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# "Alexa… what pills do I need to take today?"

Medication non-adherence is a big problem for the NHS in terms of cost and disease management; the most recent figures estimate a financial cost of £500 million per year.[1] The World Health Organisation (WHO) defines medicines adherence as the extent to which a person's behaviour - taking medication, following a diet, and/or executing lifestyle changes - corresponds with agreed recommendations from a healthcare provider.[2] Reasons for non-adherence are multifactorial: be it an aspect of illness such as memory loss or communication difficulties, polypharmacy (too many drugs to remember), miscommunication, unwanted side effects, or unspoken reservations patients have about medications.[1] To counter these, best practice advice tells us to improve patient-clinician communication, increase patient involvement, elicit patients' beliefs/concerns about medications and provide information in multiple forms to suit the person's capabilities.[3] But can digital assistants (see figure 1.) help to underpin this advice and provide a much needed adjunct to these strategies?

*Age, the internet and use of smart speakers*

Increasingly, smart speakers are entering UK households and in particular the over-55 years age group is seeing the fastest rate of adoption of this new technology.[4] The fact that digital assistants are so popular with this age-group is very encouraging for people seeking to harness this technology to improve the health and wellbeing of an increasingly co-morbid population. Indeed, despite the widespread assumption that older generations are not capable/interested in using the internet, figures show that this opinion is outdated and increasingly so, year-on-year. For instance, the percentage of women over 75 who are now using the internet nearly trebled from 13% to 37% in the year 2017-18 and the same figures for men showed a 76% increase from 29% to 51%.[5] However, it must be noted that the biggest proportion of internet non-users remains the over-65 years age group. So, while it can be expected that this number will diminish in time, we require innovative projects to increase useful engagement so that those in that category now do not get left behind. Additionally, smart speakers break down some of the barriers to using technology because they are voice-activated. Thus, they require fewer formal IT skills to operate them and increases accessibility to a broader range of people. Unfortunately, gaps will remain and they will not be appropriate for everyone, so rather than thinking of these devices as a replacement for face-to-face care, it is better to think of them as a digital adjunct in our range of existing healthcare options.



Figure 1. Example of Amazon smart speakers available[6]

**Personal digital assistant devices can be used to:**

- set reminders for medications;
- provide information e.g. exercise routines and facts about health conditions;
- improve access to the internet by voice control.

*Overview of pilot project*

Wouldn't it be great if patients had someone in their home to remind them to take their medications at a certain time of day, remind them what they have taken that day and not to miss their hospital appointment? "Yes!" – we hear you say. But, how can the NHS afford to put a nurse in everyone's homes? The good news is that it does not have to. The latest technology to enter our homes en masse are the so-called 'smart speakers' that have the potential to become 'digital homecare assistants'. A pilot study in Staffordshire has explored the potential uses of one type of digital assistant – Alexa - for patients with diabetes and many other health conditions.[7] Initial findings indicate that for improving medication adherence these digital healthcare assistants in-the-making are ready to go straight out-of-the-box. A growing number of UK homes[4] have the hardware needed already and could start to use it for those helpful functions straight away.

*Medicines adherence*

Guidance on efficient medicines administration in care homes focuses on 'The Six Rs of administration',[8] including: taking the right medicine, via the right route, at the right time and right dose. In the absence of healthcare staff to aid with this in patients' own homes, the use of digital assistants for this purpose provides a next-generation measure to improve adherence. Broadly speaking, non-adherence to medication falls into two categories: intentional, where a patient decides not to follow the treatment recommendations; and unintentional**,** where the patient wants to follow the treatment recommendations but faces practical problems doing so.[3] Alexa has a role to play in the former but it is with the latter where it can provide most utility.

- Intentional non-adherence

The reasons behind intentional non-adherence are multi-factorial but often include a patient's perception of no longer experiencing symptoms which can have serious consequences, something a smart speaker could be well placed to counteract. A common example could be an asthmatic patient who stops using their preventer inhaler because they haven't had an attack for a long time. As the disease slowly returns the patient becomes over-reliant on their symptom-relieving inhaler. Such lack of medication adherence is deleterious to health and is linked to increased hospital admission rates and death.[9] However, a simple question to Alexa such as "…what do I need to take for my asthma?" results in a response from the NHS website, outlining the purpose of the two different types of inhalers, which could be the small help needed to reinstate their prior medication adherence.

> *"It's like I've got a helper that nudges me in the right direction." – Janette 55*

Other reasons for intentional non-adherence include limited confidence in the diagnosis of their health condition, unfounded fears of side-effects, or interactions with other medications they have bought over-the-counter. Although some of these factors can be addressed by digital assistants through basic advice from the NHS website and reminders to attend healthcare appointments to discuss their concerns, these are areas which their clinician will still likely need to elicit and address personally.

- Unintentional non-adherence

Unintentional non-adherence can result from an aspect of illness such as memory loss or communication difficulties, polypharmacy and poor or ineffective instructions from clinicians. Several adherence-improving measures aimed at tackling such issues are available from community pharmacies, including: dosette boxes, medication reviews and New Medicines Service Reviews.[1,8] However, these are by no means fool-proof. Dosette-boxes still rely on the patient remembering to take the medicine in the first place and do not direct timing around meals well. Furthermore, medication reviews and New Medicines Service reviews do help the patient to understand the significance of adherence, but as they are usually conducted on an annual basis their impact can be short-lived. Regular medication reminders set up by patients on their smart speakers could bolster these existing strategies and improve patients' engagement with their medication.

*"I haven't forgotten a pill since." – John 67*

For example, Alexa could play a vital role as an adjunct to adherence in type-2 diabetes mellitus (T2DM). A recent article[10] reported findings of a study that up to a third of patients with T2DM did not take their medication correctly and this was associated with poorer diabetes control, which can obviously lead to negative health outcomes. For example, metformin (commonly used as the first-line pharmacological intervention in T2DM) relies on being taken with, or just after food. Digital-assistant reminders, set up to alert their users to take their medication at such times, increases the likelihood that metformin (or any other medication) is taken optimally and hopefully avoids preventable disease progression. Furthermore, with the diagnosis of T2DM commonly occurring over 40 years of age, the growing uptake of smart speakers in this age-group bodes well for making improvements to medicines adherence and thus the overall health and wellbeing of this cohort of patients.

*"My blood sugars have dropped by half since it's been installed!" – Darren 42*

*Findings of the pilot project*

As explained, one of the problems people have is remembering which medications to take and when, especially if they are experiencing memory decline or have cognitive impairments. Part of Alexa's core functions is creating lists and setting reminders. The study participants reported that creating digital lists reminded them of not just what medications to take but also what they had taken already. Several patients with type-1 diabetes mellitus (T1DM) explained that they often found it difficult to remember whether they had taken their last dose of insulin or not, but as long as they had told Alexa to 'tick it off the list' when they took it, they could re-check their list later and see that it had been crossed out. This was a source of great reassurance for patients as well as their carers and family members, as otherwise they could mistakenly take an overdose of their insulin and cause life-threatening hypoglycaemia. However, it must be noted that this function could do with more development. Lists need to be manually reset every day and would require tweaking to incorporate 'as required' medications that are not so regularly scheduled. But the basic functionality exists, so if a medication 'skill' (app) could be developed to solve these problems it would make the device even more useful.

Another string to Alexa's bow, is the companion app that users must download to their smartphone. It ensured that they had access to vital reminders and information out of the house. When participants were not in the house to hear their Alexa Echo device announce a reminder, they also received automatic notifications on their smartphone. This provides near 24/7 support for medication adherence, something that clinicians cannot rival. In another way, this could also be perceived as a potential drawback as it requires the user to also have a smartphone. Encouragingly however, current trends in the use of smartphones by older adults show again that this is an ever-reducing problem. For example, latest statistics show that usage rates of smartphones in these groups are rising year-on-year. They now estimate that 73% of 55-64 year-olds and 40% of the over 65s use a smartphone to access the internet on the go.[11] Furthermore, over half of all adults over 65 now shop online regularly.[11] So, it seems that the winds are favourable for the adoption of health-adapted smart technology for most ages of patients, but further promotion and engagement is required to realise its full potential.

*Conclusion*

Improving medication adherence has to be a key element of supporting the sustainability of the NHS – and a personal digital assistant such as Alexa is an accessible and effective means to that end. Whether organising medication reminders or educating patients about their condition, Alexa can be used alongside existing strategies to improve adherence to prescribed medication and other recommended health interventions. We need to make better use of existing user-friendly technology and adapt its existing functions to better support patients with long-term health conditions like diabetes, asthma and dementia.

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**References:**

1. Hagan P. *Adherence: Let's take care of it.* Omnicell; 2015. https://www.omnicell.co.uk/wp-content/uploads/2019/09/The-True-Cost-of-Medication-Non-Adherence-Report.pdf (accessed 22/02/2020).
2. World Health Organisation (WHO). *Adherence to long-term therapies: Evidence for action.* Geneva, Switzerland: World Health Organisation; 2003. https://www.who.int/chp/knowledge/publications/adherence_full_report.pdf (accessed 22/02/2020).
3. NICE. *Medicines adherence: involving patients in decisions about prescribed medicines and supporting adherence. https://www.nice.org.uk/guidance/cg76/chapter/1-Guidance (accessed 22/02/2020).*
4. YouGov. *Smart speaker ownership doubles in six months. https://yougov.co.uk/topics/politics/articles-reports/2018/04/19/smart-speaker-ownership-doubles-six-months (accessed 22/02/2020).*
5. Office for National Statistics (ONS). *Exploring the UK's digital divide. https://www.ons.gov.uk/peoplepopulationandcommunity/householdcharacteristics/homeinternetandsocialmediausage/articles/exploringtheuksdigitaldivide/2019-03-04 (accessed 01/04/2020).*

6. Newman J. *Range of Amazon smart speakers*. *https://www.techhive.com/article/3327501/how-to-use-alexa-routines.html (accessed 25/02/2020).*

7. Chambers R and Beaney P. The potential of placing a digital assistant in patients' homes. *British Journal of General Practice (BJGP)* 2020; 70(690): . https://bjgp.org/content/70/690/8 (accessed 19/02/2020).

8. NICE. *Managing medicines in care homes. https://www.nice.org.uk/guidance/sc1/chapter/1-Recommendations (accessed 22/02/2019).*

9. Royal College of Physicians. *Why asthma still kills. https://www.rcplondon.ac.uk/projects/outputs/why-asthma-still-kills (accessed 22/02/2020).*

10. Diabetes Times. *Up to a third of people with type 2 diabetes not taking prescriptions properly says study. https://diabetestimes.co.uk/up-to-a-third-of-people-with-type-2-diabetes-not-taking-prescriptions-properly/ (accessed 22/02/2020).*

11. Office for National Statistics (ONS). *Internet access – households and individuals, Great Britain: 2019. https://www.ons.gov.uk/peoplepopulationandcommunity/householdcharacteristics/homeinternetandsocialmediausage/bulletins/internetaccesshouseholdsandindividuals/2019 (accessed 31/03/2020).*

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