Smart Packaging: Increasing Therapeutic Adherence

Forgetfulness is the main culprit for why patients fail to take their medication on time; however, smart packaging may be the answer so patients never lose track again

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Failure to adhere to medicinal treatment regimens is arguably the world's biggest therapeutic challenge. The R&D spend on the discovery and extension of the drug pipeline in 2018 was reported at $179 billion, some 21.6% of sales (1). Given that typical adherence levels on average sit around 50% non-adherence to long-term therapy for chronic illnesses, intentional and unintentional medication non-adherence signifies a prevalent and persistent healthcare problem, and it is frankly amazing that greater effort and spend is not directed to addressing this global crisis.

More specifically in terms of the human impact, nearly half of all adults and approximately 8% of children (aged 5-17 years) worldwide have a chronic condition.

In terms of GDP, annual cost of medication non-adherence estimates range from $100 to $290 billion in the US, up to €1.25 billion in Europe, and approximately $7 billion in Australia (2).

The context is compelling in that the costs of non-adherence adversely affect countries, communities, and individuals, but why is this non-adherence so prevalent?

Many have undertaken research, but Omnicell's findings of 2015 broadly support much of the previous and subsequent research in that there are some fairly key areas. After we get over the 'can I afford it?' question, there are some other key findings such as:

- Memory: "I forgot to take my prescription!"
- Side effects: "I don't like the side effects, are they normal?"
- Denial: "I'm not ill! I don't need drugs!"

Interestingly, research shows that these different elements can be readily managed through the use of smart technologies and packaging, delivering excellence in communication.

Smart technologies are becoming ever more affordable and their capabilities ever more useful. In its simplest form, the package already has print, leveraging the print system by use of a 'code' or some type of image recognition – augmented reality or

other system to provide some degree of direction to a URL or a product/brand 'portal'. Sometimes even animations can work very effectively depending on the target cohort – little green men or superheroes for the younger patients and more conventional delivery mediums for the older patients. Of course, there are the radio frequency identification (RFID) and near field communication (NFC) electronics that can be useful technologies providing that same connectivity. They have their place, but are, however, unlikely to be as cost effective as the print system, certainly not in the foreseeable future – although one should not discount a number of retailers adopting RFID technologies for automated checkout and in Japan at the 7/11 convenience stores for effectively reducing the need for staff.

Speaking of the use of print in this context, the code, in the same way the NFC tag or RFID chip delivers, is the key to media and information riches. Of course, the pre-cursor is the use of the smartphone, which is becoming ubiquitous. Statistics from Statista show that there are 2.7 billion smartphone users covering 35% of

Rank	Flag	Country	Total population	Smartphone penetration	Smartphone users
19	China	China	1,415,046,000	55.3%	782,848,000
40	India	India	1,354,052,000	27.7%	374,893,000
5	United States	United States	326,767,000	77.0%	251,668,000
14	Russia	Russian Federation	143,965,000	63.8%	91,865,000
28	Brazil	Brazil	210,868,000	41.3%	87,172,000
41	Indonesia	Indonesia	266,795,000	27.4%	73,155,000
18	Japan	Japan	127,185,000	55.3%	70,327,000
4	Germany	Germany	82,293,000	78.8%	64,830,000
24	Mexico	Mexico	130,759,000	45.6%	59,597,000
1	United Kingdom	United Kingdom	66,574,000	82.2%	54,713,000
25	Philippines	Philippines	106,512,000	44.9%	47,858,000
33	Vietnam	Vietnam	96,491,000	37.7%	36,378,000
11	South Korea	South Korea	51,164,000	67.6%	34,562,000
16	Italy	Italy	59,291,000	58.0%	34,394,000
8	Spain	Spain	46,397,000	72.5%	33,631,000
7	France	France	65,233,000	76.0%	32,598,000
32	Turkey	Turkey	81,917,000	37.9%	31,060,000
27	Thailand	Thailand	69,183,000	43.7%	30,217,000

Image 1: List of countries by smartphone penetration in 2018

the global population – using this tool with the print 'key to the lock' can yield tremendous benefit. More detail in **Image 1** from Wikipedia shows the huge numbers of users even in the 'less developed' regions of the world, indicating the power and reach of these solutions.

Of course, a by-product of the smartphone is the frequently resisted downloading of an app that has, to date, held back adoption. The developers are listening, however, with newer technologies not requiring that intrusive download and providing more convenience and user friendliness without loss of security.

When one reaches the secure portal, rather than the uncontrolled content of the web, it is important to recognise that this information is controlled by the brand, and thus it is reliable – a hugely important factor in the pharmaceutical world, providing auditable provenance and confidence to users of these resources through 'back office' asset management tools. Content on these portals can, of course, take many forms: text, audio, video, and so

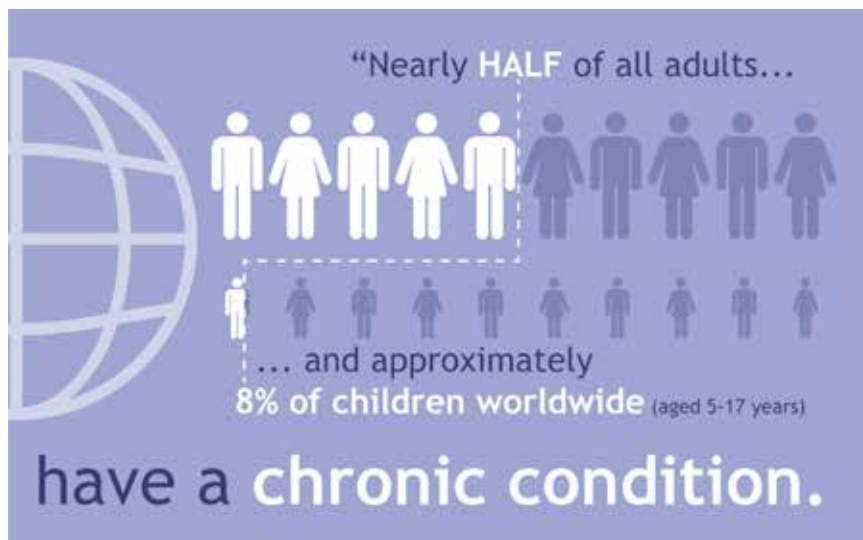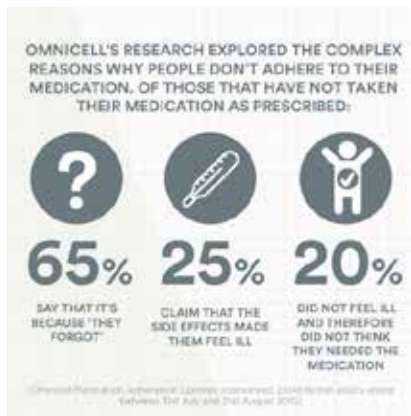forth, all delivered via smartphone or PC technologies.

Through the portals, exceptional information – custom and effective – can be delivered and provides the level of personalisation we all crave.

It's clear that we need a reason to access, and it is hoped that the 'what's in it for me?' question can be answered through the use of great interactions from experts providing solid and robust information, a frequent criticism of Big Pharma, and don't forget about the dose reminders improving therapeutic outcomes. There is no place for overt marketing, but the sharing of qualified and auditable information has to satisfy the need for better understanding.

As we saw earlier, some 65% of non-adherence is driven by forgetfulness, and the use of 'reminders' has proved to be highly successful in promoting increases in dose compliance. While the main target is the patient, for certain therapeutic areas (e.g., dementia), there is even the opportunity to establish patient 'buddies' who will receive auto calls to advise when family members and friends fail to take the correct dosages at the right time. The buddies can then proactively chase the patient, promoting compliance with the prescribed dose. In some cases, the buddy may be the pharmacy or a caregiver, where a relationship has been created often over many years and can, particularly with geriatric care, provide a level of interaction that is welcomed and further enhances the quality of life.

Additionally, there is the delivery of information in a safe and convenient form. Now, for the packaging information leaflet (PIL) there are many great examples, but there are also many examples of really bad PILs. The key is that we can do better.

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have a chronic condition.

Asthma UK estimates that around 1 million Britons are at risk because they are using their inhalers incorrectly as paper PILs do not effectively guide the patient. As an example, where communication and information delivery is failing the patient population, nearly one in five, 19% of users, do not use their inhalers effectively. To try and address this, Asthma UK have commissioned videos to demonstrate correct use – content that could be delivered through the secure portal.

For the e-PIL, it is important to recognise that the same rules do not apply when designing content; colour, illustrations, layout, links to video should all become ubiquitous as well as adding in helpful dose reminders. We have the freedom and tools of dynamic electronic communication: searchability, menus, and, of course, highly cost-effective platforms, so just dumping a static version of the PIL doesn't cut it and would explain why use of electronic documentation is not yet as widespread as we would like in this field. The electronic content must, however, be subject to the same levels of regulatory control and scrutiny, but it must deliver benefit, something that the regulatory authorities widely support. Indeed, support for the e-PIL is growing, with Australia adopting this system under consumer medicines information platforms and other countries also exploring this approach.

The smart approach to e-PILs must deliver information easily and in a manner that allows the patient to navigate effectively. This is a facility that is easy to manage, and one only has to explore Amazon or any national news site to see how search data and facility are incorporated and support interaction. Of course, we also add further benefit by the use of smart technologies; the tools at our disposal are manyfold. In the first instance, we can utilise the audio capabilities of the smartphone. Consider the scenario: a visitor to your country, or indeed someone without the benefit of education, would be unable to read the PIL provided with a drug in your country. By effective use of iconography, and audio prompts driven by the telephone set language, the IT gurus have been able to deliver highly effective capabilities that are universally accepted – true cross-border capability that delivers convenience and safety. This is achieved by understanding the patient need, something that hitherto hasn't always been at the forefront of thinking; consider the miniature fonts and the lack of colour. Legislative compliance, rather than convenience and usability, has been a driver within the pharma industry.

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In addition to the patient benefits, there are other clear business gains; the supply chain is an obvious beneficiary of the use of e-PIL technology, and the redundancy of the PIL is a challenge for artwork pre-press management and supply of print, on-line insertion, line efficiency increases, maintenance and changeover efficiencies and, finally, cost savings. It is estimated that there are in the order of 90 billion PILs printed globally on an annual basis, and even at an average cost of only €0.01 each, this costs the pharma industry some €0.9 billion per annum. That's a significant benefit, and what of the eco story? At 5g per PIL, that's 45,000 tonnes of paper annually.

As discussed earlier, there is significant evidence that by addressing the convenient access to information more effectively in a manner that is patient-centric, there will be a significant increase in therapeutic outcomes by increased adherence. This, of course, then delivers sales.

In simple terms, the growth in industry sales can be accelerated, and in a best-case scenario by 100%, which is an opportunity that could exceed

$1 trillion by 2021 if the growth predictions are to be believed.

Clearly, that's a stretch, but even an incremental 5% improvement in therapeutic adherence would be worth $50 billion in 2021. While this seems incredibly one sided to the benefit of the industry, the governmental benefits to the budget are also significant.

As many will be aware, the UK recently fought an election where the whole cost and funding of the NHS was quite rightly a subject of great debate and interest. Hypothetically, if the UK Government were able to initiate programmes that increased adherence, and improved outcomes and patient health, all through increased levels of adherence, surely the level of hospital interventions would fall and assist in reducing load on the front-line hospital resources. This would be an absolute win-win for the industry and wider society.

Final Thoughts

Smart technologies delivered through the interactions of the packaging solution and smartphones have the potential to be a game changer in

the healthcare industry. Embracing and influencing the direction through governmental policy, action, and harnessing the power of the cloud IT infrastructure via the one constant – the product packaging – provides the key to that panacea, which is more cost-effective healthcare.

Control and provenance of delivered content is essential in the same way as now; auditable, effective, and safe, providing patient confidence. True, the potential financial benefits are enormous: Big Pharma and government have a lot to gain, but overall, it is society that benefits the most. Better outcomes, increased quality of life, and life expectancies are things that we should all seek. After all, we're all getting older; wouldn't you like to see the benefits?

References
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In a career that has spanned over three decades, **Chris Waterhouse** has provided packaging and supply chain technical expertise and innovation insight to some of world's leading pharma, agrochemical, and petrochemical companies. Chris is Managing Director of **iDi Pac** and former Chairman of the UK Packaging Society, the "home of packaging professionals", which represents packaging professionals across the UK and overseas. Widely recognised as the 'go-to guy', Chris is much sought after across the packaging and supply chain industry, and is an acclaimed speaker at business conferences and industry events – well known for his technical innovations, practical insights, and leading-edge thinking.

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