

NO TYPE: AN APP TO PREDICT PATIENTS' LIKELIHOOD TO TAKE MEDICATION AS PRESCRIBED

Here, Louisa Harvey, Alper Hulusi, Bjarki Holm and Stefan Olafsson, all Co-Founders of No Type, introduce their quick and accessible app for identifying whether a patient is likely not to take their medication as prescribed.

WHAT IS NO TYPE?

No Type is an accessible, quick-to-use app that focuses on the psychological, attitudinal and environmental traits that affect medication-taking behaviour (Figure 1). These traits have been identified over decades of research involving over 10,000 people who live with a chronic condition. The No Type app can identify whether or not someone who lives with a chronic condition is likely to struggle with taking their medication as prescribed.

THE ISSUE AT HAND

Many people who live with a chronic condition struggle to take their medications as prescribed.¹⁻⁶ This has a substantial impact on patients, affecting their opportunities, health outcomes and quality of life.^{6,7} The emotional, psychological and physiological burdens of life with a chronic condition can all play a part in impacting a person's medication-taking behaviour.⁸

Beyond the patient, the economic impact of patients not taking medication as prescribed is well documented, with the annual adjusted cost per person ranging from US\$1,000 to US\$44,000 (£806 to £35,500), depending on the condition.⁹ In the UK alone, this issue is estimated to cost the UK NHS £500 million per year.¹⁰

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Figure 1: The No Type app is accessible and quick to complete, allowing clinical studies and healthcare providers to identify whether a patient is likely not to take their medication as prescribed.

As well as the impact on patients living with a chronic condition and the wider economic impact, this issue increases the requirement for healthcare professionals to monitor their patients. In 2018, the global patient monitoring device market was \$20.3 billion and is predicted to rise to \$25.9 billion by 2023.¹¹ This expenditure significantly increases the cost per patient of medication and medical devices.

WHAT IS BEING DONE TO UNDERSTAND THE ISSUE?

Pharmaceutical and medical device companies regularly commission market research and human factors studies to understand the reasons why patients struggle to take their medication as prescribed or use their medical device as intended. However, patients who find it more difficult to take their medication as prescribed often represent a relatively low proportion of patients who take part in this type of research.

This issue stems largely from research companies unknowingly tapping into online communities and patient databases, and adopting recruitment approaches that tend to capture people who are more likely to take their medication as prescribed. Such people are more likely to respond to research invitations, search out research opportunities or be part of an online research database.

The outcome of this bias is that research insights and device developments are heavily influenced by a niche voice, representing patients who are more likely to take their medication or use a device as intended, regardless of the device design.

WHAT DOES NO TYPE AIM TO ACHIEVE?

The No Type App has four broad objectives, namely:

1. To give people who often struggle to take their medication as prescribed a greater voice in human factors and market research
2. To help improve the therapy experience, quality of life and health outcomes of people who live with chronic conditions
3. To avoid the natural bias involved in current participant recruitment practices, which tends to select for a niche population
4. To ensure device development incorporates a more holistically representative patient voice.

Let's be clear – there are sensitivities and errors that must be considered when discussing the issue of medication-taking behaviour. Discussions of this nature frequently come from a perspective and include terminology that is value-loaded, negative and places much or all of the blame on patients. In contrast, the No Type app was born out of a strong commitment to uphold the integrity of and empower people who live with chronic conditions, as well as to acknowledge diversity of views, experiences and challenges that people who live with chronic conditions live and breathe on a daily basis.

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DON'T TOOLS ALREADY EXIST?

The Medication Adherence Report Scale (MARS), a self-reported measure developed in 1999, is used extensively to measure medication-taking behaviour – often referred to as “adherence”. However, this tool can be inaccurate in identifying someone's likelihood to struggle to take their medication because it only measures current behaviour (which may be influenced by a second party supporting a patient in taking their medication) and fails to tap into a patient's fundamental likelihood to take their medication as prescribed without external support. MARS, like other tools, sometimes gathers “false” information, with some people unintentionally responding to questions in a way that presents their life in a more socially acceptable light.

Many years of experience in the field of patient behaviour have demonstrated that, with skilful qualitative moderation, it is possible to identify and explore someone's medication-taking behaviour during in-depth interviews. Often, once rapport and trust has been established between a patient and a skilled interviewer, the patient starts to reveal their “true” medication-taking behaviour and the reasons behind it. In an ideal world, tools for exploring medication-taking behaviour would replicate the strengths and benefits of this qualitative dynamic to elicit true insights where medication-taking behaviour is concerned.

WHY IS NO TYPE IS BETTER THAN CURRENT TOOLS?

The No Type app offers a number of key benefits over the tools currently used to gauge a patient's likelihood to take their medication as prescribed (Figure 2). First, the app is as good as skilled qualitative interviewing for detecting people who are more likely to struggle with taking their medication. Second, the app is accessible and quick to complete on any tablet, phone or PC. Third, the app provides a quick output to those screening people into human factors and medical market research studies to ensure that they can include (or exclude) people according to their research objectives.

Figure 2:
The No Type app offers a number of advantages over currently used methods for determining if a patient is likely to adhere to their treatment regimen.



HOW WAS THE APP VALIDATED?

A total of 118 participants were sent a link to the No Type app, along with a unique code, and were asked to complete the questions presented to them. The overall sample included a mix of men and women from the south of England aged 18–85 years, all of whom had a chronic condition and were taking regular medication – including for asthma (29.7%), anxiety (27.1%), depression (27.1%) and high blood pressure (24.6%). Most participants (86%) were taking tablets to treat their condition, but the sample included patients using inhalers, injectors and pumps. Over a quarter of the participants were using two or more medications with different modes of administration (e.g. tablets, an inhaler and an injection pump). Most of the participants were employed, and their level of education ranged from primary school through to PhD level.

The participants were recruited to the study using a broad range of approaches. To enable appropriate validation of the app, all participants had to be fluent in English and comfortable using technology such as smartphones. For the purpose of the study, factors such as geographical location and ethnicity were not purposefully screened for. The questionnaire contained in the app included 27 questions, formulated using information from a literature search on adherence algorithms, combined with the expertise in qualitative research that the No Type development team has developed over the course of thousands of interviews exploring medication-taking behaviour. Participants were blinded to the outcome and their responses.

Having completed the questionnaire, the participants were telephoned a few days later by an expert qualitative researcher who conducted an in-depth one-to-one telephone interview with them, lasting approximately one hour. Importantly, the interviewer was blinded to the participant's quantitative results from the online questionnaire. After building rapport with the participant through a discussion about their condition and treatment, the interviewer asked a series of questions about the participant's current medication-taking and factors that impact their ability or willingness to take their medication, as well as any changes they had noticed in their behaviour over time.

Based on the interview, the researcher was able to define, in their opinion, the participant's likelihood to take their medication as prescribed. Participants were categorised (internally) as either "likely to take their medication as prescribed" (takes their medication at least 80% of the time) or "unlikely to take their medication as prescribed" (takes their medication less than 80% of the time, or might take one medication as directed and not another owing to their beliefs about the medication). The insights gleaned from the follow-up qualitative interviews were then compared with the results from the online survey.

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HOW DID NO TYPE FAIR?

Based on the qualitative interviews, 89 participants were identified as being likely to take their medication as prescribed and 29 as unlikely to take their medication as prescribed. The team witnessed a strong concordance between the qualitative interviews and the app, which also identified 84 participants as likely to take their medication as prescribed (true negatives) and 26 as unlikely to take their medication as prescribed (true positives). Compared with the qualitative data, the app incorrectly labelled five participants as "likely to take their medication as prescribed" as opposed to "unlikely to take" (false positives) and three participants as "likely to take their medication as prescribed" instead of "unlikely to take" (false negatives).

The results indicate that the app identified patients who are unlikely to take their medication as prescribed at a sensitivity of 90%, with a 95% confidence interval (CI) of 73–98%, and a specificity of 94%, with a 95% CI of 87–98%. Clopper–Pearson CIs were calculated using the epiR package in R. Therefore, the No Type app was determined to be over 90% accurate at predicting likelihood to take medication as prescribed.

POTENTIAL USES OF THE NO TYPE APP

The issue of whether or not someone takes their medication as prescribed is both complex and dynamic, with far reaching consequences for the patient (physiologically, emotionally and practically), healthcare system and the wider economy. The No Type app offers medical device market research and human factors companies the means to identify and recruit suitable participants for their research.

Beyond the world of market and human factors research, the No Type app has many other potential uses. These include enabling healthcare teams to identify patients' support and guidance needs at the point of being diagnosed with a chronic condition.

Moving forward, the No Type team is committed to putting the app and algorithm through its paces by running further studies

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with broader and larger samples, including reflecting greater ethnic and condition-related diversity, as well as validating the app overseas. But for now, the results are exciting and represent a step forward in ensuring that medical device design efforts are inclusive of all patient voices, needs and experiences.

ABOUT THE COMPANY

No Type is a patient-centric medical behaviour technology company based in Cambridge, UK. No Type was founded by a team with experience across medical devices, usability research and technology with an aim to help improve patient voice and improve medical devices and pharmaceuticals globally.

REFERENCES

1. Cheen MVHH et al, "Prevalence of and Factors Associated with Primary Medication Non-Adherence in Chronic Disease: A Systematic Review and Meta-Analysis". *Int J Clin Pract*, 2019, Vol 73(6), e13350.
2. Cramer JA, "A Systematic Review of Adherence with Medications for Diabetes". *Diabetes Care*, 2004, Vol 27(5), pp 1218–1224.
3. Naderi SH, Bestwick JP, Wald DS, "Adherence to Drugs that Prevent Cardiovascular Disease: Meta-Analysis on 376,162 Patients". *Am J Med*, 2012, Vol 125(9), pp 882–887.e1.
4. Nieuwlaat R et al, "Interventions for Enhancing Medication Adherence". *Cochrane Database Syst Rev*, 2014, Vol 2014(11), CD000011.
5. Rolnick SJ et al, "Patient Characteristics Associated with Medication Adherence". *Clin Med Res*, 2013, Vol 11(2), pp 54–65.
6. "Adherence to Long-Term Therapies: Evidence for Action" (Sabaté E, ed). WHO, 2003.
7. Chisholm-Burns MA, Spivey CA, "The 'Cost' of Medication Nonadherence: Consequences we Cannot Afford to Accept". *J Am Pharm Assoc* (2003), 2012, Vol 52(6), pp 832–826.
8. Heckman BW, Mathew AR, Carpenter MJ, "Treatment Burden and Treatment Fatigue as Barriers to Health". *Curr Opin Psychol*, 2015, Vol 5, pp 31–36.
9. Cutler RL et al, "Economic Impact of Medication Non-Adherence by Disease Groups: A Systematic Review". *BMJ Open*, 2018, Vol 8(1), e016982.
10. Hagan P, "The True Cost of Medication Non-Adherence". *Omniceil*, Oct 2015.
11. "Patient Monitoring Devices: Global Markets". *BCC Research*, Aug 2018.

ABOUT THE AUTHORS



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Alper Hulusi is Co-Managing Director at Harvey Medical and has 28 years' experience as a qualitative researcher. Mr Hulusi started out in social policy research (ethnicity, policing, employment, health) before moving across to medical devices and usability research. He specialises in qualitative research techniques, in-depth focus group moderation and sensitive issues research. Mr Hulusi has presented at several conferences on qualitative research and the art of moderation. He is a Co-Founder of No Type.



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