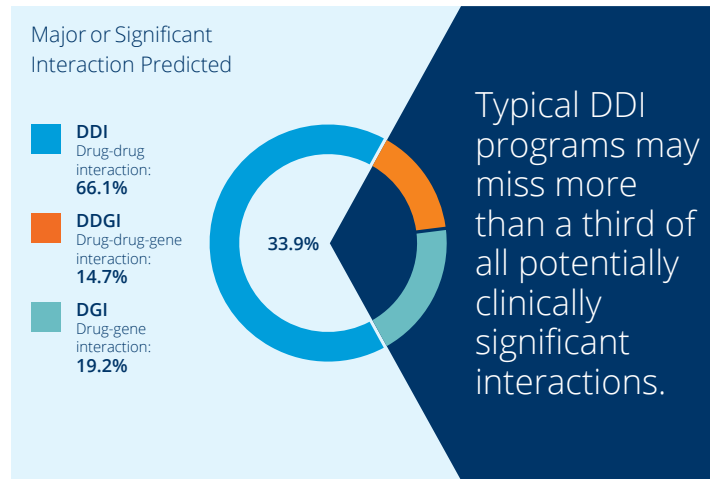


## How Common are Drug and Gene Interactions?

The CDC and Journal of the American Medical Association report that adverse drug reactions are a major health issue in America, costing billions of dollars a year and affecting millions of patients. Many of these are the typical drug-drug interactions (DDI) that most EHRs and e-prescribing systems can catch. However, typical DDI programs miss drug-gene interactions (DGI's). Only YouScript® can detect both DDI's and DGI's. And only YouScript can find their combined effect — the drug-drug-gene interactions.

Drug-drug-gene interactions (DDGI's) happen to drugs which have two or more metabolic



pathways when one pathway is reduced by a genetic mutation and the other pathway is blocked by an inhibiting drug.

But how common are DGI's and DDGI's? Until now, the prevalence of DGI's and DDGI's compared to DDI's hasn't been examined. But a new paper is

now being published by the journal, Pharmacogenomics.

Titled *How common are drug and gene interactions? Prevalence in a sample of 1143 patients with CYP2C9, CYP2C19 and CYP2D6 genotyping*, the paper shows that typical DDI programs may miss more than a third of all potentially clinically significant interactions.

The paper, written by Genelex's P. Verbeurgt, T. Mamiya, and J. Oesterheld, will be published this April in Pharmacogenomics, Issue 15 (Volume 5).

To request a copy, visit: [youscript.com/DDGI-research](http://youscript.com/DDGI-research)

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# DNA Today



## Nursing Home Unites Local Healthcare Community

Cave City, Arkansas is a small town. A very small town. Less than 2,000 people live there. But the thing about small towns is their citizens support each other, come together as a community and when something new comes along, it can create ripples throughout the area. The staff at Cave City Nursing Home are creating exactly this effect in their new personalized medicine approach to patient care.



By using YouScript®, the staff at Cave City Nursing Home have been able to improve their patient's quality of life and, through it, act as a uniting force in the local healthcare community.

Cave City Nursing Home is located just off Main Street and has roughly 100 staff and 70

long-term residents. "We have people who have been here 15, 18, 20 years," said Debbie Stewart, LPN, ADON, "We know them. We know their family."

In February 2014, Cave City Nursing Home started using YouScript® as part of its medication management strategy. Older patients are uniquely vulnerable to adverse drug events and treatment problems. About three-quarters of older adults have more than one chronic condition, such as hypertension, diabetes or osteoarthritis, and tend to take

**"It's a win for the healthcare system because it's saving money. It's saving everybody money."**

more medications as well. The average person over the age of 65 takes four to five prescriptions and two over-the-counter drugs. This can cause problems since the risk of adverse drug events increases exponentially with each new medication.

*(Continued on page 2)*

## Can Pharmacogenetics Increase Adherence?

Failing to follow directions can be deadly. The New England Healthcare Institute (NEHI) estimates that one-third to one-half of American patients do not take their medications as prescribed and that drug-related morbidity, including adherence problems, results in as much as \$290 billion in extra medical costs each year.

There are many reasons for this nonadherence. Some patients struggle to remember exact instructions, schedules or have trouble paying for the medications. New programs

**"Studies have shown patients were more adherent after genetic testing, no matter what their test results indicated."**

and applications such as DrFirst and SimpleMed+ can help address cost and memory issues, but research now suggests that trust and communication play a large role in adherence as well.

It makes sense that patients would be less likely to admit to nonadherence when they're afraid of criticism or admonishment. But the nonadherence itself often stems from poor

communication too. In *The Challenge of Patient Adherence*, the authors say the patient must believe the physician is someone who understands their unique story and characteristics and actively involves them in care choices.

Sounds a bit like personalized medicine.

Pharmacogenetic testing can help prescribers hone in on effective medications without

*(Continued on page 3)*

### In this issue:

**2** What Is Epigenetics?

**3** Lesser Known YouScript Features

**4** How Common are Drug and Gene Interactions?

## What Is Epigenetics?

In the last five years over 1,200 papers have appeared in PubMed with “epigenetics” in their title, and at first glance it seems like it might be related to pharmacogenetics. But epigenetics is actually an emerging field all of its own.

Epigenetics is a scientific discipline studying heritable changes to gene expression that *aren't* caused by changes to the DNA sequence. DNA isn't typically found as a free-floating molecule in cells; it's surrounded by a framework of structural and support molecules. Changes to these can affect how the DNA is expressed.

Unlike genetics, epigenetic changes can sometimes be triggered by environmental or behavioral circumstances. Researchers are now exploring epigenetics' role in gene expression, health and evolution.

So what does this mean to the field of pharmacogenetics? Not much.

When it comes to drug metabolizing enzymes specifically, there isn't conclusive evidence. Researchers don't yet understand all the factors that contribute to epigenetic variation and how to predict their precise effect and

impact on gene expression. The only factors that seem to conclusively and predictably affect the expression of these genes are mutations to the DNA itself or interactions with medications, herbal compounds or certain foods.

Genelex does not currently test for epigenetic factors because no known epigenetic factors have been shown to change a patient's drug metabolism. There simply isn't evidence to make them clinically actionable. An internal Pharmacy & Therapeutics committee continually reviews new scientific literature. If

**“No epigenetic factors have been shown to change a patient's drug metabolism.”**

epigenetics ever shows the ability to create concrete predictions, it will be considered for inclusion in YouScript®.

For now, epigenetics is an interesting research subject, similar to where pharmacogenetics was twenty years ago. Whether it eventually develops into a clinically actionable field like pharmacogenetics remains to be seen.

## Nursing Home Unites Local Healthcare Community

(Continued from page 1)

Cave City was already performing mandatory pharmacist-led medication reviews, but now they've integrated YouScript into that process. The first round of analysis revealed many patients needed small adjustments, such as separating administration times. Other patients needed larger changes, such as one patient known for having sleep problems who was taking thirteen medications. “She was miserable all night long, continually needing something for her pain or something to help her sleep,” said Stewart. The staff analyzed her regimen, then changed or stopped several of her drugs. “Afterwards, she started sleeping better than she ever had in

her life. I've known this lady for years. And I've noticed a whole change in her personality. She sits at the table and talks with people. She smiles. She's a totally different person.”

### Personalized Care Helping To Unite The Community

Outside doctors have taken note. In addition to the staff at Cave City, residents regularly see a network of general practitioners, physical therapists, dentists, surgeons, social workers, and pharmacists outside the home. Shortly after implementing YouScript, the staff at Cave City began using the analysis provided by the program to talk to these outside practitioners about medication choices. Most

**“Afterwards, she started sleeping better than she ever had in her life.”**

have been very interested and receptive. Some have even requested access to YouScript as well to help personalize their patient's care.

One of the community's big goals is reducing hospital admissions. Jansen and Brouwers (2012) found that about one out of every eight elderly patients in US hospitals are there because of adverse drug events. “We have several tools to help reduce the potential for these readmissions,” said Stewart, “and we think YouScript is a great tool to help us with that.” Reducing admissions is a win

for the patient, Cave City, and the hospitals, too. “It's a win for the healthcare system as well because it's saving money. It's saving everybody money.” When asked what they'd say to other geriatric care professionals, Stewart said, “[Personalized prescribing] is a phenomenal tool... It needs to be used.”

By using YouScript, Debbie Stewart and the rest of the staff at Cave City Nursing Home have been able to improve their patients' quality of life and, through it, act as a unifying force in the local healthcare community.

## Get More Precision With Lesser Known YouScript® Features

Are you getting the most out of YouScript? The YouScript Personalized Prescribing Software's patented algorithms can crosscheck thousands of medications at a time. But what prescribers may not realize is that these same algorithms can also be tailored to deliver exactly the level and type of information each prescriber needs.

Prescribers faced with too many notifications and prompts can develop alert fatigue, which can hamper a prescriber's ability to recognize important problems. To help solve this, YouScript has two filters that can help prescribers

hone in on the most pertinent details of a patient's case. The Gene Only Filter lets prescribers hide drug-drug and only see drug-gene interactions, which typical DDI programs miss. Meanwhile, the Drug Alert Filter lets prescribers decide what level of alerts they want to see, from the relatively minor to the most severe.

### Flagging Specific Patient Conditions

YouScript can also flag some specific patient conditions. By entering “Elderly (>65 years old)” in the drug list, the program will automatically factor BEERS Criteria data into its predictions. Entering “smoking”,



“alcohol (acute)” or “alcohol (chronic)” into the drug list will take regular tobacco use or drinking into account.

Finally, if prescribers want more personalized advice, they can turn to the Ask a Pharmacist option under the Support Menu. By clicking this, prescribers can email Genelex's

pharmacists directly for advice or consultation on the specific patient.

YouScript is a powerful, customizable tool for prescribers. By using some of these lesser known features, prescribers can streamline their workflow and gain more precise prescribing advice.

## Can Pharmacogenetics Increase Adherence?

(Continued from page 1)

resorting to trial and error prescribing, which can frustrate and discourage patients. Plus, pharmacogenetic testing can prevent side effects and simplify complicated drug regimens, which can also help improve adherence.

### Favorable Behavioral Effects

But it turns out there may be psychological effects as well. Studies have also shown patients were more adherent after genetic testing, *no matter what their test results indicated*. Just the fact that the doctors took the extra step improved the patient's adherence to their prescription, even if the medication regimen didn't change.

“A pharmacogenetic test result communicated directly to

patients has a favorable effect on their health behavior,” said Charland et al. (2013), “...Patients have some degree of personal utility for the information provided.” Perhaps pharmacogenetic testing can help patients feel like the doctor understands their unique situation, feel like they're more of an active participant in their healthcare decisions and reinforce their trust that chosen medications are worth taking.

### Pharmacogenetics: Part of the Solution

Medication nonadherence is a major problem in the American healthcare system today and no single solution will completely solve the pharmaceutical or psychological causes of it. But by using pharmacoge-

netic testing, prescribers can not only improve adherence, medication efficacy and avoid adverse events, but also build

a stronger, more trusting relationship with their patient.

### Why Test?

Every year, more than 2.2 million severe adverse drug events are reported in the US.

Visit [www.youscript.com/riskanalysistrial](http://www.youscript.com/riskanalysistrial) to get started today.

### Talk to Your Doctor

If you feel drug sensitivity testing would help you, talk to your doctor about YouScript.

Visit [www.genelex.com/patients/ask-your-doctor](http://www.genelex.com/patients/ask-your-doctor) to take the first step.