A Conversation with the Pioneer Behind the Groundbreaking Study in Antibiotic Resistance—Dr. Stuart Levy

What if you were asked to conduct an industry study, but what you initially set out to prove took a surprising turn, and along the way, what you ended up finding was far more impactful than you or anyone ever could have imagined?

This is THAT story, and while notable at the time in journals of medicine, it wasn’t broadly appreciated for decades. More than 40 years later, PYA is helping retell it, because it needs to be heard. The profound implications are playing out in hospitals, critical access hospitals, and long-term care settings around the world. We are talking about a remarkable, groundbreaking study in antibiotic resistance conducted by renowned researcher and physician Dr. Stuart Levy.

Infectious disease specialist and head of PYA’s antibiotic stewardship services James M. Keegan, MD, along with his colleagues, Senior Director of Business Strategy Michael Levesque and Consulting Senior Aaron Elias, had the honor of speaking with Dr. Levy. The conversation below provides insight into the mindset at the time of the study, what was learned and how it was received, in what ways it has influenced Dr. Keegan and others committed to preserving antibiotics for the next
generation, and why the story must be retold.

Aaron

Good afternoon, Dr. Levy. Let me first start by introducing my colleagues. Infectious Disease Specialist Dr. James “Mike” Keegan leads our antibiotic stewardship team at PYA. He is joined by Michael Levesque, senior director of business strategy, and me. I serve as a healthcare consultant for PYA. As you may recall, we last spoke earlier this year when we submitted an article for your Alliance for the Prudent Use of Antibiotics [APUA] newsletter.

Dr. Levy

Excellent. It’s a pleasure to join all of you.

Aaron

You’ve had a very long and distinguished career as a researcher, microbiologist, and Professor of Molecular Biology & Microbiology and of Medicine at Tufts University School of Medicine, so we’d love to hear about some of the more notable events or achievements that have shaped your perspective on antibiotic resistance.

Dr. Levy

Well, this conversation actually is quite timely, because recently we were interviewed regarding a project that we conducted in the 1970s dealing with the use of antibiotics as growth promoters in animals, a project that had sort of been put to rest years ago. At the time, it was well-received in the New England Journal of Medicine, but it was not creating a lot of broad interest. It wasn’t until later that we encountered all these news media people wanting to get a copy of the paper.

To make a long story short, the project was conducted at a small farm outside of Boston. It dealt with tracking the bacteria associated with chickens and humans. It was the only project of its kind – the only demonstration of [antibiotic resistance] in people following the feeding of low-dose tetracycline in an animal model.
Michael

One of the questions that I have for you, Dr. Levy, actually relates to that farm study, and I was wondering what prompted you to conduct that study in the first place?

Dr. Levy

It’s interesting that you ask. The Animal Health Institute, whose members are pharmaceutical companies, funded the research. The U.S. Department of Agriculture or probably the U.S. FDA told [the] industry that it had to produce new data dealing with the consequences of the use of antibiotics in animal feeds.

The industry was looking for data that evaluated the impacts of low-dose antibiotics in animals and humans. In any case, we were asked to come up with three projects on a model farm which would “add more meat to the bone.” So, I took the challenge and alerted all in those days who were working in infectious disease areas.

I wrote up three different protocols and passed them around [to] the leading scientists at the time and asked them whether they would accept the results of a project in which we would add an antibiotic—an oxytetracycline—to the feed of freshly hatched chickens–baby chicks; they affirmed, and we undertook the project.

So this was our way of not being “forced” to do something we had not initially proposed. We were excited about this opportunity, and rightfully so, because as it turned out, no study had mimicked what we had documented at that time or even later. We had lots of experimental controls that are all outlined in the New England Journal of Medicine.

It was an exciting time. The children on the farm played an important role in terms of providing our team with fecal samples, so that we could look at what happens to the human fecal bacteria when the antibiotics were introduced to the animals.

The farm kids were asking great questions. It was just an idyllic time, and little did we know that it would be the first-of-its-kind study. It was not appreciated by the members of the Institute. They thought it was impossible that animals given low-dose antibiotic-laden (tetracycline) feed would then lead to the emergence of high-level resistant bacteria in the flora of farm personnel.
We were providing feeds that had low amounts of antibiotics hoping to see what a small amount of antibiotic would do to the intestinal bacteria. The thought at the time was, that if you give an antibiotic to someone, or an animal, at low doses, you would get low-dose resistance.

An Institute overseer visited weekly and could not believe the phenomenon that occurred—that is, **feeding low-dose antibiotics to animals was followed by the emergence of bacteria with high-level resistance.** As we then learned—and we certainly suspected it—we were dealing with plasmid-mediated resistances which were selected in the flock fed oxytetracycline.

We were, more or less, not received with great enthusiasm by the funder. They [Animal Health Institute] sent staff scientists over to see that we were following protocol...and it certainly kept things moving.

**Aaron**

Wow. You mentioned your results were not well-received, but was there a period of time in which you felt like you were sounding an alarm, or at least raising awareness, of something that wasn’t otherwise widely known?

**Dr. Levy**

In the first month, we were seeing this phenomenon, and as a young scientist in the field being aware of the low-dose/high-dose emergence effects, I wasn’t at all surprised. But I was surprised when the people that were sent by the Animal Health Institute to evaluate our studies said, “We don’t understand this,” or, “Are you sure there isn’t a mistake? Are you sure you tested correctly? Can we have a sample of the feed to examine at our headquarters?”

There was honest amazement by them, but the noteworthy result in the study was not part of the first line in the study. The first lines of the study dealt with the low dose, the use of antibiotics in animal husbandry, and watching what effect antibiotics would have on one group of chickens that was receiving the feed and another that was not.

The study was very simple, but as I said earlier, it was unique, because you’re
raising animals—we had to find a farm and so forth—but it was met with disbelief that low-dose antibiotics in the feed would produce high-level antibiotic resistance.

**Dr. Keegan**

Dr. Levy, I have a two-part question. I know over the years that you have sounded the alarm, and I think much of the medical community has been slow to respond—certainly the prescribing community. From time to time, we are encountering that as well—there are a lot of people that are more tied to the status quo, or the current standard of care, and resistant to change. So, the first question I have is, what have you seen or done that’s been effective at helping to influence the change necessary?

**Dr. Levy**

Promoting awareness—the broader the awareness, the more successful the effort will be. We found this with doctors who were being forced to prescribe [antibiotics] when they said they didn’t really want to and didn’t need to, but that’s what the public wanted, and so that revealed—that whole issue where public pressure dictates what the doctor prescribes. I became aware of that in the early 80s and was struck by the influence the public had, and how the family would look around for a source of antibiotics if their son or daughter had a little cough.

That was the revelation that helped me to write the book [*The Antibiotic Paradox: How Miracle Drugs Are Destroying the Miracle*, 1992], because I realized that people were influenced by what they were reading. We then formed groups to give lectures, and created a lecture series.

So, we kept adding on avenues to broadcast and identify the problem of resistance. As new data was released, we would show it. We looked for resistance, recognized it, and attempted to determine how sustained it was. We like to think that we accomplished something. It was not known then, but I must say all of our early work became part of what we’re talking about today in antibiotic-resistance awareness.

**Dr. Keegan**

All right, well thank you. The second question I had is comprised of three parts, and
a little bit tied to the newer technologies. What are your thoughts, as far as the role in effective antibiotic stewardship programs (ASPs), of the newer polymerase chain reaction (PCR) rapid diagnostics, understanding of the human microbiome, and even newer technologies like clustered regularly interspaced short palindromic repeats (CRISPR) gene editing technology, as far as the speculated utility in dealing with highly resistant bacteria?

Dr. Levy

I think everything has become more sophisticated. It’s amazing how the practicing physician ever catches up, because things are moving at such a rapid pace.

Microbiome studies are showing us the collateral damage done by antibiotics – highlighting the need for us to be conservative and targeted in our approach.

These newer technologies open up new doors for the rapid identification of infectious agents – allowing more targeted therapy with narrow-spectrum drugs.

The whole objective is awareness, awareness at whatever level, but get the message across. Dr. Keegan, you and your team have been very instrumental in that, which is one of the reasons I was delighted to have you contribute an article for the APUA Newsletter and pleased to be a guest for this interview.

The whole idea that you can influence physicians’ prescribing behavior was not accepted 30 years ago, but it is certainly becoming more accepted today. It is obvious that antibiotic resistance is happening. Television shows feature it. The revelation is that we can do something about it, but the message must be repeated over and over. Tell me, what did you go through in the early days of trying to convince patients how to respect antibiotics?

Dr. Keegan

I think we’ve been working on this in western South Dakota for about 18 years or so. We saw the rising resistance (because we have one microbiology lab serving an entire region of the west here—it’s rural and frontier), and we saw that the literature suggested that we have options. For instance, not using some of the newer antibiotics that seemed to be driving the resistance, the more broad-spectrum
antibiotics—we went back to older prescribing habits.

**I think a lot of the rationale for physicians wanting to prescribe the newer antibiotics was a strategy to not miss anything—to save money on the diagnostic side, and not miss anything therapeutically. The antibiotics were very good at doing that; however, what we saw were the consequences of that.**

And so, instead of using antibiotics as “insurance” to not missing anything, we made ourselves available to respond to any phone calls that doctors would have, if they thought they needed to order something.

**Dr. Levy**

We’re now talking about antibiotic resistance being a problem 30 to 40 years after some of the first antibiotic-resistant bacteria were isolated. It’s fascinating because you were leading the cause in your area of the world, and your work was right on target. It’s impressive. Who was the leading crusader that you looked to in this area of science?

**Dr. Keegan**

Well, thank you. I think a lot of that was looking at many of the things you were writing at the time including how antibacterial soaps can produce resistance and so forth. I just used literature that you were contributing to, as well as others, to show our medical staff.

As you mentioned, showing the data is critical. But I was also making myself available. I was actively practicing and seeing the sickest of the sick at our referral hospital; I was always available. My colleagues knew that I wasn’t promoting a particular product, but instead, I was promoting a strategy. They liked not having to wear as many gowns and gloves because we didn’t have as many resistant bacteria. **We were able to keep our bacteria just as sensitive in 2016 as they were in 2000 or 1998 - when our sensitivity was at its peak.**

We just didn’t use carbapenems; we didn’t use quinolones; we didn’t use tigecycline; we didn’t use the newer broader spectrum antibiotics; we had them all in the
reserve category for that rare instance for when we might need to use something, and as a result, they’ve remained a very effective course.

**Dr. Levy**

Were you speaking to a select group? Because when we’ve talked to people, often it goes in one ear and out the other, but you were successful in making an impact.

**Dr. Keegan**

We showed them the science—and thank you for producing that science, by the way—and then every day at the hospital, we would monitor the antibiotic use and all the positive cultures, then stay on top of it and get feedback. We also set up a network of pharmacists that we purposefully had trained.

And that’s what we did for the last 16 years to keep a handle on it and sustain the benefit. It initially took us about an hour-and-a-half a day, and we were that committed to doing it. And now it’s maybe 10-15 minutes two to three times a week of oversight.

As you know, as new antibiotics are introduced or new physicians come on board that are accustomed to practicing a different way, sometimes you have to intervene immediately, but we’ve always done it in a nice way, a collaborative way.

**Dr. Levy**

What’s the underlying, strongest message that you think gets transferred over from the science side to the public?

**Dr. Keegan**

I think currently it might be to preserve our antibiotics for our children and our grandchildren because they’re losing their effectiveness.

And the way to do that is to confirm the infection, be it viral or bacterial—most are viral in the outpatient area—and then only use specific, targeted therapy if therapy is indicated. When we convey that message to practitioners, prescribers, or the public, we find that it’s very well received.
When we interact with hospitals across the country, I see maybe a quarter, or as much as a third of the time, the prescribing problem is actually an infectious disease physician who feels the need to prescribe the latest thing that’s out there to demonstrate his or her merit—it’s almost an insecurity at times, or a different philosophy. They don’t seem to understand the damaging effect on the human microbiome and the consequences. Maybe they’ve just read a selective amount of literature, or maybe they don’t keep up because they’re so busy. I agree—nationally these remain significant challenges.

We had discussions with a prominent hospital about nine months ago, and when we looked at their antibiogram, we quickly noted that it was awful. And we looked at the top 10 antibiotics used, and there are a number of antibiotics on its list that we would not advise using at all. They believe that they have a leading program, and they teach people how to integrate antibiotic stewardship principals. So, I think there’s a lot of that.

Dr. Levy

One needs to have a message which is easily accepted, and it’s interesting because there were several of us talking about the prudent use of antibiotics before it became widely known as sort of a moniker.

But what’s interesting is, as I go around and lecture to different places, it’s amazing how many people, how many physicians, including nurses, how much they are talking about the prudent use of antibiotics—using microbiomes and stories like that to convince everyone of the problem.

It’s always been about prudent use of antibiotics, but you know, suddenly everyone is talking microbiomes.

I’ve seen a change in the public acceptance of the prudent use of antibiotics, without question. Now there are weak areas, like you were describing—poor use is still happening—but in essence, in looking at the total picture at different areas, you’ve done a good job. But the question is: how did it come to be? And I think the solution comes through individuals that are teaching at the same time they are providing [patient care].
Dr. Keegan

Yes, yes, yes. I absolutely agree. I think there’s a certain credibility that has to occur in providing care for patients and being academically engaged. I think that’s key. I absolutely agree with you.

Dr. Levy

It’s funny, about 20 years ago, I was on a plane and sat down next to someone who was reading a medical journal. I was trying to figure out what she was doing without being too intrusive. The woman was there with her son of about five-years-old, and she said that she’s bringing him home to get an antibiotic treatment, which was interesting in itself.

I asked, “How do you know when to give the antibiotic?” She said, “Oh, that’s easy. It’s when his temperature goes above this number.” She shows me something that looks like it’s a penicillin response.

I said, “So how do you know when to stop?” She said, “Oh, that’s also easy. You just look at the temperature again.” That was the critical point, the temperature, and when it is higher than you want, you continue antibiotic treatment, but once you saw it going down, you’d stop it. And she said it in a way that was sort of trying to tell me, “Why are you so stupid? It’s very simple.”

Dr. Keegan

Little did she know.

Dr. Levy

So are you constantly working with different hospitals in different locales? How much of the work is dealing with the community outside the hospital? And how do you go about interacting with the community regarding resistance?

Dr. Keegan

As I mentioned previously, we were doing a 30-hospital collaborative in West Virginia. When we started, West Virginia was in a Washington Post article as the
highest-use antibiotic state per capita in the country, and sure enough, there was a high incidence of MRSA and other drug-resistant infections.

And, as you go from the northern part of the state to the southern areas, MRSA rates go from 40% to 50% to 60%, and 65%. It has high IV use, antibiotic use, and so forth. So, at the same time we were winding up our first year of work with that collaborative of 30 West Virginia hospitals, the CDC was reporting that nationally, antibiotic use was not decreasing in hospitals. The CDC reports were published about a month ago.

And it was being reported that broad spectrum antibiotics were increasing as well.

The West Virginia hospitals collaborative decreased total antibiotic use by 6% and experienced a 16% decrease in broad-spectrum antibiotic use. All but four hospitals decreased broad-spectrum antibiotic use, and their results were impressive.

So, yes, I think they’ve done a very, very nice job. We provided information and helped them effect change. In several of the hospitals, we were able to augment the education with on-site visits. We interacted with the medical staffs and clinical teams directly. Some of the hospitals we worked with peripherally and taught them how to influence the prescribers; most were able to do that. We used a lot of the information from the human microbiome project to set the rationale for the strategy of avoiding broad-spectrum use, avoiding antibiotics altogether, or using a precise, targeted therapy.

Dr. Levy

I was struck by your earlier comments that you could use the argument that there will be no antibiotics for your children and grandchildren. I was trying to think of incentives to bring about change—I think that would probably be one that would help.

Dr. Keegan

Yes, I think that’s been very powerful. We struggled early on with how to help
hospitals we worked with influence their community. Contemplating the impact for
next generations resonated with people. The hospitals found the message to be
effective when they did public service announcements or health fairs and things of
that nature. It’s hard to argue against trying to create a better future for your
children and grandchildren.

The second part of your earlier question was about our involvement in community-
wide projects? The answer is “yes,” particularly in some of the smaller communities
where critical access or rural hospitals are tied directly to the clinics and nursing
homes in the community.

For instance, we found that the director of marketing of one hospital was also the
mayor of the town, so when there is a natural connection, we set those up from the
very beginning as community-wide projects. I think a potential test or pilot area for
the U.S. may come out of the rural setting where a community-wide antibiotic
stewardship program can be implemented from the very beginning.

Dr. Levy

As a researcher, I’ve always felt that a community-wide effort would be challenging,
because there is very little control in those situations. It’s very nice in the hospitals
where the patients are right there. You’ve got the chart, and in the ideal situation,
you have complete control over their treatment. That isn’t true in the community
setting, where a person might take the antibiotic for one day and not come back, or
all sorts of other scenarios that we are all used to.

Dr. Keegan

I think one other thing that is really helping smaller communities is the rapid PCR
diagnostics becoming more affordable and able to be used in regular labs.

Dr. Levy

It’s interesting that you said that resistance can be identified. So, I guess it’s both
“resistance can be identified,” but also treatments can be provided in a quicker way
now, and at a cost that is within reason—is that a fair statement?
Dr. Keegan

Yes, absolutely. Take, for example, patients experiencing respiratory issues—90-95% of sinusitis, upper respiratory infections are viral; and, yet, we know that 75-80% of the time patients are treated with antibiotics.

So, when you have the rapid diagnostics for outpatient respiratory infections available, and you can identify that the infection is viral, then what we’re doing for patients is providing value of a diagnosis and not belittling them by saying, “Oh, it’s likely just a viral infection. You don’t need an antibiotic.” That leads us to say, “We can preserve the antibiotics for you and your family in the future.”

So, they’ll be affected because this is a respiratory virus or whatever the name is that we identify, and that preserves future opportunity for you. It also keeps you healthy and prevents your protective bacteria from being damaged by antibiotics with whatever recovery period that would ensue.

Michael

Dr. Keegan, I would add that the availability of rapid diagnostic modules, very small portable PCR modules, can be used in situations as small as critical access hospitals (under 25 beds). They’re available now in the marketplace, so I think the availability of PCR technology certainly goes hand in hand with diagnoses and antibiotic stewardship.

Dr. Levy

And they’re willing to pay in the small hospitals?

Dr. Keegan

Medicare and Medicaid do cover the diagnostic cost, and so the business analysis actually looks like there’s about a six-month return on investment depending on your need to capture some of the outpatient testing in a critical access area. Hopefully, the cost will come down further over time.

Michael
The CDC has expended considerable resources to shed light on the resistance problem. The President’s Council on Science and Technology, Joint Commission, and obviously your work of over 40 years—do you think we’re getting near a tipping point where the “collective will” might be significant enough to start reversing our path toward the post-antibiotic era?

Dr. Levy

A nice idea. I think what’s remarkable is that we are seeing a change.

I know a physician from a particular area in Greece. She would review the record of every patient who was having an antibiotic; she was a one-person control. She demonstrated that she could get the levels of resistance down and reduce the amount of antibiotic use, and that was a very impressive result for her.

At some point, the project was stopped. It was later reported that, in fact, once she went on vacation for the month of August, suddenly all these wonderful results went away.

Michael

It’s interesting that you should say that. I believe that there is a study that is often cited by the CDC, I think it was a Maryland hospital that instituted an antibiotic stewardship program, which saved a tremendous amount of money—up to $3 million after three years—through the reduction of antibiotics, antifungal agents, etc.

After seven years, the study concluded. I suppose they concluded that they achieved their goals and there wasn’t really further incremental benefit.

I’ve heard that rationale expressed—after a period of time, antibiotic use and cost has been reduced, and the future gain after that will be marginal—so they stop the ASP. So back to this Maryland hospital, once the study was completed, the use of antibiotics rose sharply [32%], over the subsequent two years; they lost most of their excellent gains. It’s interesting. Dr. Keegan, you’ve seen that as well, haven’t you?

Dr. Keegan

Yes, I think the physicians will often revert back to broad-spectrum use, so that they
don’t miss anything, unless you can help continue to monitor that and give them safer options.

I think it does require ongoing monitoring—often on a daily basis, but certainly depending on the size of the hospital. Prescribers will revert back, and you see that in infection prevention measures as well. People will come up with ways of confounding best, or proper, practices, and so you’ll have to be on top of it.

I think that the challenge in West Virginia hospitals is going to be: will the data feedback be enough, or will they need further intervention and ongoing support?

I think some hospitals will opt for staying engaged with our team, and some hospitals are going to see if they can just do it on their own, so it’s going to be interesting to see what happens. As Dr. Levy mentioned earlier, the science is just evolving so quickly, it’s almost on a daily or weekly basis that new information comes out that affects the decisions that you should make.

Michael

Dr. Keegan and I spoke this week about the moving target as it relates to sepsis protocol and antibiotics and antibiotic stewardship. Dr. Keegan, would you elaborate?

Dr. Keegan

Sure. The national campaign for early sepsis recognition—hospitals tend to use a lot of very early criteria for antibiotic use, and they choose to use broad-spectrum antibiotics. We returned recently from a hospital where we saw that the *C. difficile* rate increased because they were using meropenem for people coming into the emergency room for early sepsis.

So, they saw their antibiotic rate increase with the incidence of *C. difficile*, and they were proud that they had a very high rate of early sepsis recognition and treatment. But, the problem is that there are consequences to that. We helped them balance the proper use of antibiotics and mitigate *C. difficile* incidence. Why would you include antibiotic coverage for selected urosepsis or cellulitis, for instance? We helped the hospital modify that, so they then wouldn’t be forced to deal with the
consequences of an increased *C. difficile* rate.

**Dr. Levy**

Do hospitals recognize the financial incentives when this happens in their facilities?

**Dr. Keegan**

Yes. This was done through the West Virginia Hospital Association, so it was a quality project of their quality committee, vetted by the board, and so it was voluntary for the hospitals. It didn’t cost them anything, because it was covered through their dues in the West Virginia Hospital Association. Notwithstanding that, the hospitals realized significant expense reductions through the decreased use of antibiotics and improved quality of care. They also benefited from some of the less measurable metrics like length of stay, readmissions, hospital-acquired infections, HAC penalties, and so on.

One of the challenges across the country is that the critical access hospitals often don’t have access to infectious disease (ID) physicians to help guide some of their internal strategies and practices.

We get a fair number of inquiries from hospitals like that, and what we’re told is they had a lot of trouble finding infectious disease physicians and need more information than is available to them to answer questions. As you know, there is a declining number of ID physicians available.

**Dr. Levy**

I think the results of your West Virginia study will be instructive, and I would encourage you to get it into a journal that would be popularly read, because I think some of the good work that you all have done has demonstrated certain characteristics which would help in the care of the patient and the success of the hospital.

**Dr. Keegan**

Yes, and I think the West Virginia Hospital Association is also very interested and
willing to do that, so I am optimistic we’ll be able to do that.

**Aaron**

Dr. Levy, we just want to thank you again for your time. We’re honored to be able to speak with you. Thank you for taking the time out to talk with us. We greatly appreciate it.

**Michael**

I think your clarity of vision has been remarkable and so consistent over the years. And I do appreciate all your work and what’s been accomplished so far. It’s fascinating to me how this really started for you.

**Dr. Levy**

It is—it’s fascinating—I think that what’s telling is the rapidity with which new findings are presented as they [the findings] reflect on the care of the patient and the use of the antibiotic.

And, I think it does help for all of us to be involved in antimicrobial stewardship. So, I encourage you in that direction, and thank you for the invitation, and thank you for your work.

**Stuart B. Levy, MD**

*Stuart Levy, MD, is Professor of Molecular Biology & Microbiology and of Medicine and Director of the Center for Adaptation Genetics & Drug Resistance at Tufts University School of Medicine. Dr. Levy discovered the efflux mechanism for drug (tetracycline) resistance and was among the first scientists to document the transfer of resistant bacteria from animals to farm workers.*

*Much of Dr. Levy’s work as a microbiologist and physician has focused on the mechanisms and control of drug resistance, in both bacterial and mammalian cells.*

*He is also co-founder and President of the Alliance for the Prudent Use of Antibiotics, the leading global non-governmental organization working to preserve the effectiveness of antibiotics for current and future generations.*
Dr. Levy in the News

- American Association for the Advancement of Science news release, “The American Society for Microbiology Honors Stuart B. Levy,” June 2012
- Associated Press article, “Does Giving Antibiotics to Animals Hurt Humans?” April 2012
- The Boston Globe article, “A Leader of the Resistance,” January 2011
- CBS Evening News with Katie Couric, “Guidelines Issued for Antibiotic Use in Animals,” July 2010
- “Dan Rather Reports Investigates Our Heavy Dependence on Antibiotics—What Are the Causes…and the Consequences?” January 2011
- NPR article, “Bacterial Infections Defy Treatment,” April 2010
- “Testimony of Dr. Stuart B. Levy...Before the Subcommittee on Health of the U.S. House Committee on Energy and Commerce,” July 2010
- The Huffington Post blog, “The Antibiotics Crisis” by Dan Rather, January 2011
- USA Today article, “Antiseptic Soaps Bubble Up Again,” October 2005
With more than 20 years of antibiotic stewardship program experience and a record of proven results, PYA delivers a comprehensive solution for healthcare providers across the U.S. PYA’s interdisciplinary team of MDs, infectious disease specialists, RNs, C-Suite CEOs, CMOs, and other executives focuses on developing and refining single-facility and system-wide, community-based ASP initiatives, providing essential, life-saving treatment protocols for patients. As such, PYA offers unparalleled expertise in ASP prescribing modification, access to world-class data analytics, and established best practices. If you have questions about antibiotic stewardship programs, or would like to request a speaker on this topic for your organization or event, contact one of our executives below at (800) 270-9629.