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When Is Intelligent Healthcare Packaging the Right Choice?

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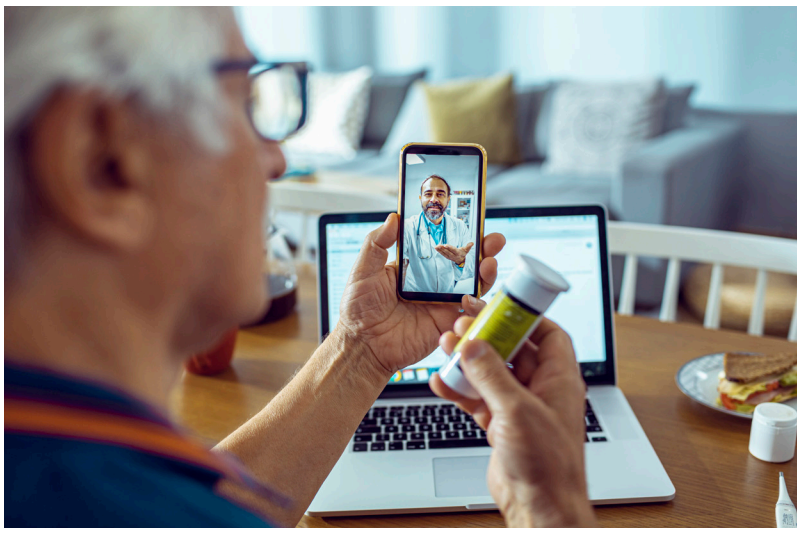
As we know, the primary purpose of packaging for prescription or over-the-counter (OTC) pharmaceuticals, vitamins and supplements is to protect products as they move from production facilities to consumers and patients. While product protection remains a critical outcome, technology innovations have now expanded healthcare packaging's traditional functions.

When packaging engineers and brand managers imagine what they can achieve with the help of new packaging technologies, it's difficult to know where to start since the potential use cases, goals and outcomes of product packaging have grown so significantly. What's more, the technology itself can be confusing.



This article is intended to help those involved in the conceptualization and development of healthcare packaging understand the capabilities of packaging technologies and determine the best choices for their products, as well as for patients and consumers.

Background

Traditional Versus Intelligent Packaging

The purpose of traditional packaging is to protect, promote, and preserve its contents. Traditional prescription packaging typically evokes images of an amber-colored bottle with a screw cap and a label with basic and limited information about the product. For OTC drug products, vitamins and supplements, we see brand names, images and product taglines used to compete for consumer attention on crowded retail shelves.

Over the past 20 years, the possibilities for packaging to "do more" began to emerge, and technology innovations were developed to support evolving outcomes. The applications for intelligent, or smart, healthcare packaging quickly grew. [1]

"Active" packaging, one of the first types of intelligent packaging, includes specific components built directly into a package or as a separate component, with the purpose of enhancing performance of the overall packaging system. Examples include labels that contain special inks that shift color with defined temperature changes, or desiccant packets that absorb moisture to extend the shelf life of products.

Connected packaging is a more recent innovation within the intelligent packaging space, and has rapidly moved to the forefront of the healthcare packaging evolution. Simply put, connected packaging contains a mechanism that triggers an action on a compatible device. The mechanisms can be optical, like a barcode, or electronic, like an NFC tag. What's exciting about connected packaging is the fact the latest versions of this technology are accessible to anyone with a smartphone.

Common examples of optical connected packaging used widely today include Universal Product Code (UPC) barcodes and Quick Response (QR) codes. Both contain information that can be optically scanned, such as Stock Keeping Unit (SKU) data that is registered and stored for managing stock and initiating action in the supply chain. QR codes can also contain text, like URLs, and trigger a webpage to open on a smartphone or tablet.

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Electronic mechanisms for connected packaging involve components that are embedded in the package itself. These electronic components trigger an action or response when they interact with a compatible device. The component is usually low powered, battery free, flat and flexible, lending itself to use in a wide array of packaging applications. Radio frequency identification (RFID) is a common example; the RFID tag is scanned by a special reader that triggers an intended activity. Near-field communication (NFC) labels or tags, which are a type of RFID technology, are both intelligent and convenient when applied to packaging, given they can be scanned by a smartphone to trigger an activity, like opening a webpage.

Packaging Powered by the Internet of Things (IoT)

The IoT is the convergence of technologies, analytics, sensors and systems to control and track physical objects. When healthcare packaging is intelligently connected to the IoT, it can be tracked from a manufacturing facility to the person consuming the product. Through this connection, valuable data can be collected that enables not only a better understanding of the product, but also patient and consumer behavior.

Consider the power of intelligent packaging connected to the IoT as it reports its own location and status in the supply chain. Is it moving, or in storage? If the latter, how long has it been idle? What environmental conditions did the product experience on its journey and did they alter the quality of the product? The answers to these questions are invaluable for drug developers, product managers, and supply chain specialists.

Connected packaging can also help clinicians and drug innovators better understand patients and consumers by delivering information about the patient experience. This kind of packaging can answer questions like when and where the OTC product was purchased, its ultimate destination, where and when it was opened, and how much time elapsed between locations. For prescription medications, connected packaging can better inform the patient and serve a role in medication adherence.

This barely scratches the surface on ways intelligent packaging connected to the IoT can help healthcare product producers, and volumes could be written on its limitless applications. However, not every product is a good fit for connected packaging. In the next section, I will offer a framework to help you determine if, and what form of intelligent packaging is the right choice for your product.

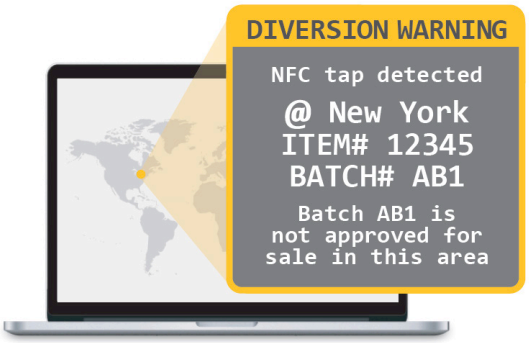
When to Choose Intelligent Packaging

When determining if intelligent packaging is the right choice for your drug product, I would recommend beginning by defining your desired outcomes within the context of the product and the patient or consumer, while also considering macro trends in healthcare.

Outcome #1 – To Drive Continuous Supply Chain Improvement for Enhanced Patient and Consumer Safety

Considering macro trends in healthcare, a better understanding of patients and disease has driven the development of precision drug therapies that deliver better results. These therapies can be more valuable and in many cases, the patient populations are smaller. This has created a more complex supply chain with a higher volume of expensive goods moving through it.

RFID's long-range scanning capabilities enable instant identification and continuous monitoring of items throughout manufacturing, distribution and sale by utilizing RFID scanners that can detect a large number of objects within a predetermined area—such as a warehouse, transport truck, or store.



This form of intelligent packaging can help pharmaceutical companies enhance supply chain security, prevent diversion and anti-counterfeiting, improve efficiency, forecast more accurately and validate purchases. Intelligent connected packaging equipped with RFID technology can not only communicate its location, but also alert us when product tampering has occurred, or if the product or packaging has been adulterated or compromised.

For OTC pharmaceuticals, vitamins and supplements, rather than waiting for periodic retail reports, product managers can use RFID technology to monitor purchasing trends in real time. As this significant body of data is generated, improvements can be applied to make supply chains more efficient. Product forecasting and distribution plans can be more effective, and healthcare products will get into the hands of those who need them, when they need them most.

Outcome #2 - To Help Patients and Consumers Make Informed Decisions About Their Health, Promote Self-Care and Enhance Adherence

Another rapidly growing healthcare trend is the desire for patients and consumers to be better informed about their care and to administer treatment from their homes. The COVID-19 pandemic has put the spotlight on self-care, although its popularity was rising beforehand.[2] With many areas implementing stay at home orders, in-person doctor visits were cancelled but of course, treatments needed to continue.

It's also true some prescription medications require precise dosing protocols to achieve the best efficacy. Noncompliance and poor patient adherence have a significant and costly impact on healthcare, leading to higher morbidity rates, and increased hospitalizations. It has been estimated that in the US alone, the estimated annual cost of prescription drug–related morbidity and mortality resulting from non-optimized medication therapy was $528.4 billion, equivalent to 16% of total US healthcare expenditures in 2016.[3]

Intelligent connected packaging can improve compliance and patient adherence by delivering an enhanced patient experience, including convenient access to internet resources that introduce the brand, explain the protocols, review potential side effects and contraindications, and offer an option to receive dosing reminders.

Outcome #3 - To Gain New Insight Into the Patient and Consumer Journey for Decision-Making

Companies go to great lengths and invest significant resources to better understand the consumer experience as it relates to their products, since this drives important insights for decision-making. That said, once a product is in the possession of a consumer or patient, it's difficult to continue to gather data and engage with the consumer or patient throughout their ongoing journey with a product.

NFC labels or tags are data and engagement enablers – they allow brands to better assure, inform and engage consumers before and after purchase, as each label has its own unique identifier that creates real time, item-level data.

For marketers, the fact an NFC tag can stay attached to product packaging throughout its lifecycle creates a channel for recurring and remote engagement with consumers outside of traditional methods. With every tap, contextual messaging can be provided to the patient or consumer. For example, scanning the label in-store could provide a message regarding an upcoming promotion, in addition to more detailed product information. Once the consumer or patient is at home, scanning the label could provide a recommendation on how to use and store the product, as well as the brand preferred e-commerce channels for reordering the product, which helps minimize brand switching.

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Conclusion

The purpose of pharmaceutical packaging has evolved significantly over the past several decades. As the industry has imagined new and valuable outcomes that can be achieved through packaging, we have also seen innovative technologies evolve to support endless possibilities – and this can be overwhelming.

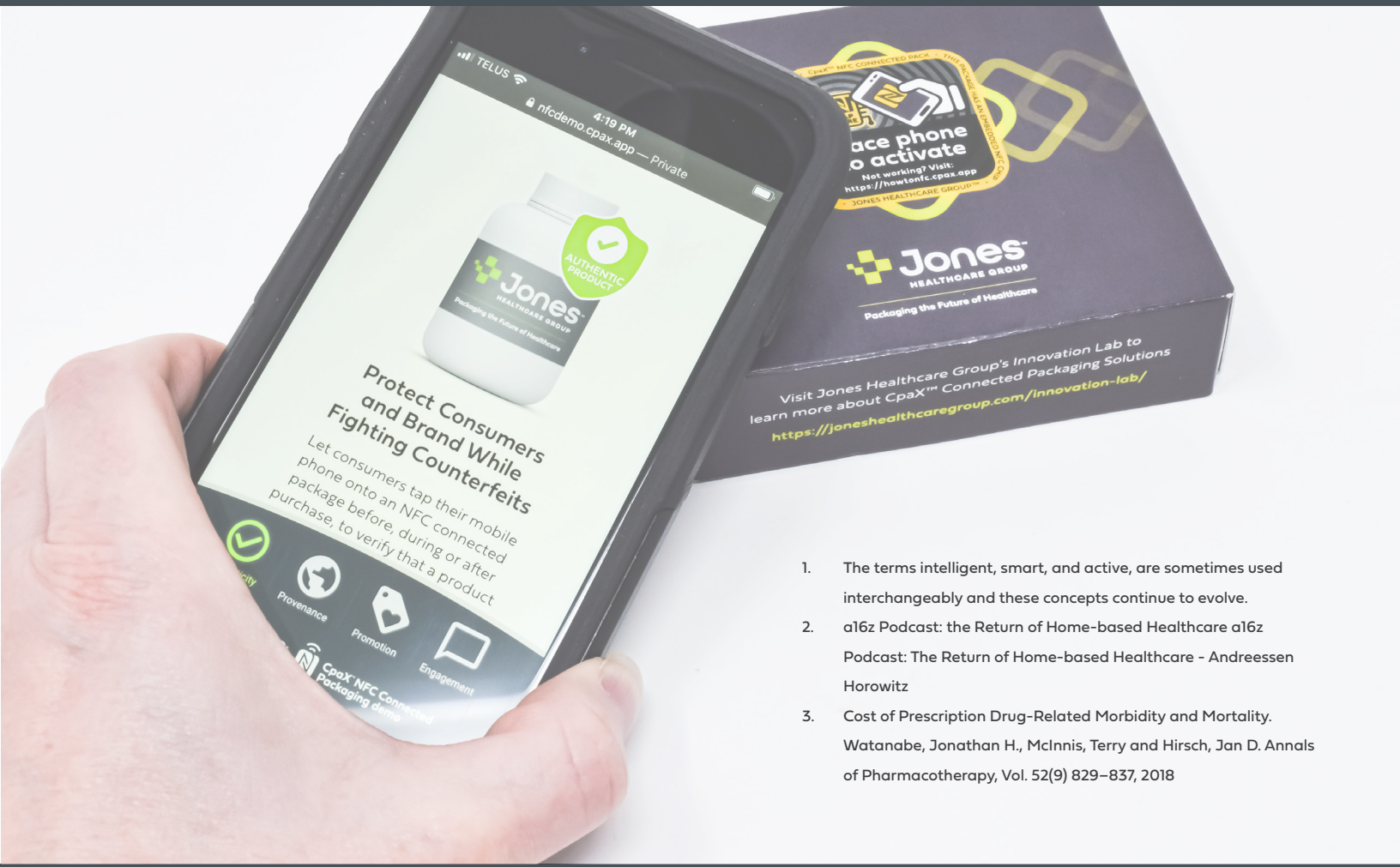
Traditional, active, and intelligent packaging, including connected packaging, each have specific capabilities that can play a role in achieving better drug delivery outcomes as they operate in the IoT.

When determining if intelligent packaging is the right choice for your drug product, it is valuable to begin by defining your desired outcomes within the context of the product and the patient or consumer, as well as consider macro trends in healthcare.

About the Author Andrew Wong

Andrew is the Senior Manager, Corporate Sustainability at Jones Healthcare Group. He is responsible for evaluating and transforming emerging technologies into commercially viable packaging solutions that better serve consumers and patient outcomes.

Andrew is actively engaged in the greater active and intelligent packaging community, providing both leadership through publications and presentations, but also serving as a participant, looking for the next, new transformative technology.



1. The terms intelligent, smart, and active, are sometimes used interchangeably and these concepts continue to evolve.
2. a16z Podcast: the Return of Home-based Healthcare a16z Podcast: The Return of Home-based Healthcare - Andreessen Horowitz
3. Cost of Prescription Drug-Related Morbidity and Mortality. Watanabe, Jonathan H., McInnis, Terry and Hirsch, Jan D. Annals of Pharmacotherapy, Vol. 52(9) 829–837, 2018