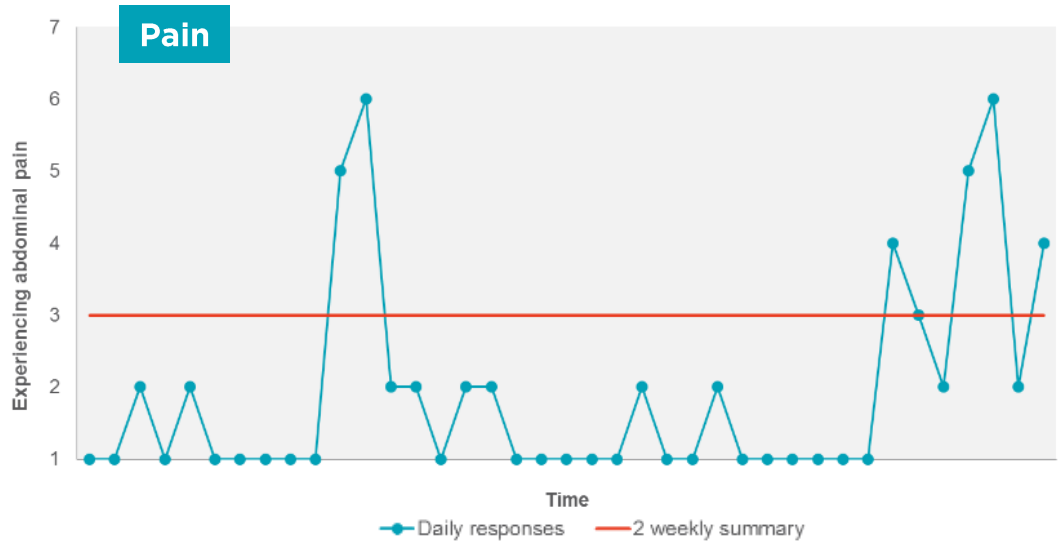
Main Findings of Crohn's Study

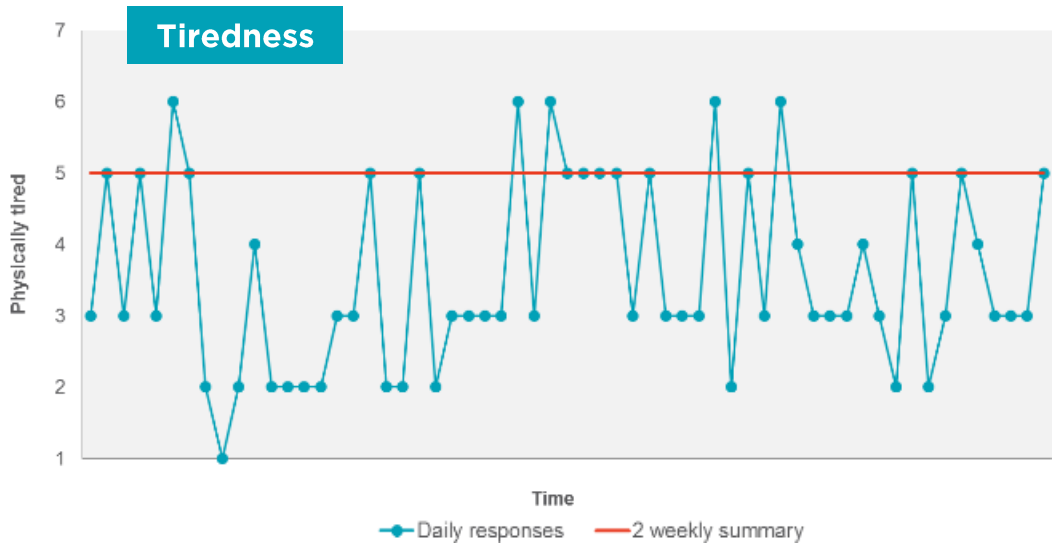


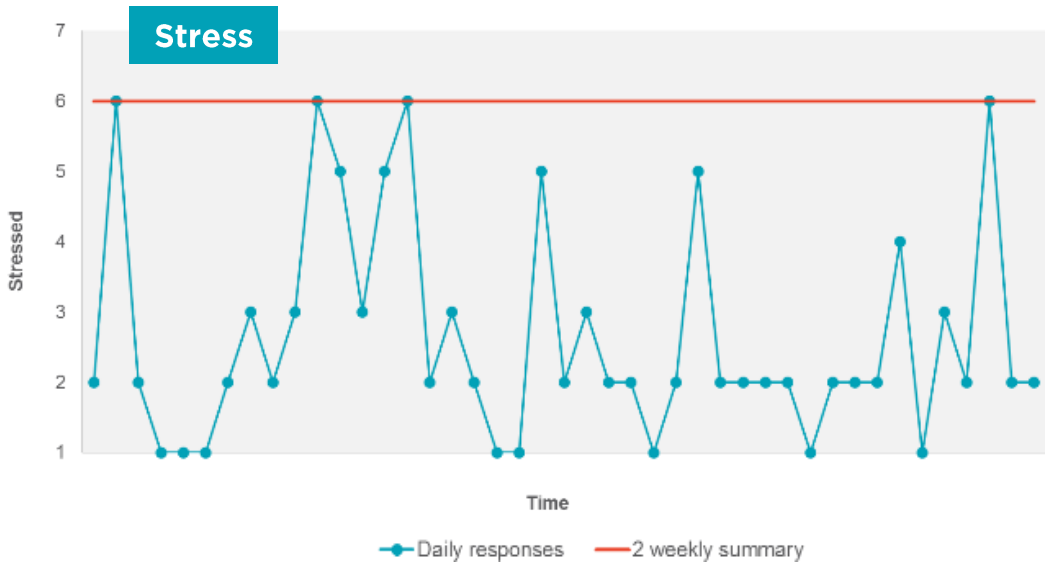
As can be seen from the graph above, capturing moments in the day to ask somebody how they felt (average blue bar) did not generate the same level of disease impact as being asked, for example, 'How physically tired were you over the past two weeks' (the average red bar).

Across the factors of abdominal pain, physical tiredness, feeling stressed and feeling energised, there were statistically significant differences in the means. This suggests that this is down to more than chance.

So what's going on? A look at some individual responses may give us a clue.


Pain
Experiencing abdominal pain
7
6
5
4
3
2
1
Time
Daily responses
2 weekly summary


Tiredness
Physically tired
7
6
5
4
3
2
1
Time
Daily responses
2 weekly summary


Stress
Stressed
7
6
5
4
3
2
1
Time
Daily responses
2 weekly summary

In the three separate cases above, both the peak end rule and significant peak points seem to determine the script that respondents use to reflect on their past experience. And from this remembered basis, they reflect higher rates of actual disease burden.

Think about the implications of this? If we were to use the remembering self for our predictive forecasting model we would in fact be exaggerating what is actually happening. How often are we faced with forecasting models that over represent the present?

There were also a number of further compelling observations from the data that are worthy of further consideration.

One such relates to the comparison between those who were on a biologic and those who were not. During both the qualitative phase, when asked to 'remember' 'abdominal pain' and 'tiredness' over the past two weeks, there was little difference between the two groups. In fact, with regard to pain, the scores were near identical.

However, the scores from the 'experiencing' data self-indicated statistically higher levels of pain in the non-biologic group. Surprisingly, higher levels of tiredness in the biologic group were also observed. It can be argued, that the remembering self, is simply not sensitive enough to understand the significant differences that the experiencing self can have as a result of therapy.

Some further findings emerge that lead us again to consider more questions and explore the value of using these technologies. Qualitatively, pain and fatigue related factors seemed to go hand in hand; the respondents talked about them in a related way. Yet in the study, no correlation existed between pain and either stress, tiredness or lack of energy.

This considers the possible independent physiological properties of fatigue within the relapsing phase of the condition that do not seem to relate to pain as a dependent factor; even though it may still have a moderating role.

Implications of the study

Clearly there is only a limited amount that we can deduce from a pilot case study, but it does indicate the difference between two self-reporting methods. Currently, the advent of those two new modern cultural paradigms (smartphone apps, and our understanding of our health and wellbeing from behavioural economics) have implications and challenges for two specific areas of pharmaceutical/healthcare enquiry:

- Clinical Research: At its boldest level, can we safely rely on the premise that we are giving an objective evaluation of experience based on Q.o.L questionnaires that ask for two week reflections of life's events? Does it necessarily differentiate sensitively enough between different clinical states, and are we losing some important objective findings that could add value to our understanding of the differences products make to people's lives?

- Marketing: Perception is all in marketing. Those peak end moments that fuel the scripts we make about our illnesses are those that the physician hears about from the patient. They may undoubtedly drive decision-making at a socially heuristic level. Similarly, understanding these peak end moments and particular experiences in an accurate and objective manner may allow us to understand more meaningful insights about a person's illness, or a physician's treatment and management behaviour. They can often be taken for granted; however, reflecting on actual behaviours may reveal deeper insights.

Adherence remains relatively poor in the area of biologics, so what drives low adherence, the experiencing self or the remembering self? What about the patient who remembers that they were in pain over the past two weeks, and yet their actual behaviour and experience would suggest they were not.

From a behavioural economics perspective, the experiencing self is more automatic and likely to drive the simplest behavioural route. Remembering requires higher cognitive tasks and more self-effort - The Type 1 and Type 2 thinking we discussed earlier. If adherence relies on that Type 1 thinking, more likely to be 'in the moment', then understanding how that experiencing self feels and thinks could be a very useful tool in driving up adherence levels.

The use of apps to better understand patient experience can have a bearing on the industry's use of 'added value' offerings to physicians, patients and carers. Clearly, apps that give a better insight into the patient's illness burden can help the physician's decision-making regarding treatment and management strategies. They have the potential of using the data collected from the app to help ground discussions on disease burden.

Mobile apps give us a unique space to understand 'in the moment' behaviours, feelings and beliefs that few other mediums can provide. They give us the ability to capture the moment in an unrivalled way. However, they have their limitations; they need to be balanced and work in conjunction with methods that explore meaning and context behind behaviours.

Paul Mannu

'In the moment' uses of Mobile Apps for Marketing Research Purposes

It seems clear from the Crohn's Disease study described in this paper that there are differences in the experiencing and the remembering self. They both have their place within the context of gathering essential healthcare information that informs both clinical and marketing initiatives.

In broad terms the use of mobile apps brings you closer to the markers of actual behaviours and the precursors of judgement and decision making. If you want, it might be regarded as a more objective understanding of what happens. It enables responses to be made within the context of the environment that the respondent is in: the 'what, where, when and how' of behaviour, feelings and attitudes. In conjunction with other qualitative methods that explore meaning making (the why), they can give a more complete insight into customer behaviours.

Understanding patient perceptions of the burden of disease, 'in the moment', can be explored via a mobile app by the use of innovative uses of video, audio or photo capture.

In fact, with the respondent's permission we can even use 'geo tagging' facilities. This is an in-built feature of most smartphones that can determine where the user goes, and are becoming increasingly more sensitive. If you wanted to know about mobility within a chronic disorder and compare different groups, this might be an approach you could take.

An area of considerable challenge is understanding patients' use of medication. It is notoriously difficult to determine adherence behaviour by asking people about whether they have taken their medication. Merely asking the question raises the issue of 'I should take my medication' and can lead to either intentional or non-intentional bias. However asking people to simply state if and when their medication has been taken at different points in the day may give a better evaluation of actual practice.

Health care professionals are often asked to explain and explore their treatment and management pathways; mobile apps and connected data create a more accurate medium to collect such data. Mixed methodologies, such as combining mobile apps and face-to-face qualitative enquiry, create a frame of reference regarding behaviour

that is found in actual experience (use of mobile app) and meaning making behind usage patterns using qualitative approaches. In effect the mobile app is providing more accurate information, which can be used to better inform face-to-face interviews of management pathways. Is this not a better way of inputting the values you need for forecasting and predictive modelling?

Rather than considering one point in time, mobile apps also facilitate processes over time, for example ongoing development programmes where the customer's input is required and a more iterative approach is beneficial. This facilitates co-creation methods with joint collaboration between developers and end users to examine product or message developments. Again, the mobile app creates contextually framed and longitudinal environments to collect data.

Dave Bostock

The Limitations of Mobile Apps

As with all methods of acquiring data, it is worth bearing in mind that there is no 'one size fits all'. Mobile apps are limited in terms of the amount of time a person is prepared to engage in the activity, irrespective of the motivating nature of the exercise. They are well suited for the ability to capture a moment in time but NOT necessarily to understand the meaning, rationale or significance of that moment of time.

As a result, it is important to see how the mobile app 'adds value' to existing methodologies and the skills involved in traditional market research techniques. As noted, this may involve triangulated methods around a core objective or behaviour that needs to be understood both in its objective and subjective framework. If it is noted that a patient did not take their medication over a period of time and in similar circumstances, why was this? The why is difficult to explore in detail with an app.

As a result, mobile apps in market research should be seen as a framework for understanding actual behaviours, supplemented by qualitative techniques that enhance memory recall, as well as exploring the more subjective influences on judgement and decision-making.

At Cello Health Insight, novel approaches alongside the use of mobile apps are used. For example, investigative enquiry and cognitive interviewing techniques, alongside ethnography and phenomenology, are all used to capture the additional pathways we use to understand the wealth of factors that influence the judgements and decisions that influence our behaviour, 'in the moment'.

More importantly, they give us insights into how we create meaning in the world and communicate this to others that influences the creation of brand identity.

Whilst recent figures indicate that a large proportion of the population now have smartphone apps, there are variances in the demographic split of usership. As a result, working with patients who are very elderly may not be feasible (albeit this is a rapidly diminishing limitation), as well as patients who for reasons of dexterity or function cannot use a smartphone. Similarly, when conducting international studies in, say, emerging markets, standard mobiles may be more popular than smart-enabled phones and, as a result the use of smartphone apps may not be feasible.

Dan Brilot

Important Points to Consider when Conducting Research with Mobile Apps

Before considering the practicalities of mobile technologies, it is important to bear in mind that the app is an intrusion on the person's daily living or working environment. Studies need to conform to data protection laws regarding the use of online, digital information, and the respondent needs to be fully aware of the type of data being collected and for what purposes they will be used.

Respective disclaimers and signed confirmation are required and need to be incorporated within the app design. As an example, if geo-tagging is used it should be made explicit (i.e. not in the small print) that data will be used to monitor where they are.

Here are seven top tips for conducting mobile app studies:

1. Clarity: be clear on the nature of the questions you want to ask and ensure that they are not ambiguous. Often this requires a phase of preliminary research and a pilot phase.
2. Robust screening: accurate screening is needed in order to draw robust comparisons. It also provides additional data that can be used to cross tabulate output data.
3. Rapid introduction of the app following recruitment: in our experience it is important to ensure respondents get going with the app soon after recruitment to ensure retention and completion
4. Ensure ease of functionality and navigation: our in house programmers often spend considerable time ensuring this feature.
5. Monitoring: our experience suggests that telephoning respondents and monitoring data uploads is an important consideration to improve data input.
6. If using random 'push' notifications be aware that these should be confined to waking hours.
7. Keep the questions simple: if the respondents are pushed daily or at multiple points during the day you can only ask a handful of questions or activities.

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