



Drug-Induced Nutrient Depletion: The Pharmacist's Responsibility

by John Preckshot, RPh, CCN

- Upon successful completion of this activity the pharmacist will be able to:
1. Describe the role that selected medications play and their effect on metabolic pathways.
 2. Choose appropriate nutritional supplementation to offset drug-induced nutrient depletions.
 3. Design a plan to develop a profitable nutritional niche by preventing drug-induced nutrient depletions.

Upon successful completion of this activity the pharmacy technician will be able to:

1. Describe the role that selected medications play and their effect on metabolic pathways.
2. Identify patients who, based on their drug regimen, should be referred to the pharmacist for nutritional supplement counseling.
3. Design a plan to develop a profitable nutritional niche by preventing drug-induced nutrient depletions.

INTRODUCTION

Pharmacists are the most highly trained health care professionals on pharmacodynamics, including drug mechanism of action and adverse effects. When you stop to consider all of the time the pharmacist spends taking classes in physiology, biochemistry, pharmacology, organic and inorganic chemistry, and other related sciences, it is a challenge to find any other conventionally-trained health care practitioner who can match the pharmacist's professional training and background. They should be considered experts who can provide accurate

information on nutritional supplements and their role in patient health care. The public has long recognized the value of this training in the pharmacist and regularly seeks out pharmacists for verification and validation of information found in the media or on the internet. The pharmacist holds a unique and valuable position in the multiple prescriber, multiple prescription health care environment that exists today. Daily, pharmacists accept the responsibility of detecting possible interactions and adverse effects that can occur with multiple prescribers and too many medications.

Pharmacists have long been the most accessible health care professional in the marketplace. In the regular course of their day, pharmacists routinely see patients who fit the criteria for groups identified as being at risk for nutritional deficiencies. Each day pharmacists serve athletes who are undergoing intense training and competition, bariatric surgery patients with altered nutrient absorption, obese patients, patients with diabetes, individuals on weight reduction and weight management programs, and cancer patients. But perhaps the largest group of patients subject to nutrient depletions is the most overlooked; those patients who are at risk for drug-induced nutrient depletions. A deficiency is due to inadequate dietary intake. A depletion is a loss created by an outside influence such as a prescription medication. In other words, many patients are at risk of a nutrient depletion caused by drug therapy. This last patient group is the subject of this article. Some patients in the previously mentioned, specific patient groups can be hard to identify. However pharmacists who oversee drug administration and/or dispensing are perfectly situated to identify patients at risk for drug-induced nutrient depletion. It would only follow that a pharmacist involved in the process of dispensing medications that may ultimately

create drug-induced nutrient depletion should shoulder some responsibility for preventing those deficiencies.

Looking at this situation from the business side, pharmacies manage their prescription drug inventory to satisfy the needs of the patients that they see. Pharmacies should take care however, to maintain nutritional supplement inventory variety and quantities sufficient to address the nutritional depletions created by prescribed medications. A well-managed nutritional supplement department is good not only for patient health, but for the health of the pharmacy business. As profit margins continue to decrease on prescription medications, the margins on nutritional supplements continue to be healthy and can be a welcome source of revenue for a pharmacy. Research has demonstrated that the nutritional supplement market is a multi-billion dollar business. Studies have estimated that 70 percent of Americans are taking some type of nutritional supplement and are constantly seeking a source for reliable education on their supplements.

EDUCATION

The introduction described some of the areas of formal training that most pharmacists experience. However, undergraduate training in nutrition and the role of supplements in contemporary patient care is quite often overlooked. Pharmacists are routinely trained in drug/drug, drug/diet and drug/herb interactions in regard to the medications they dispense. But training to think critically about drug/metabolic interactions and the symptoms of nutrient depletion is inconsistent. Many health care professionals are more likely to add a drug to treat a symptom than they are to attribute symptoms to a nutrient depletion and recommend supplementation. The concept of looking for drug-induced nutrient depletions secondary to prescription medications is NOT regularly taught in either pharmacy or medical school. Given the pharmacist's education, he or she is best suited to assimilate the information to go forward in this area.

In learning something new, often the first step is to unlearn something old. And that something old that we need to unlearn is the concept of the Recommended Daily Allowance (RDA), found on every Supplement Facts and Nutrition Facts label, and its value in contemporary nutrition. The RDA was established by the U.S. government in the 1930s to act as a guide in preventing nutritionally based diseases, such as rickets, pellagra,

beriberi, and other nutritionally based diseases found in other parts of the world. By recommending that Americans consume the minimum allowance of various nutrients, it was believed that such problems could be prevented in the United States.

However, since the 1930s there have been several significant changes in the nutritional foundation of Americans that make the RDA of the 1930s archaic and incapable of addressing contemporary nutritional challenges. For the past 20 years health and nutrition experts have been frustrated by the growing prevalence of a high-fat, high-sugar, highly refined diet or, the "standard American diet," often referred to as the "SAD diet." Unfortunately nutrient wise, that is just what it has become. The unhealthy diet of many Americans may support life, but does not support or encourage health. The nutritional choices made by Americans today are void of healthful nutrients. Yet the abundance and convenience of such items as processed foods encourages their consumption, which leads to inflammatory processes in the body, promotes obesity and discourages health. Over the years since the 1930s, the nutritional value of even healthy food, particularly fresh fruits and vegetables, has deteriorated. Studies performed by the U.S. Department of Agriculture have charted an ever decreasing level of nutrients in the produce consumed in this country. The blame for much of this is attributed to the factory farming methods of agriculture today versus the farming methods of the 1930s and '40s.

Along with their nutrient deficient diet, Americans today are consuming more drugs and are exposed to more chemicals than ever before in our history. These drugs, dispensed in large part by pharmacists, along with other chemical and environmental exposure, result in noteworthy nutritional deficiencies with accompanying metabolic disruptions. It is well known that many of the diseases that plague us today, such as cancer, obesity, and Type 2 diabetes, are subject to a nutritional influence in regards to their development and outcome. We have all

seen images of starving children with nutrient-poor diets in third world countries. However, a large portion of the U.S. population, the 70 percent that are either overweight or clinically obese, should be considered nutrient-poor as well. Though good nutrition has a place in overall health, nutrient deficiency in the United States can't be blamed solely on drug-induced nutrient depletion.

NATURE AND SCOPE OF DRUG-INDUCED NUTRIENT DEPLETIONS

"You cannot poison a crucial enzyme, block an important receptor, or interfere with a metabolic function for the long term and expect a good result"

—David Brownstein, MD, *Drugs that Don't Work and Natural Therapies that Do*

The issue that we need to look at here is not whether alternative or complementary therapies are superior to prescription medications, but instead the way in which drugs work in the body and their effect on metabolic pathways. Most medications work by inserting themselves chemically into various metabolic pathways. One only has to review the mechanism of action of a medication to see terms like "inhibitor," "modifier," "agonist," and other similar terms that would indicate a change in metabolic pathways created by the presence of a drug. When inserted into these pathways, drugs can affect nutrient absorption, synthesis, transport, storage, metabolism and excretion. That is the crux of Brownstein's statement. What is the ultimate nutritional and metabolic outcome to the patient from the long-term usage of drugs in the body? Is it possible that drugs, when taken over time, have the potential to create problems equal to or greater than the disease state for which they were initially prescribed to treat?

Pharmacy and medicine are very endpoint and outcome oriented. "Have we lowered the cholesterol levels sufficiently?" "Have we provided symptom relief for the patient complaining of esophageal reflux issues?" Clinicians who fail to take into consideration the potential

nutrient depletions which accompany long-term medication administration, ultimately undermine the patient's health and well-being as well. Nutrients are critical to normal body function. The various vitamins, minerals and other micronutrients taken up daily in our diet, facilitate the thousands of metabolic processes that occur in the body. A review of the normal biochemistry of the body does not reveal a requirement for any of the drugs and other chemicals which we consume on a daily basis. It does, however, denote a need for enzymes, co-enzymes, and other nutrients essential for life as we know it. Additionally, drug-induced nutrient depletions can be multifactorial. We can reliably identify nutrient depletions specific to a particular drug. However, what happens in the case of the patient who is taking multiple drugs, all inserting themselves into various metabolic pathways and adversely affecting the overall ability for the patient to properly utilize nutrients? This is a definite consideration in the geriatric population who tend to have more extensive medication profiles along with decreased drug clearance functions. Finally, there is the insidious nature of problems that can arise in patients from extended nutrient depletion. These problems, brought about by drug-induced nutrient depletion, can arise several months after beginning a drug. When the problems arise, they may not be quickly connected to the introduction of a medication that occurred six months prior. Instead, they are viewed by the physician as a new complaint warranting the addition of yet another drug. For the pharmacist who is cognizant of nutrient depletions, it provides the opportunity to look back on prescriptions begun six months prior, and ideally sparing the patient from adding yet another drug to their profile.

The scope of drug-induced nutrient depletion directly correlates with the endless introduction of new products into the patient population. In 1999, when Ross Pelton and James Lavelle created "The Drug-Induced Nutrient Depletion Handbook," their text was essentially a pocket sized reference, cross-referenced by nutrient depleted and depleting drug. In 2008 Stargrove, Treasure, and McKee's text, "Herb, Nutrient, and Drug Interactions," had grown to a full-sized text of 800-plus pages. Even as our knowledge of drug-induced nutrient depletions increases, our arsenal of drugs continues to grow and it will remain a challenge to the pharmacist to manage all of the necessary information in a practical fashion.

SELECTED, POPULAR MEDICATIONS AND THEIR EFFECT ON NUTRIENT DEPLETIONS

The products selected for this in-depth discussion represent just a few of the many drugs that have been shown to create drug-induced nutrient depletions. The selection was based upon drugs with which most pharmacists are familiar and currently dispense to a large number of patients, demonstrating the applicability of nutrient depletion counseling in any pharmacy practice.

Cholesterol Lowering Agents (HMG-CoA Reductase Inhibitors)

To hear the messaging in the media regarding cholesterol management, you would think that cholesterol serves no useful purpose in man and that the management of cholesterol and the reduction of cholesterol levels are absolutely essential for optimal health. This messaging is certainly heard by physicians as prescriptions for cholesterol lowering drugs account for \$25–29 billion in sales each year and position the HMG-CoA reductase inhibitors (statin drugs) as the number one most prescribed prescription drug class in the United States. The HMG-CoA reductase inhibitors work by blocking HMG-CoA reductase, a rate-limiting enzyme in the production of cholesterol and an important electron carrier in cellular energy synthesis, Coenzyme Q10. While the medical community doesn't typically worry about depleting cholesterol, it is necessary for health. A review of the role of cholesterol in the body (Table 1) demonstrates the purpose that cholesterol fulfills in the body.

Table 1. Selected Roles for Cholesterol in the Body

1. Cholesterol is necessary for mammalian cell membrane stability.
2. Cholesterol is the precursor for the production of all adrenal stress hormones.
3. Cholesterol is the precursor for the sex hormones.
4. Cholesterol serves as a precursor to vitamin D.
5. Cholesterol is necessary for dietary fat and mineral absorption.
6. Cholesterol is essential for the myelin sheath that covers the nerves.
7. Cholesterol is critical for cognitive function.

Given the complex role that cholesterol plays in the body, the pursuit of lower cholesterol levels can result in problems in multiple body systems. As the precursor for the production of the adrenal stress hormones and the sex hormones, decreased cholesterol can result in a diminished capacity of the body to deal with chronic

stress. Suppressed cholesterol will also inhibit the body's ability to produce progesterone, estrogen, and testosterone in men and women. In individuals dealing with stressful situations, that stress can result in elevated cholesterol levels as the body responds to accommodate a greater need to synthesize those hormones. vitamin D has received significant mention in the medical literature recently, as many individuals in the United States are already deficient in vitamin D. Drastically decreased cholesterol will inhibit vitamin D production. Cholesterol is also noted as being essential in the composition of the myelin sheath that covers the nerves. Finally, the brain requires cholesterol for competent cognitive function. A dramatic decrease in the level of cholesterol in the brain helps account for the brain fog, dementia, and depression listed in the drug monographs for these products.

However, as mentioned previously, inhibiting HMG CoA reductase inhibits the synthesis of coenzyme Q10 (CoQ10) which may lead to symptoms of deficiency. A review of the mevalonate pathway demonstrates that CoQ10 is depleted before cholesterol lowering even begins. In practice, this depletion in CoQ10 will be expressed as patient complaints of muscle pain and weakness, body aches and pains, brain fog, dementia, and potentially heart failure, as CoQ10 is essential for cardiac function. These depletion-based problems can be addressed by supplementing 100 mg of CoQ10 or 100 mg of ubiquinol, the active metabolite of CoQ10, for each medication known to deplete CoQ10 that a patient may be taking. If the pharmacist believes in the protective effects of statin drugs, then it would follow that a recommendation for the supplementation of CoQ10 100 mg would accompany any prescription for these products. Taking the pharmacist's involvement one step further, patient discussion of complementary options for lowering cholesterol such as diet, exercise, policosanol, berberine, and fish oil may be perceived as a valuable adjunct to help lower cholesterol levels without depleting CoQ10 and help minimize the dosage of statin necessary to get the desired clinical results.

H2 Antagonists and Proton Pump Inhibitors

Given the poor diet and high-stress lifestyle of most Americans, it is no wonder that the number of prescriptions for acid-lowering medications such as Proton Pump Inhibitors and H2 Antagonists are second only to statin drugs in the number of prescriptions filled each year. By blocking an enzyme in the gastric parietal cell, the proton pump that secretes stomach acid cannot secrete acid into the stomach. Without acid production, the pH of the stomach will rise abnormally, inhibiting effective protein digestion.

Table 2. The Role of Stomach Acid in Digestion

1. Stomach acid breaks down dietary protein.
2. Stomach acid enhances the availability and absorption of B vitamins
3. Stomach acid helps reduce the trivalent ferric iron to ferrous iron for absorption.
4. Stomach acid protects the body from food borne infections.

Looking at Table 2, we can see the critical role that stomach acid plays in digestion and the immune system. Once protein has left the mouth, the stomach is the last location to specifically break down protein for nutrient absorption in the digestive tract. Given the haste with which many individuals consume their meals, proper digestion of protein can present a real challenge. Digested protein is the primary source of vitamin B12, folic acid and the rest of the B vitamins. Protein needs to be thoroughly and properly digested to release these vitamins for absorption. Individuals who practice a vegetarian diet are often deficient in these vitamins due to lack of protein. Inadequate acid production can also account for compromised absorption of the minerals iron, zinc, copper and calcium. Of even greater importance than protein digestion and nutrient absorption, is the role the acidic pH of the stomach plays as a barrier to food borne infections. The results of reduced stomach acid can be seen in Table 3.

A complication also seen when addressing symptoms of perceived hyperacidity is the similarity of the symptoms of hyperacidity and

Table 3. Problems Resulting From Reduced Stomach Acid

1. Increase in gastric cancer and colon cancer
2. Vitamin and mineral deficiencies, especially B12
3. Increased incidence of allergic reactions due to the presence of undigested, intact protein in the lower G.I.
4. Bacterial overgrowth due to gastric pH change. Increase in H. pylori and C. difficile infections.
5. Increase in yeast and candida infections.

hypoacidity, having too little stomach acid. It is estimated that 46 percent of patients presenting with complaints attributed to hyperacidity are actually suffering from too little stomach acid. When recommending nutritional supplementation to compensate for nutrient depletions secondary to usage of PPIs or H2 antagonists, the pharmacist may attempt to determine whether too little acid or too much acid may be the true cause of complaints. In the absence of a gastric ulcer this is done by consuming a teaspoonful of vinegar dissolved in a small amount of water just before eating. If the addition of the acid from the vinegar relieves the GERD (gastroesophageal reflux disease) symptoms, too little acid is the problem, as opposed to not enough acid. Suggestions for lifestyle and diet modification, along with recommendations for supplementation with betaine, glutamine or digestive enzymes to improve and enhance digestion and protein breakdown, may bring relief to patients. Lifestyle changes such as better chewing, not eating on the run, eating smaller meals, and not eating late in the evening can all impact the appearance of GERD symptoms and therefore use of PPIs and H2 antagonists. Such recommendations may prevent the long-term nutritional and digestive problems that can occur from extended usage of PPIs and H2 antagonists.

Estrogen Based Replacement Products

The nutritional deficiencies accompanying combined hormonal oral contraceptive (COC) usage have been noted since 1975. A number of small studies report that levels of folic acid, vitamin B6, and vitamin B12 are lower in women who take COCs than those who do not. The mechanism of the depletion is not clear and randomized, controlled clinical trials are needed to evaluate causation and clinical significance. Until such time that studies are available, women taking COCs, any type of estrogen supplementation or estrogen-progesterone hormone replacement should be monitored for signs and symptoms of deficiency.

Long term B-vitamin depletion creates damage to blood vessels. Depletion of folic acid has been clearly shown in the literature to adversely affect cellular division and replication and cause neural tube defects. The health issues that are associated with long-term nutrient depletion secondary to estrogen administration are listed in Table 4. Once again, a valuable recommendation by the pharmacist would be the supplementation of folic acid, or better yet, the active form of folic acid, L-methylfolate and a complete B-vitamin complex for all women using estrogen replacement.

Table 4. Symptoms Associated With Nutrient Depletion From Long-Term Estrogen or Oral Contraceptive Usage

1. Anemia, weakness, low energy
2. Increase in birth defects
3. Cervical dysplasia
4. Elevated homocysteine levels
5. Depression
6. Sleep disorders
7. Vascular disorders: stroke, blood clots, heart attack
8. Increased incidence of breast, uterine and colorectal cancer

Antibiotic Therapy

So far this discussion has lent itself to the nutrient depletions accompanying extended medication usage. Drugs such as statins and acid-lowering medications are all being reviewed for the adverse metabolic effects which accompany long term usage (six to 12 months). But one of the most significant metabolic disruptions that can occur is associated with the administration of antibiotics; a course of therapy may last for only five to 14 days, yet create a long-term depleted state.

The microbiome, more commonly known as the gut flora, is a synergistic balance of bacteria, yeast and other microbes that are essential for the maintenance of good health. Some of the essential roles played by the gut flora are:

- Digestion of food and absorption of essential nutrients
- Destruction of ingested toxins
- Production of short chain fatty acids that provide 5-10% of our daily energy supply
- Synthesis of vitamin K, niacin, vitamins B6, B12 and folic acid
- Maintenance of our immune system

It is estimated that more than 70 percent of our immune process is dependent upon the gut flora. Researchers are looking closely at the role that this gut flora plays

in the development of cancer, irritable bowel disease, colitis, arthritis, and even obesity. As part of their function, antibiotics eliminate both pathogenic bacteria and good bacteria, resulting in an imbalance and disruption of the normal gut flora. The prevalence of vaginal candida infections in women following antibiotic administration is one example of how this imbalance can be expressed. Other disease entities that have been associated with disruptions in gut flora secondary to antibiotic usage are:

- Increase in fungal infections
- Increase in allergic asthma
- Increase in allergies
- Increase in eczema

Long term or repeated courses of antibiotics and their effect on gut flora can result in depletions in folic acid, inositol, and vitamins B1, B2, B3, and B12. To help offset these potential effects, pharmacists should be routinely recommending quality probiotics, particularly formulations which contain the yeast *Saccharomyces boulardii* when they are providing antibiotics to patients. And to help restore depleted gut flora quickly, fructooligosaccharides or FOS powder should be recommended as well to help accelerate gut flora restoration.

ADDRESSING PRE-EXISTING NUTRITIONAL DEFICIENCIES

One of the strongest arguments against the value of the Recommended Daily Allowance (RDA) discussed earlier in this article is the existence of established vitamin deficiencies in the U.S. population. Researchers have found that as much as 75 percent of the U.S. population is deficient in vitamin D, 60-70 percent of the population is deficient in magnesium, and 34 percent is deficient in zinc. Each of these nutrients has an important role in maintaining and protecting health. Vitamin D is referred to as a fat soluble vitamin, but actually performs in the body as a hormone. The active form of vitamin D is 1,25-dihydroxycholecalciferol and can be measured in the serum through routine lab testing. This allows

patients and physicians the ability to determine if an actual vitamin D deficiency exists. In our body vitamin D aids in the absorption of calcium from the intestinal tract, helps the body assimilate phosphorous, stimulates bone mineralization and helps the pancreas release insulin.

Magnesium is involved in more than 300 enzymes used in various metabolic pathways throughout the body. Most importantly, magnesium serves as a cofactor for the production of ATP, the body's energy source. Magnesium plays a critical role in the body for sleep, heart function and rhythm, muscle strength and endurance, and nerve function, just to name a few. That is why loss or deficiency in magnesium can result in a wide range of symptoms. These symptoms of deficiency can include insomnia, heart arrhythmia, cardiovascular disease, fatigue, and complaints of muscle pain and spasm. Zinc is also widely used in the various enzymatic pathways in the body. One-hundred specific enzymatic reactions requiring zinc as a cofactor have been determined. Zinc is essential for taste and appetite, is critical for prostate health, promotes thyroid activity, and is essential in the utilization of insulin by the body. Just like magnesium, a deficiency in zinc results in a long listing of symptoms and complaints including hair loss, impaired wound healing, decreased sexual function, fatigue and immune deficiencies. Given the extensive number of metabolic pathways supported by vitamin D, magnesium, and zinc, functional medicine practitioners and clinical nutritionists routinely recommend supplementation with these three supplements to offset these pre-existing deficiencies found in the population. Table 5 lists these three nutrients and some of the common medications which deplete these nutrients in the body, further exacerbating pre-existing deficiencies.

DRUG-INDUCED NUTRIENT DEPLETION: PROFITING FROM THE RESPONSIBILITY

As was pointed out at the beginning of this article, pharmacists should be the most recognized and sought after experts in the distribution of accurate information concerning nutritional supplementation. To review, pharmacists:

1. Are the most highly trained health care professional in pharmaceutical information and should be able to offer the most valuable nutritional consultations.
2. Are recognized by the public as the expert on pharmaceutical and non-pharmaceutical medication interactions.
3. Are uniquely positioned in the health care dynamic to review poly-drug usage and evaluate for potential interactions.
4. Are the most accessible health care provider to patients.
5. Routinely see patient groups requiring specific nutritional consultation such as diabetics, the obese, bariatric surgery patients, athletes, and cancer patients.
6. The health care provider ultimately responsible for the dispensing of medications which can result in long term drug-induced nutrient depletions.

So with that being said, why doesn't every pharmacist grasp the opportunity to address this responsibility? The answer to that question lies in two areas; education and investment.

Education

The public has increased its desire for more information in the areas of functional and integrative medicine. In response, the number of books, articles, and websites available to the public exploded. Pharmacists and physicians find themselves without enough time to read, much less critique, lay literature. Patients can find information based on poor, or proper, scientific studies that reinforce their personal beliefs or conclusions. However, there are competent texts and reference sources available which can provide the pharmacist with sound, scientific

Table 5. Selected Drug-Induced Nutrient Depletions For Vitamin D, Magnesium and Zinc

Nutrient	Depleting Drugs
• Vitamin D	• Antacids, Anticonvulsants, Bile Acid Sequestrants, H2 Blockers, PPIs
• Magnesium	• Antihypertensives, Estrogen, Digoxin
• Zinc	• Antihypertensives, Estrogen, H2 Blockers, PPIs

nutritional information quickly. It is not necessary for a pharmacist to have a working knowledge of functional medicine or clinical nutrition to provide competent consultation to patients regarding nutrient deficiencies and drug-induced nutrient depletions. Learning the nutrient depletions created by a particular medication is no different than learning another indication or side effect for that medication. Nutrient information is simply information that is built upon the pharmaceutical knowledge base already possessed by the pharmacist.

Investment

Making recommendations for nutritional supplements to offset drug-induced nutrient depletions does require an investment in some nutritional inventory. For pharmacists with professional stores with little front end space, the idea of carrying sufficient inventory to offer any type of nutritional support may seem unrealistic. Likewise, pharmacists who already have stores with many feet of shelf space dedicated to supplements may resist paring down their product offerings to just the products that sell and make a good margin and bring in pharmaceutical grade dietary supplement lines. Since dietary supplements are not regulated as drugs, “pharmaceutical grade” does not mean FDA-approval; instead it means that the manufacturer has implemented a program of independent analysis of product purity and bioavailability.

The key to inventory management relies on the pharmacist’s recommendation of a specific product for a specific nutrient depletion; not on stocking every nutritional product that a patient may be seeking. Looking at the nutritional supplement inventories of physicians who practice functional medicine and recommend nutritional supplements to their patients, a very successful nutrient niche can be developed by allocating a three to four foot section of shelf space in an office setting. The goal is to not have the exhaustive vitamin inventory present at a vitamin store, health foods store, or large chain store. The goal is to have the specific inventory curated by a pharmacist that can be recommended by the pharmacist to patients based upon the prescriptions they take. With ever decreasing margins seen in conventional medication dispensing, the addition of a companion sale for nutritional support can be a welcome addition to the bottom line of the pharmacy and a valuable measure against future health complication to the patient.

PLAN FOR PROFITABILITY

Pharmacists who fail to embrace the responsibility of addressing drug induced nutrient depletions are failing their patients and failing to capture a potentially profitable professional niche. To that end, I would offer the following plan for developing a nutritional support service based on drug-induced nutrient depletions:

1. Survey current prescription records and identify those products generating greatest number of sales or sales volume.
2. Determine the associated drug-induced nutrient depletions associated with those products. Sources for this information are:
 - The University of Maryland Medical Center Complementary and Alternative Medicine Guide (<http://umm.edu/health/medical/altmed>)
 - “Drug-Induced Nutrient Depletion Handbook” (Pelton and Lavalle, 2001)
 - “Herb, Nutrient and Drug Interactions” (Stargrove, Treasure, McKee, 2007)
 - Natural Standard Database (www.NaturalStandard.com, subscription web database)
3. Incorporate recommended nutritional supplementation into prescription processing software.
4. Create patient messaging that explains why pharmacist is recommending supplementation.
5. Attach supplement to the prescription at prescription pick up point.
6. Create additional patient centered messaging that discusses drug-induced nutrient depletion and the benefits of nutritional supplementation for other medications the patient may be taking. **ap**

John Preckshot, RPh, CCN, is PCCA Director of Wellness Works. The conflict of interest was resolved by peer review of the content of this monograph.

Drug-Induced Nutrient Depletion: The Pharmacist's Responsibility

Dec. 2, 2013 (expires Dec. 2, 2016) • Activity Type: Knowledge-based

To earn continuing education credit: ACPE Program 207-000-13-012-H01-P; 207-000-13-012-H01-T

A score of 70 percent is required to successfully complete the CE quiz. If a passing score is not achieved, one free reexamination is permitted.

Answer sheet for your use below

	a	b	c	d	e		a	b	c	d	e
1.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	11.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	12.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	13.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	14.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	15.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	16.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	17.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	18.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	19.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	20.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

FREE ONLINE CE To take advantage of free CE for this program, go to the CE Center of Pharmacist eLink (www.pharmacistelink.com) by clicking on the CE tab to take a test on the material of this article. You will receive immediate online test results. (Please note: you must achieve a passing score of 70% on the activities post-test and will receive 2 opportunities to successfully pass the post-test). NCPA will submit your CEUs to the CPE Monitor system. Please allow 6 weeks for the upload of your CEUs prior to checking your CPE Monitor transcript. If you do not already have a CPE Monitor e-Profile ID, please go to www.cpemonitor.net to register.

NCPA® is accredited by the Accreditation Council for Pharmacy Education as a provider of continuing pharmacy education. NCPA has assigned 1.0 contact hours (0.1 CEU) of continuing education credit to this article. Eligibility to receive continuing education credit for this article expires three years from the month published.

CONTINUING EDUCATION QUIZ

Select the correct answer.

1. Which is NOT a reason why pharmacists should be the experts in nutritional supplementation?

- a. Pharmacists have extensive training in the pharmaceutical sciences.
- b. Pharmacists have access to patient prescription records.
- c. Pharmacists are not trained to identify nutrient deficiency.
- d. Pharmacists are highly accessible to patients.

2. Which of these groups are known to develop nutritional deficiencies?

- a. Geriatric patients
- b. Bariatric surgery patients
- c. Cancer patients
- d. Patients on weight loss programs
- e. All of the above

3. Which is not a nutrient deficiency disease?

- a. Alzheimer's
- b. Beriberi
- c. Scurvy
- d. Pellagra
- e. Rickets

4. Which statements are false?

- a. The RDA is the upper limit daily dose of vitamins
- b. The RDA for dietary fats is 5–10 percent of daily calories.
- c. Whole fruits and vegetables contain more nutrients today than ever before.
- d. All statements are true.
- e. All statements are false.

5. When inserted into metabolic pathways, drugs can affect nutrient _____ (fill in the blank)

- a. Absorption
- b. Synthesis
- c. Metabolism
- d. Excretion
- e. All of the above

6. When examining drug-induced nutrient depletion which of the following is true?

- a. Complementary or alternative therapies are superior to pharmaceutical options.
- b. Drug-induced nutrient depletions normally express themselves within two weeks of starting a medication.
- c. Drug-induced nutrient depletions can create long term health issues if not addressed.
- d. Prescription drugs approved after 2011 have submitted findings from clinical trials showing no evidence of drug-induced nutrient depletions.

- 7.** Which is not a function of cholesterol in the body?
- a. Cholesterol serves as a precursor for the production of the sex hormones.
 - b. Cholesterol serves as a precursor for vitamin D.
 - c. Cholesterol is essential for the myelin sheath that covers the nerves.
 - d. All of the statements are true.

- 8.** A fictional HMG CoA Reductase inhibitor drug was approved in 2013. What might a pharmacy do to anticipate prescriptions for this drug?
- a. Pre-order inventory and wait for clinical studies to see if it affects Coenzyme Q10 synthesis.
 - b. Draft a fax communications for local cardiologists reminding them of the importance to supplement folic acid when taking “statin” drugs.
 - c. Draft a bag stuffer for all “statin” drug patients with information about Coenzyme Q10 depletion.
 - d. No special action is required; drugs approved after 2011 do not deplete nutrients.

- 9.** Which is a role for stomach acid?
- a. Breaks down dietary protein
 - b. Enhances the availability and absorption of B vitamins
 - c. Reduces the trivalent ferric iron to ferrous iron for absorption
 - d. Protects the body from food borne infections
 - e. All are functions of stomach acid.

- 10.** J.P. is a 45-year old male patient who has been using cycles of a “cleanse diet” to detoxify and lose weight. He presents to the pharmacy today looking for a supplement to give him more energy. The pharmacist advises J.P. that his weight loss plan may not be providing him with essential nutrients. Which of the following should be ruled out as a possible cause of J.P.'s low energy?
- a. Anemia due to Vitamin B12 deficiency
 - b. Anemia due to iron deficiency
 - c. Anemia due to washout of gut flora
 - d. A and B Only

- 11.** Nutrient supplementation is recommended for which of the following?
- a. Oral contraceptives
 - b. Manufactured estrogen replacement.
 - c. Bio-identical hormone replacement
 - d. All of the above.
 - e. None of the above.

- 12.** The appropriate primary nutrient supplementation for patients on estrogens is?
- a. Calcium and magnesium
 - b. L-methylfolate and B vitamin complex
 - c. Vitamins E and A
 - d. A statin drug and a PPI
 - e. Probiotics and FOS powder

- 13.** Which of the following may occur secondary to antibiotic usage?
- a. Vaginal yeast infections
 - b. Flare of allergic asthma
 - c. Flare of eczema
 - d. All of the above
 - e. A and b only

- 14.** Which is the true statement regarding antibiotic usage?
- a. Repeated short courses of antibiotics will not deplete gut flora.
 - b. Antibiotics are non-specific and eliminate both pathogenic and non-pathogenic bacteria.
 - c. Taking antibiotics along with yogurt will not disrupt gut flora.
 - d. Antibiotics alter gut flora, but do not create nutrient depletions.
 - e. Ten percent of our immune function is in the gut.

15. More than 50 percent of individuals in the United States demonstrate a deficiency in which of these supplements?

- a. Vitamin D
- b. Magnesium
- c. Zinc
- d. All of the above
- e. A and b only

16. Which of these nutrient levels can be routinely measured in a standard blood test?

- a. Coenzyme Q-10
- b. Vitamin D
- c. Vitamin A
- d. None of the above
- e. All of the above

17. A patient presents to you with a complaint of altered taste sensation. What would be a reasonable recommendation for a supplement to use?

- a. Vitamin D
- b. Magnesium
- c. Zinc
- d. Coenzyme Q-10
- e. B complex

18. Which of the following is the gold standard test for detecting a nutrient depletion?

- a. Expensive testing is not needed, recommend 325 mg ferrous sulfate once daily and assess labs in four weeks.
- b. Expensive testing is not needed, recommend a complete daily multivitamin.
- c. DNA analysis to reveal genetic predisposition to nutrient deficiency
- d. There is no single test to detect nutrient depletions due to involvement in complex metabolic pathways.

19. R.S. is a 52-year-old female patient who regularly fills her omeprazole prescription after being diagnosed with Barrett's Esophagus. What recommendations does her pharmacist make when her bone mineral density screening reports a T-score of -1.1?

- a. Supplement dietary intake of magnesium, calcium and vitamin D to compensate for decreased absorption due to stomach acid changes
- b. Supplement with Ubiquinol to prevent cognitive changes that would lead to memory loss and poor adherence
- c. Supplement dietary intake of vitamin A to compensate for decreased calcium absorption
- d. No supplementation is recommended for R.S.

20. Pharmacists have an advantage in recommending nutritional support for their patients taking prescription medications because:

- a. They already possess their prescription records and profiles
- b. They can program their computer software to inform the pharmacist when the patient is getting a prescription with a noted nutrient depletion problem
- c. Pharmacists have the public's trust and respect.
- d. A, b and c
- e. A and C