What I'm going to talk about for the next few minutes is preoperative evaluation of elderly patients. This is a completely clinical talk about hopefully informed by recent research findings.

So these are some of the areas we are going to cover today. We are going to look at preoperative risk factors for individualizing recommendations for elderly people going to the operating room. Those risk factors are of sort of two categories. The first is the traditional factors that every general internist knows in terms of cardiac risk assessment but then also geriatric factors such as functional status and cognitive abilities which are equally or more important, and also to remember the preoperative assessment of an elderly patient is an opportunity step back a moment and do a comprehensive evaluation of this person's total picture in terms of multidimensional evaluation.

So some background about elderly people, they are nationally a third of the population, here in Allegheny County of course much more. Nationally elderly people have about a third of all surgical procedures and consume about half of hospital days across the country. Here in Allegheny County again it's probably more like 75%. Older people stay in the hospital for a longer period of time, increased risk of functional decline in the hospital. The perioperative mortality for older people is higher than for younger people. Across the country right now the overall mortality is less than 1% for people under age 65 which is remarkably good. Over age 65 it goes up to 3 to 5%, but that is still quite good. And then as we all know in this room the elderly are a very heterogenous group. If you've seen two 75 year old people you can't really say these people are just like each other, these people are very likely to be very different from each other.
So here is a little question to get us thinking. So which of these factors is the most predictive of 30 day postop mortality? So who thinks that it might be cardiac risk factors is most predictive? Age of the patient is most predictive? Presence of comorbidities is most predictive? Functional status of the - all right geez, what a smart group of people. It is functional status. These are the classic factors that influence the risk of surgery. First is the type of procedure, one could think of procedures as low risk, intermediate risk and high risk. So a low risk procedure would be something like a cataract extraction. High risk procedures tend to be those that I show you here that are in a body cavity or that involve vascular or cardiac surgery. The second factor is whether it's an elective or an emergency. Basically emergency surgery carries at least triple the risk of elective surgery. Thirdly the comorbidities that an individual patient might bring with them, such as presence of coronary disease, chronic kidney disease and so forth. Next is the functional status of the patient, which is absolutely key. And then also an independent factor but the least important of these 5 factors is in fact the age of the patient.

To look a little bit at the impact of the age of the patient, this is a very old slide but still a good slide. This is from years ago from the Baltimore Longitudinal Study of Aging. Where is Stephanie? Anyway what this shows is what happens to certain physiologic parameters through normal aging. So at about age 30 here going to age 90, at 30 things are about 100% and this is what happens as we get older and many of us are on this downward trajectory and know exactly what's - so as bio-machinery we are at our best at age 30 but even at age 90 nothing here has, nothing here is at zero, things are about at half of what they used to be. These are asymptomatic changes. So no patient will ever come to you and say, doc, my GFR isn't what it used to be. But when a person is stressed such
as the stress of surgery they don't have the residual capacity to deal with stress as well as when they were younger.

One of the corollaries of normal aging is that we metabolize drugs more slowly when we are older. This is another classic old slide, this is the half life of Diazepam which is Valium at different ages. So even at age 20 years the half life of Diazepam is an entire day and by age 80 the half life of Diazepam is actually 4 days. So we've all seen the little old lady in her 80s who comes to the office and says but doc, I only take Valium twice a week on Mondays and Thursdays, but in fact that's all it takes to be maintaining a constant blood level of Diazepam, 2 pills a week.

This is sort of the view from 50,000 feet of the risk of surgery by decile of age, people in their 50s, 60s, 70s and 80s, and you can see that the risk of complications and the risk of in-hospital mortality goes up steadily with decile of age.

There was a recent study within this past year looking at surgery in people who are in their 90s. This was a large registry that included over 5600 people all over the 90 who underwent all types of surgeries. And these are the most common types of surgical procedures that these people underwent. Hip fracture number 1, followed by cataracts and then elective hip replacements. In this large group of 5600 people there were only 38 major complications and only 4 people died out of this large number. So although age does increase one's risk it's not out of the question to consider surgery on somebody at any age.
So let's look at a specific case to see if we can operationalize some of these principles. This is an 80-year-old person, this was an 80-year-old woman who has a bad knee. Her pain in the knee has been getting worse for 5 years, she now has to walk with a cane. She occasionally says my knee gives way and she's actually had several falls. She saw an orthopedist who recommended that she get a total knee replacement. This is her past medical history, some common conditions, hypertension, hyperlipidemia, overweight and she does have COPD although she fortunately quit smoking about 20 years ago. These are the medicines that she's taking right now, again nothing unusual here. Hydrochlorothiazide, Amlodipine, Simvastatin and Fluticasone/Salmeterol which is Advair and then Albuterol inhaler when she needs it. She lives alone, importantly she is able to climb one flight of steps so that we know functionally she's not doing too badly even though she's got this bad knee.

On physical exam she has a BMI of 30, blood pressure a little borderline, she's awake and alert but has a borderline MMSE score of 23 out of 30. Lungs are clear but decreased air entry, heart is in sinus rhythm. She has a systolic murmur over the aortic area and she's got that bad knee. Her baseline laboratory testing is normal except for a creatinine that's slightly elevated at 1.5. So what are her preoperative issues? Her traditional preoperative issues we would say are that she might have coronary disease. She has multiple risk factors. She might have aortic stenosis, she's got that murmur at the aortic area. She does have high blood pressure which is borderline controlled. We know she has COPD and she's got some mild renal insufficiency. So, so far so good.
Not just considering elderly people but adults in general we do have some guidelines for when somebody looks like they should have their surgery cancelled or postponed because of a medical problem. These are the guidelines in general for when to delay surgery. Systolic, and you can see Systolic blood pressure that's too high or too low, the cutoff for 200 high is 180, AF or SVT that's in a rapid ventricular response, febrile pneumonia, recent MI, CHF, things that we all know that are as true for younger people as for older people.

One new study that was published with the past year since the last time we had this conference was the effects of a recent ischemic stroke on somebody's subsequent risk of having a cardiac event. This was a study from Denmark where they have this registry of all patients in the entire country who are undergoing surgery. Here is the end, 480,000 people and they looked at who had a stroke and then who subsequently had a cardiac event, and what they found was that after a stroke one's risk of a cardiac event approximately triples and it stays up for about 9 months after an acute ischemic stroke. So the comment was made that if there is an opportunity to delay surgery such as an elective knee it probably makes sense to delay surgery for at least 9 months.

If somebody has had a recent MI the general suggestion is wait 4 to 6 weeks or longer before doing elective surgery. If somebody has had a coronary intervention, if they've had a bare metal stent wait 6 weeks, and if they've had a drug alluding stent wait 6 to 12 months. The person with the drug alluding stent is now on aspirin and Clopidogrel or another antiplatelet agent and they are going to have an increased risk of bleeding in the operating room and the surgeons are not going to be happy with you.
So those are sort of the traditional medical issues that we would consider but in addition there is a whole other set of issues that are just as important when we think about older people going to the operating room. This is a list of a number of them. What is the patient's life expectancy? Seems kind of obvious, if somebody has only got a year or two to live we shouldn't be putting them through something like a knee replacement. What is their functional status? As we've already mentioned what are their personal values? Is it important that the person have this surgery? If we discover for instance that a person has lung cancer and we are thinking about doing a potentially curative lobectomy but they are 92 years old and have Alzheimer's and live in the nursing home is that necessarily the right thing to do? Are they competent to give informed consent? In the case of our 80 year old woman this morning her mini mental is 23, is she competent or not? Mini mental is not that good to know for sure but it certainly raises the question. Is the patient depressed? People who are depressed do much worse postoperatively in terms of rehab than people who aren't depressed. People who are depressed have increased mortality after surgery and after hospitalizations in general.

Beside the meds on the person's medication list what else are they taking? There is lots of people who have stuff that we don't know they are taking if we don't specifically ask. You know all of those people taking Tylenol PM so that they can sleep and you know you don't know if you don't ask. The person is having 3 cocktails every night with dinner, and then they come into the hospital and on day 3 they go into delirium tremens, I'm sure that many of us have seen that. You never knew they were a drinker and then all of a sudden they are having seizures on day 3. And then also
we should be thinking preop prehospitalization what are going to be their post-hospitalization rehab needs? It shouldn't be a surprise that somebody is going to have more rehab needs than somebody else.

This is a case of polypharmacy. See this is my exam table and this is a photo I took, I couldn't believe all these medicines that this person had, hardly any of which had been prescribed by me. So it's just - in fact this person with terrible medicine compliance and of all these meds there was only one that they took religiously and never missed every single day and you can probably guess which one that was.

So getting back to that list I showed you a minute ago, the first one was life expectancy. We know what a person's life expectancy is at every particular age. This is data form the CDC by the way, you can go to cdc.gov and you can search around and find this. But if we have an 80 year old woman her life expectancy is about 9 1/2 years. These data are a couple of years old so maybe by now her life expectancy is a few tenths longer than that. So is average 9 1/2 long enough that she might benefit form a total knee? That's up to her personal value system, but one might say yes.

There are some global indices for the overall risk of a surgical procedure that I'll just mention. The grand-daddy of them all is the ASA Scale, this is the American Society of Anesthesiology, the original reference was Dripps, et al, Lester Dripps was the President of the ASA in 1963. They ASA Scale although it is now 50 years old is still used in every one of our hospitals every single day, it's on the pre-colonoscopy clearance sheet, it's on the pre-upper endoscopy as well as on every preop
sheet in every hospital. And the reason that's been around for 50 years is it's still useful. And we'll come back to that in a minute.

Functional status I mentioned is still very important. The cut point for having problems with low function going to the operating room seems to be a functional status that's worse than 4 METs. A MET as you know is a measure of energy expenditure, 4 METs means that you can climb a flight of steps, or that you can walk a block on level ground. So people who cannot do that are at increased risk. And this has just been reinforced in the guidelines of the ACC and the AHA, American Heart Association which I'm going to reference in another couple of minutes. They just updated their preoperative guidelines within the past year.

Thirdly is frailty indices and there is a number of these that we don't really use in clinical practice but I'll show you one. Gait speed, which Stephanie has been a great pioneer in talking to us and educating us all about the importance of gait speed as a predictor of mortality, and also gait speed as a predictor of perioperative mortality and complications.

And then I'm going to show you something called the American College of Surgeons National Surgical Quality Improvement Project Surgical Risk Calculator. This is something that's available online, it's fabulous, I'll show you in a moment.

So the ASA Scale originally was 1 to 5, in this era of organ transplants they added a level 6. And then one puts an E after any class if it's an emergency surgery because emergencies are much more
So ASA 1, this is a hypothetical person not normally seen in geriatric practice. ASA 2 is hopefully most of us and ASA 3 is in fact what the great majority of people going to surgery in the United States are classified. ASA 3 is something like 2/3 of everybody. And then 4 is somebody who is very ill and 5 is moribund.

So there was a study published again within this past year looking just at ASA 3 patients. So ASA 3 is defined as having a systemic illness. These people went further and they said let's take all of these people with systemic illnesses and measure their functional status. And so we'll talk about ASA 3, Class A and Class B. Class A is the people with better functional status and Class B is the people with worse functional status. And they found that for each of these age groups under 60, 60 to 70, 70 to 80, over 80, for every one of these groups knowing functional status sharpened one's predictive skills for ASA 3 patients. And I think that intuitively that's what we in geriatric medicine do anyway is we think about the global picture of the patient, not just some number based on strict medical criteria. So this is kind of for me this is validating that we have the right idea in geriatric medicine of including functional status in our assessment of patients.

So frailty, this was a nice study from Hopkins published about 5 years ago. They measured frailty by this - by these measures. And I'm not going to go into more detail than that, and they said people who are more frail are they going to do worse in the postoperative period? Are they going to have an increased mortality in the postoperative period? And the answer of course was yes. There was an increased risk of postop complications, longer length of stay, increased risk for transfer to a nursing
home and again a recurrent theme is that when you combine a frailty index with something like the ASA Scale you can sharpen your predictive abilities.

This was a different frailty scale, this was again a recently published article. This is Kim et al, this is an article that was published from South Korea and they used a totally different frailty scale but it was the same idea, multidimensional index. This is increasing degrees of frailty and you can see what happens to the mortality rate with increasing degrees of frailty. It's almost a linear relationship.

So the American College of Surgeons Surgical Risk Calculator, here is the website, riskcalculator.facs.org. I think this is just great. These people have been calculating data on surgical procedures in the most hospitals around the U.S., probably all of our hospitals participate in this program. They have a database of literally millions of patients because they keep adding several hundred thousand per year to their database. To devise this calculator they looked at 1.4 million patients in this period, '09 to '12, 21 different variables such as these here, age, sex, functional status and many others. One of the weaknesses of the calculator is that functional status was self-reported. Basically they say to the patient how are you and the patient says I'm fine, and then check mark. There is also nothing in there about cognitive status, right, it just doesn't show up. There is a number of other things in there that we might like from a preoperative assessment point of view such as results of cardiac stress test, results of echocardiogram, results of baseline EKG. None of those things are in there. But even so it's such a huge database and includes such key variables that it's still very, very useful even without those data elements.
This is a screenshot of what their website looks like and it starts with typing in what procedure is contemplated and then filling out a bunch of check sheets, age, gender, etc., emergency, yes/no, ASA class and so forth. So it's really easy, it takes less than a minute to put in all of the patient factors. The idea is to put in these factors when you are sitting in the exam room with the patient. Almost all of us now have electronic health records and if you can get to the internet from the exam room you can punch this up right there while the patient and their family are sitting with you. You can enter this and then you can get a printout right there and print it out and hand it to the patient or show it to them on screen. And sometimes this helps with shared decision making. So if you can say to the patient you have a 50% chance of needing rehab after your operation the patient might say I thought I had only a 5% chance, I don't want to go forward with this. So it can really help the patient and their family knowing what's coming.

So I applied this risk calculator to this specific patient and her complication risk was a very acceptable 6%. Serious complications, excuse me. Any complication, 7.8%, her risk of death was less than 1%. Her risk of having to go to some post care place, a SNIF or a TCU of acute rehab was greater than 50%. And so I thought that was really helpful to be able to do this for this particular patient, especially in one minute.

In general if the procedure is not urgent there is this concept called Prehabilitation which you can start before they ever go into the hospital to try and get them in better shape for surgery. And these are common sense things, start getting some exercise, debride the unnecessary medications, make sure that the nutrition is good, evaluate and treat depression.
So then I want to shift gears a little bit and talk about specifically cardiac evaluation. I think the traditional internal medicine approach to preop eval is really all about cardiac evaluation whereas I've said for care of the elderly this is just one piece. Nevertheless it's an important piece, old people do have heart attacks at a much greater rate than younger people, most perioperative MIs in fact do occur in older people. So the classic way for assessing cardiac risk preop as you all know is the multifactorial cardiac risk index which was developed by Lee Goldman and his associates as Mass General Hospital, published in 1978. Goldman and his colleagues were senior residents in the Internal Medicine Residency Program and they had this rotation, they each had to spend one month rotating with the surgeons. In those days we could admit people to the hospital preoperatively instead of on the morning of surgery so patients might come in on Monday or Tuesday for surgery on Wednesday, and they would have their preop assessment as inpatients and the assessments would be done by the unwilling house staff.

So Goldman was clever enough to enlist all of his co-residents in gathering data about all of these preoperative assessments that they were doing and they came out with their Cardiac Risk Index which was a landmark study, sort of the first study looking at preoperative risk assessment. In fact it only predicted about a third of the total risk, it wasn't that great but it was a major step in the right direction.

Twenty years later Thomas Lee, et al, in an article here in Circulation updated the Goldman criteria and they called it the Revised Cardiac Risk Index and this is what we use nowadays, the RCRI,
Revised Cardiac Risk Index. The weaknesses in terms of care of the elderly is that the average age of the patient in this cohort which I think was about 1,000 patients, the average age was about 60, and our patients are much older than that. So one of the principles of evidence based medicine is does the evidence apply to your specific patient? And in terms of the Revised Cardiac Risk Index it was based on patients younger than our typical patient. Nevertheless these are the classic index points. You get a point for each of these things.

There is something that's a little better that has come out in the last couple of years. It's called the Gupta Risk Calculator, some of you may have seen this. This again goes back to that American College of Surgeons National Surgical Quality Improvement Program database. This was based on data from 2007, they looked at over 200,000 patients, they came up with a predictive model and then they validated it on the '08 database. The end points they were looking at were perioperative MI or cardiac arrest within 30 days of surgery and again as I said a minute ago this database does not improve - does not include things that we would like to know but it is what it is.

So what Gupta found was that presence of CHF or diabetes actually didn't predict risk but these 5 things did predict risk and to nobody's great surprise these are the exact same things that intuitively make sense. This is sort of high face validity. The C statistic, which means the goodness of fit of this particular model, is .88, which is pretty good and which is better than the RCRI C statistic.

So this is the reference if anybody wants to look it up, 2011. I applied it to our patient this morning, our 80 year old lady with the bad knee and her risk was less than 1%, which is consistent with the
other risk calculator, so pretty safe. One of the nice things about the Gupta calculator is that it's included in a suite of formulae in this thing called QX Calculate, this is a download that every one of you could and should have on your smart phone right now. QX Calculate, it's either free or 99 cents I forget which, I am not connected with these folks and have no commercial stake in them whatsoever, but it's a darn useful app and I use it all the time for clinical work.

So the ASA again, the American Society of Anesthesia, came out within this past year with some new guidelines as part of their Choosing Wisely Campaign as we know the American Board of Internal Medicine has started this campaign several years ago called Choosing Wisely. They've asked each medical society in the U.S. to come up with a bunch of things that perhaps we don't need to do anymore. So the ASA within the past year came out with theirs. And one of the low value activities that they question I'll read the quote. "Baseline diagnostic cardiac testing, meaning transthoracic echo or transesophageal echo or cardiac stress test in asymptomatic stable patients even with known cardiac disease who are undergoing low risk or moderate risk noncardiac surgery this is a low value activity." So this is 180 degrees away from what we were doing 10 or 15 years ago. We were doing preoperative stress tests on everybody with known cardiac disease weren't we? But now the ASA says we don't need to do that, that's a low value activity that isn't helpful, don't need to do it. So I realize that here in the Pittsburgh community many of our cardiology colleagues are doing them on everybody preop but the evidence would now suggest otherwise.

This is again 2014, this is new data, these are the new guidelines that were just published within the past year by the ACC and the AHA about who needs a preop stress test and these are their criteria.
If a person's calculated risk of a cardiac event is greater than 1% and they have poor functional capacity, which is defined as less than 4 METs, and the procedure is intermediate or high risk, meaning not just a cataract or something, and the information from the stress test would affect management then it's reasonable to do a preop stress test. Meaning effect management means that we would delay the proposed procedure and do a cardiac cath. So if this is not somebody who would be a candidate for a cardiac cath then it's not somebody who is a candidate for a stress test either. And recognize that if we do do a cardiac cath and do an intervention we are talking about delaying surgery for potentially a year if we put in a drug alluding stent.

Also looking at the new ACC guidelines, they put out a separate guideline this past year about who should have a beta blocker. So again a decade ago we were saying that the people who should get beta blockers going preoperatively is essentially everybody. We were generally using beta blockers as the new panacea, but since then it's been shown that not necessarily a good idea. There was a study published 5 or 6 years ago that many of you are familiar with called the POISE Trial which was preoperative beta blockers which showed that beta blockers in fact did reduce the risk of perioperative MI but increased the risk of overall mortality in the postop period. So beta blockers increased the risk of death in the perioperative period.

There has been a number of other studies since then. Also the original studies which showed that beta blockers saved lives has since been called into serious question. In medicine we don't like to think about scientific misconduct, we don't like to think about fraudulent research but it looks like there might have been some scientific misconduct in those original beta blocker trials so the original
trials have actually been sort of recanted and removed from the literature. When you recalculate the risk of perioperative MI with beta blockers taking out the potentially falsified data the data now does not support the use of beta blockers except in very specific circumstances. And those circumstances are these two here. If somebody is already on one you can continue it, or "it may be reasonable if it's high risk patient and high risk surgery but it has to be started at least several days in advance." So that's the gospel from the ACC/AHA within the last 6 months.

In terms of statins preoperatively the current wisdom is if somebody is already on a statin continue it. I have seen surgeons in our community tell patients to quit their statin preoperatively. The evidence for that is flimsy, I think patients should continue their statins. In terms of initiating a statin in somebody who is not already on one for vascular surgery or cardiac surgery I think it's probably a good idea and "may be considered in people with coronary disease who are going for high risk procedures." So it's not yet standard of care to start a statin on people going for surgery but we are certainly moving more and more in that direction as the evidence becomes stronger.

So what I've said up until this point is that the traditional preop evaluation is necessary but not sufficient. We also need to consider specific geriatric issues such as the patient's functional status, are they frail, what is their life expectancy, what are their personal goals for themselves? Beta blockers and statins are going through some major changes in what we recommend these days and when we think about sending people to the hospital we need to think about not only their immediate postop period but longer term potential declines in function and in cognition.
There is one really good reference, it's now several years old, it's available from this website. It was a joint venture of the American Geriatric Society and the American College of Surgeons. I understand that there is a revision of this document that is currently being prepared but as far as I know it's not out there yet.

So we are about out of time. This is reminder that postoperatively complications are very common, especially in elderly people. We've already talked about all of this. And I will just end there.