



Issue Date: July/August 2009,

QUALITY CONTROL | Brand Protection

By Dean Hart

Nano Tool a Weapon Against Counterfeiting

New method of brand protection could provide safety for pharmaceutical companies and patients



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Pharmaceutical manufacturers, the pharmaceutical supply chain, and unsuspecting patients are under attack by sophisticated and well-funded criminal elements seeking to profit from counterfeit and illegally diverted medications with no regard to the detrimental impact their actions have on the health and well being of patients. Unfortunately, counterfeiters and diverters seem to be winning many of the battles, if not the war.

In 2006, the World Health Organization (WHO) estimated that 10% of the world's medicines were counterfeit and noted that the severity of the problem varies with geography. In the United States and Europe, about 1% is counterfeit; in Russia, 12%; in Mexico, 40%; and in Nigeria, 80%.

Closer to home, the Center for Medicine in the Public Interest (CMPI) has estimated that counterfeit drug commerce will grow 13% annually through 2010, a growth rate nearly twice that of legitimate pharmaceuticals; this growth in counterfeit medications will generate \$75 billion in revenues—a 92% increase from 2005.

According to a January 2009 report by the British newspaper, *The Observer*, "Figures collated for the first time reveal that British border officials seized more than half a million counterfeit pills destined for the [National Health Service] and high-street chemists last year, an amount equal to the quantity of counterfeit drugs found in the whole of Europe in 2005."

And in perhaps the most telling report, the European Commission announced in December 2008 the results of MEDIFAKE, an action that targeted customs control on illegal medicines entering the European Union (EU). During this two-month program, customs inspectors from the 27 member states put a special focus on coordinated action to stop illegal medicines from entering the EU. Among the products intercepted were antibiotics; anti-cancer, anti-malaria, and anti-cholesterol medicines; and painkillers, erectile dysfunction drugs, and drug precursors. Frighteningly, this first EU-coordinated action netted more than 34 million illegal medicines in just a two-month period.

The WHO report projected that developed countries like the U.S. and Great Britain were likely to have rates of

counterfeits in the range of 1% or less. Applying that rate to the approximately four billion U.S. prescriptions dispensed in 2008 means 40 million prescriptions filled with bogus medicine.

While many in the industry may consider 1% high, the question that must be posed is what level of perceived counterfeiting is comfortable for manufacturers, governments, and patients? Is it 0.5%, a potential 20 million prescriptions filled with fake medicines? Or 0.25%, a potential 10 million prescriptions filled with fake medicines?

Obviously, a single instance of counterfeit or illegally diverted medication is unacceptable; unfortunately, forces are at work that could make the aforementioned counterfeit percentages seem conservatively favorable.



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Pills being dispensed by NanoGuardian's NanoEncryption machine, which manipulates the coatings and gelatins used in the manufacturing of tablets and capsules at the micro- and nanoscale level, resulting in NanoCodes. Specialized equipment and software is used to detect counterfeits that do not have NanoCodes.

Illegal Diversion

While illegal diversion often takes a back seat to counterfeiting, many security experts view it as the catalyst for the counterfeit market. Criminal elements may first test the supply chain loopholes by introducing illegally diverted product—for example, product intended for sale at a lower price in other countries, expired product, or product sent for compassionate use purposes—into the supply chain. If this effort succeeds, they often migrate to counterfeit product, which offers easier availability and lower cost than authentic, albeit diverted, product.

At the heart of the escalation in counterfeiting and illegal diversion is the global economic downturn. By the end of 2009, as many as 6 million people in the United States are predicted to be out of work, and the U.S., of course, is not alone in its economic pain. Virtually every part of the world is experiencing economic issues, and families are carefully evaluating how every dollar is spent. All non-essential needs, including hobbies, leisure activities, and vacations, are under scrutiny. One essential need that is often beyond scrutiny is the medication many unemployed individuals and their family members rely upon for their health and well being. The need to continue these medications, even when health coverage has been compromised and income diminished, creates a difficult situation in which patients feel they have no choice but to search for cheaper sources for their medications.

At the same time, delays in government-driven and supported brand protection initiatives such as California's ePedigree legislation, which has been pushed back at least eight years, negatively impact the focus and commitment that will be required by governments, manufacturers, and virtually all members of the supply chain to meet the goal of a globally secure pharmaceutical supply chain.

Finally, the availability of pharmaceutical products on the Internet also speeds the growth in counterfeiting. According to a July 2008 report from the European Alliance for Access to Safe Medicines, "The Counterfeiting Superhighway," 62% of Internet medications were found to be substandard or counterfeit, 49% had no packaging, and 30% of blister packages had been tampered with or damaged. An April 2008 congressional press release noted that up to 360,000 packages containing counterfeit drugs enter U.S. international mail facilities each day—up to 10 million packages a month and 130 million counterfeit drug packages a year.

These factors combined—economic hardship, a lack of coordinated global interventions, and the ease of obtaining

seemingly legitimate product on the Internet—create what equates to a perfect storm for counterfeiters and illegal diverters. There has perhaps never been a more opportunistic environment in the pharmaceutical industry for counterfeiters and diverters.



A photo of two pills, one ordinary and one NanoEncrypted, shows that there are no distinguishing features to differentiate the two.

Mitigating Risk

Ultimately, it is the manufacturers' products and the health of the patients they serve that are most at risk. Manufacturers therefore shoulder the burden of implementing measures to fight counterfeiters and diverters, protect patients, and raise the pharmaceutical supply chain to a higher level of integrity. Manufacturers must understand that the enemy in this war is highly motivated and resourced. Traditional methods of brand protection are still necessary and valuable, but this new war requires supplementing and extending the usual weapons. To stem the tide of counterfeiting and illegal diversion, manufacturers must fight these organized criminals with everything at their disposal, including state-of-the-art technologies that protect the integrity and therapeutic benefit of each and every dose.

Manufacturers have traditionally focused on securing product through on-package strategies; the most common include color-shifting dyes, holograms, 2-D barcodes, tamper-evident seals, and serialization. Covert on-package tactics are also used, including threads, taggants and RFID. While these tactics provide a strong first level of defense, counterfeiters have shown the ability to replicate virtually all elements of pharmaceutical packaging, including boxes, bottles, and blister packaging. Often, the quality of the illicit copies is so good that only those who actually package the product at the manufacturer's plant can determine the authenticity or lack thereof.

Another reason for enhanced protection is the fact that most, if not all, on-package brand protection tactics become ineffective when a product is repackaged. Unfortunately, repackaging occurs the vast majority of the time in the U.S. pharmaceutical supply chain and is supported by the EU in the environment of parallel trade.

For these reasons, the best approach to fighting counterfeiting and diversion is a brand security strategy that combines on-package and on-dose tactics. On-dose technologies are typically grouped into overt (visible with the naked eye) and covert (special detection tools required) technologies. Color schemes, on-dose printing, and special marking schemes are common overt on-dose brand protection tactics. Unfortunately, while these strategies are useful, counterfeiters are adept at mimicking any aspects of the dose that they can see, including security features.

One overt on-dose brand protective weapon available to manufacturers is taggants, chemical or physical markers that can aid in authentication of a medication. Taggants generally consist of microscopic particles built up in many layers. Primarily used as an on-package security tactic, taggants are expanding into on-dose security. Taggants used for on-dose applications are usually generally recognized as safe (GRAS) compounds.

NanoEncryption technology is an on-dose brand protection weapon that manufacturers can implement immediately to protect brands and patients, because it does not require an investment by downstream supply partners in order to be effective. Developed by NanoGuardian, NanoEncryption adds no additional chemicals or materials to the dose and is achieved by making purposeful manipulations in the coatings and gelatin used in the manufacturing of tablets and capsules, respectively. These manipulations occur at the micro- and nanoscale level and result in overt, covert, and forensic-level security features on each individual dose.

The overt and covert nanoencrypted features allow in-field authentication of every dose—tablet, capsule, or single-use vial cap—at any point in the supply chain, while the forensic-level, nano-sized nano-codes provide comprehensive tracing information on each and every dose.

NanoGuardian's NanoCodes can be associated with an unlimited amount of data including, but not limited to, product information (strength, expiration date), manufacturing information (location, date, batch, lot number), and distribution information (country, distributor, wholesaler). Because of their nanoscale size—350 of NanoGuardian's NanoCodes fit in the width of a human hair—reading the NanoCodes requires the specialized equipment and software housed at NanoGuardian's Product Integrity Center, the first of which is located at Nano-Guardian's office in Skokie, Ill. All materials must be sent there for testing. The process used to decrypt the NanoCodes is nondestructive and can be completed within minutes, yielding a wealth of dose-level tracing data for the manufacturer. NanoGuardian's NanoEncryption gives manufacturers a single weapon to use in the fight against both counterfeiting and illegal diversion.

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A Good Offense

It has been said that the key to a good defense is a strong offense, and that's certainly true in the war against counterfeiting and diversion. Manufacturers must take the fight to those who mean to harm them and their patients by aggressively defending their intellectual property and proactively monitoring the supply chain for intrusions of counterfeit or diverted product. While one approach to supply chain auditing is data mining of manufacturer, wholesaler, distributor, and retail pharmacy ordering patterns to find discrepancies, NanoGuardian has launched a program that is directed specifically at the medication being dispensed to patients.

NanoGuardian's Closed-Loop Protection program combines the on-dose authentication and tracing benefits of NanoEncryption technology with a proactive pharmacy auditing program. Using statistical modeling and an assumed counterfeit rate, the Closed-Loop Protection program can provide manufacturers with a confidence interval as high as 99.9% to detect counterfeit and illegally diverted product that has entered the supply chain. The ultimate objective is to provide manufacturers with an early warning system in the detection of counterfeit and diverted product, thereby reducing risk to brands, companies, and patients.

In an environment of global economic hardship combined with a lack of coordinated global interventions and the ease of obtaining seemingly legitimate product on the Internet, criminals are reaping huge profits by deceiving government agencies, law enforcement, health care providers, the global pharmaceutical supply chain, and, most importantly, innocent and unsuspecting patients.

While the attention to this issue is also at its strongest level in years, pharmaceutical manufacturers must focus on securing their brands by implementing comprehensive protective strategies with an immediate impact. By doing so, manufacturers can take the upper hand in the war against counterfeiting and illegal diversion, protect the reputation of the safe and efficacious products they have worked so hard to develop, and ensure that the patients they serve continue to receive authentic medicinal benefits that positively add to their health and well being. n

Hart is executive vice president at NanoGuardian. For more information, e-mail busdev@nanoguardian.net or call (847)679-NANO (6266).