

# Exercise and Cardiometabolic Risk Reduction in Diabetes and Prediabetes

## A Web-based Training

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# Physical Activity for Managing Cardiometabolic Risk

A Web-based Training  
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## Overview

It's a pleasure to present to your group today. I am a physiologist at Duke University, the Endocrine, Nutrition, and Metabolism Division here in Durham, North Carolina. I have consulted with the IHS for, gosh, I don't know, maybe close to 15 years and have a great interest in prediabetes and exercise physiology of course.

Well, let me get started here. Just to let you know, if we don't get as many questions that you have time to ask, my last slide will have my email address and you are more than welcome to email me, and I will be glad to send you or dialogue with you, send you documents whatever looks good, but you also will have a copy of this presentation, a hard copy that you can print out just in case.

So the agenda here is quite a bit for about 50 minutes, but I am going to hit the high points of a number of issues on cardiometabolic risk and exercises at glance. The new caloric expenditure guidelines for weight loss, and how they should be differentiated from risk reduction. They are not the same. The amount of exercise to reduce weight is a good bit more than to reduce risk. Although they do overlap, and that's something that needs to be said upfront.

Modes of physical activity. We'll talk about weight loss considerations of course, some new guidelines on measuring your patients change of total body adiposity between visits. This is going to be new to a lot of you where we are using as now as being used in most cardio-metabolic risk clinics subscapular and/or triceps skinfold.

And then we will talk about some isolated hopefully very practical strategies to energize your patients to exercise more and we'll close with some new exercise screening guidelines.

First slide here, we don't need to define cardiometabolic risk these days hopefully. It's a fairly new term, but it basically is a combination of the risk factors for the metabolic syndrome and diabetes merged with the Framingham Heart Disease Risk Factors, and that's exactly what we mean by Cardiometabolic Risk.

We also need to differentiate between physical activity and fitness. We use those terms interchangeably. A lot of you use those terms interchangeably on your grant proposal request. Fitness, although they overlap with physical activity, fitness is a measure of capacities, whereas physical activity may or may not increase for instance aerobic fitness that much, but certainly will go a long way to reduce risk. Of course, both reduced risk, but they are not exactly the same thing, and we need to articulate that upfront.

There is a lot of information around physical activity that did not improve fitness, a very little if at all that also reduce risk with physical activity. So that's something that we need to think about.

In terms of modes of activity, I wish we had time to go through of all of these, we don't. We will close with the utility of using more spiritual mindful exercise, especially in the Native American tradition. But for energy expenditure purposes we are going to pretty much center around aerobic exercise, cardiorespiratory exercise as it's also called, and physical activity, that's utilitarian. That is domestic household chores, etcetera.

Now, without being too academic here, boy, are there some good news? I cannot tell you. You're going

to see a fairly sizable revolution in exercise science, and actually it's already begun on the pathways with which any form of movement can help reduce risk, with or without weight loss. Most of these mechanisms without getting into the biophysics of them, work very similar to what the godfather of diabetes research in this country, or at least one of them Ralph DeFronzo had shown recently in a paper he wrote showing how TZDs, of course like Pioglitazone or Actos, work to reduce fat in all regions of the body, and of course reduce risk and then improve insulin sensitivity.

When I saw this, all I needed to do is just plug in physical activity. It's exactly also what physical activity does. And that's the bottom line here is that, movement of just about any form, but especially movement that is in the range of at least moderate intensities work very similar to Pioglitazone, Metformin, the new kid on the block which is a PPAR delta activator, which is probably at least a year-and-a-half, two years away from being approved by the FDA.

## **Guidelines**

### ***Energy Expenditure***

Exercise should also not just be an option, but a preferential option. I will go so far as to say in many of our patients preferentially to these drugs, because significant exercise as we will define in a moment, works very similarly to these particular prescriptive medications.

Now, if you look, and this is a brutal reduction of now about 210 or 215 papers over the last couple of decades. If you add 500 calories of exercise a week or about 5 miles of walk in a week, 10 miles walk in a week, 25 miles walk in a week to someone's sedentary existence, basically what the research now shows that between 500 and maybe 1200 or 1500 calories per week or anywhere from 5 to 15 miles per week of walking is more than enough to activate most of the mechanisms that are diabetes drugs, not all, but some drugs activate very similarly.

When you look at the data what is the minimum requirement for weight loss, the threshold is a good bit higher. I think we all know it takes quite a bit of exercise over time to lose weight and tied to the weight loss is reduction of total cholesterol and LDL cholesterol.

And then finally to maintain the weight loss, especially if it's significant weight loss. To maintain the weight loss it's pretty clear now the expenditure per week, now these are per week values, is a bit more than it took to lose the weight. However, once you are fit, you can get these 2,000 to 2,500 calories per week executed fairly rapidly, because you are fitter, you can exercise faster and whatnot.

So that itself is -- this slide itself is a seminar. But that's the way it's looking. So do we need to lose weight to reduce risk? Absolutely not. Is it good to lose weight in addition to these benefits here? Absolutely. But for those people who have not lost weight, but have exercised at least to some measurable extent, they have very, very likely reduced their risk, cardiometabolic risk, especially diabetes.

### ***Weight Loss and Exercise***

So what are the new exercise guidelines, say about how much physical activity, caloric expenditure are required for a significant reduction in body weight? The answer is a bunch. That's all I can say. More than most of us are willing to do, although there are some caveats that I will mention in just a moment

versus how many calories per week of exercise to reduce cardiometabolic risk? Not so much, but with fewer caveats.

Now the NIH guidelines, CDC guidelines for weight loss now, it was revised in 2009. For weight loss generally it's 2,000 to 3,000 calories of exercise a week or 250 to 300 minutes per week that is more than 60 minutes a day, at least five days a week of moderate level exercise, whereas for public health purposes and I also should put here, for just reducing risk of diabetes, about half of that. 30 minutes a day, most days of the week or 1,000 to 1,500 calories a week.

This is an important distinction. This is a very important distinction. I think our first goal is get patients within this guideline or as far as we can. And then of course, in time, the ones it needs to lose weight are going to need to spend more time.

The American College of Sports Medicine guidelines which are the highest order guidelines for weight loss, because they include so many studies worldwide, of course, it advocates for weight loss. The intensity of exercise should be between a 4 and a 6 on a 0 to 10 Perceived Exertion Scale or 40 to 60 of Effort Max or aerobic capacity max, not to be confused with heart rate max; heart rate max percentages are higher range.

For metabolic syndrome the only difference between obesity and those patients who have the metabolic syndrome, of course one of the features of metabolic syndrome is being overweight. But those there just have a touch of over-weightedness and the full-blown metabolic syndrome, we can advocate going at a little bit higher intensity, and I will explain why in just a minute. Otherwise the amount of exercise five to seven days a week, 30 to 60 minutes per session still holds true for either those who are overweight and/or have the metabolic syndrome.

So the long and short of it is, for obesity purposes, eventually, close to 300 minutes of moderate intensity exercise a week is the guideline. The thing you have to remember for our patients that are diabetic or pre-diabetic, exercise intensity is the most liable commodity. That's where you can injure someone orthopedically in terms of the load that they are exercising against or the speed at which they are exercising, and that's the thing that has to be -- that's the factor that has to be compromised.

So eventually, obese patients may progress to greater than 60% of effort max or percentage of aerobic capacity max, but that is the last thing in this range they should be starting with. They should be starting much, much lower than this.

Just an example, if you can get a patient to add a 1,000 calories of exercise per week, this is just a rough idea of what that 1,000 calories of gross energy expenditure added to the weekly habits would be. For instance, someone 160 pounds, ten miles of walking at a moderate to fast walking pace, two-and-a-half to three hours of continuous exercise at moderate intensity, again, these are all 160-pound people.

Now, the good news is that, note, with BMIs greater than 35, are those people much heavier than 160 pounds, they are going to burn quite a few more calories for any given level of effort or time because they are carrying more weight. Typically, most of us will burn about 100-110 calories per mile of walking or running, an overweight or significantly overweight person that will be closer to 130 plus calories per mile.

So you shouldn't be surprised that early onset weight loss is a reality with the heavier someone is, the only thing you have to understand is you have to compromise on the speed or the load or the

environmental stress. Environmental stress, for instance, very high heat loads, for instance, it's very hard on someone who is overweight.

So if you can, it's not always possible; you want to have them exercise and maybe more controlled environments early on, rather than like right now, outside here in Durham at Duke University, it's 94 degrees, about 90% humidity. I would not wish that on any new obese patient, at least not for another couple of weeks when it gets cooler.

### ***Cardiometabolic Risk***

You also have to understand if you've done already what is moderate. This is a legally defined term. Moderate exercise means 40-60% of effort max or aerobic capacity max, not heart rate max. So if the patient, you were to show a patient a scale of 0-10, 10 would be exhaustion on their perceived effort, a 4 to a 6 would be roughly 40-60% of effort max or 3 to 6 metabolic units.

Vigorous is defined as an excess of 60% of effort max. That has stood the test of time for the last almost 20 years. You are going to have this, and you actually already -- you will have it on the IHS quick-guide card website, diabetes website. You will have definitive examples of what moderate intensity and vigorous intensity exercise is for both sporting, recreational, household chores, etcetera, just in case you needed a reminder for that.

Now again, one more thing about just to caution; if recommending vigorous intensity greater than 60%, consult the ACSM decision tree for if that patient, if that participant requires a pre-exercise program graded exercise test with EKG, in other words, a treadmill EKG test. This is a legal standard for those that you are attempting to have your patients start out in an effort level greater than 60%, and I don't know who that would be, but if you are, and you are on record for that, they need to see this decision tree, we are going to close with that decision tree in about 25 or 30 minutes.

Now, do you need to do the 50, 60, or 30 minutes a day all at once? Absolutely not. We have long sensed, from the last decade we have seen that the total amount of minutes per day can be accumulated.

The current standard is that anything less than ten minutes is not as good as bouts of exercise that lasts longer than ten minutes at a time. That I can tell you is going to be revised, but it won't be in print for another couple of years.

I just have to say that even 30, 2-minute bouts per day in several studies have shown at least the same responsibility in reducing cardiometabolic risk, but we don't have enough of those studies to put it in the consensus guidelines yet. So right now, it says ten minutes or more at a time, is really what we are shooting for. But I can tell you, anything will help, and I cannot stress that enough.

Just a quick caution; what about your patients that already have type 2 diabetes?

The guidelines on the amount and the duration and intensity pretty much hold true for diabetics. Just know this, diabetics who've had type 2 diabetes more than a decade generally, you are going to have chronotropic incompetence. That's a fancy word for saying if you use their heart rate as a guide; you are going to be disappointed. Most cannot reach their age predicted maximum heart rate for a variety of reasons. So you cannot use heart rate charts at least very accurately in type 2 diabetics.

The same thing with blood pressure. That's one reason that their inability to get heart rate and blood pressure up for the most part is one reason they have such high ventilation rates when they breathe pretty

heavy early on in exercise. So they also have a blunted aerobic capacity or oxygen uptake response. As a group, there are exceptions. They also have thermoregulatory responses because they have peripheral neuropathy, etcetera and they don't sense being over-heated quite as quickly. Hyperthermia and long walks, when we get to talking about pedometer, tracking outdoors in a few minutes. We always pre-hydrate diabetic patients before they take their longer walks in the summer time. Pre-hydration usually is anywhere from 4-12 ounces of water or very dilute glucose solutions. When I say very dilute, I'm talking about 6% or less. Gatorade is about a 6% glucose solution.

We pre-hydrate, but ideally, with water and that is something we always learn to do, especially in summer time with type 2 diabetics, they are going to be exercising more than 30 or 40 minutes outdoors.

Just a little bit on resistance exercise, everybody wants to know about weight training. The newest guidelines on weight training that have encapsulated now about 200 exercise studies, we know weight training, resistance training, is good in its many forms. We know that compared to resistance training alone, resistance training combined with cardiovascular exercise may increase a loss of fat mass. I think that's not new information. This is probably also not new; resistance training may enhance muscular strength, while you are doing it and if you are not. But the news that most people don't know is there is no evidence now that currently exists for the prevention of weight regain after weight loss or a dose effect for resistance training and weight loss.

In fact, the patients are in general, if they are fairly unfit are going to gain several kilograms of lean mass depending on the level of weight training. So they will actually gain body weight, not to be interpreted as a gain in fat weight. But a prevention of weight regain after weight loss, the last three or four studies have not shown that at all, and that's basically the point we are trying to make is that we don't use it for any weight regain by itself.

What is the prescription for exercise according to American College of Sports Medicine for pre-diabetic and diabetic patient? Well, it's basically the same as it is for unfit apparently healthy adults. I won't go through all of these two to three sets. After two sets of resistance exercises, you don't gain that much more strength. So that's been shown in many, many trials and meta-analyses.

How much weight do you put on the bar? No more than 80% of one hour in max, you wouldn't. But here is the bottom line, I just added this. This may not be in your – this slide that your handout; I added this a few moments ago. All diabetic and high-risk patients should use the ten rep minimum rule. If they cannot do ten repetitions, they've got too much weight on the bar, and too much weight of the bar increases systolic blood pressures too much, so they cannot do.

And some investigators advise if they can't do 15 reps, but that might be a little bit much as far as I am concerned. But if they can only do one or two reps, it's too heavy, you've got far too much weight on the access with the bar, or the pulley, or whatever machine you're using.

## **Exercise and Weight Loss**

The National Weight Control Registry is the longest standing registry now, almost 3000 patients today that have kept at least 30 pounds off of weight for at least a year, and it's self-report. However, when they surveyed these patients that have kept this weight off for over a year, they found on average the patients were doing at least 2600 calories per week of exercise.

For their body weights, this is about 20 plus miles of walking per week, per week, okay, just to give you an idea for those who had significant weight loss, and maintained it. There is a whole bunch of people who've done very well doing it.

Now, I'm going to go to -- I'm going to skip a slide and go straight to this one, why do exercise and exercise programs tend to generate less than expected desired weight loss, when we can go on and on about this? There is a variety of reasons. Because other things that affect your total daily energy expenditure offset your exercise program that morning; we'll talk about that.

Gender specificity, it is not new news to investigators to research that women generally tend to lose less weight for a given workout over the course of a week, a year or whatever than men do. There are a variety of reasons for that. However, they do not have any differences in lack of reducing risk of diabetes for any given level of exercise. It's just the weight loss if you're using that as an outcome to measure.

Energy conservation and compensation, we'll talk about that. Body composition changes know that if you're using the scales to dictate your outcome's measures, you're going to be missing the boat. I'd rather use a Pedometer to assess exercise compliance and then the scale, although certainly you would want to measure or weigh people that are overweight, but not is the only outcomes measured, and I'll explain why in just a moment.

And then genetics play a role for weight loss. Some people inherit a higher proportion of type 2 aerobic high metabolic fibers than type 2, which are faster twitch fibers used for strength, etcetera. The ratio of 1:2 fibers pretty much is set at meiosis when you're conceived, not that you can't change it a little bit, won't talk anymore about that, but this is just one of a number of genetic factors that defend bodyweight.

Now, this total daily energy expenditure impact, just say if you exercise half an hour every morning, what do you do with the rest of your day, if you eat another scone because you exercise, you're going to offset the caloric intake, of course, that will certainly have an impact. So total daily energy expenditure has to be reduced. The total 24-hour energy expenditure has to be reduced in order for weight loss to occur. Now, that sounds like pretty straightforward logic. But it's not, it's very complex. What you do with the rest of your day? And I'm going to talk about that.

In terms of men versus women, this is just one of Joe Donnelly's study, one of the landmark trials. A few years back, where a 16-week program with equal numbers of men and women, each bar represents a week, both groups were doing 400 calories of walking per session, per workout, or 2000 calories per week. Look at what happened to the women. On average, they gained weight over the course of the program where men tend to lose the weight.

Now, we're not saying we know exactly why this occurred, but we have a pretty good hunch that women tend as a group, and their exception to this, to compensate more by taking a few more calories in, over the course of the day after they've worked out. There are other reasons behind this as well. But this is quite dramatic, I'm not saying this occurs in every patient, but this is one of the more dramatic examples of one study which showed that.

Now the big contaminant, we're trying to predict weight loss due to exercise is energy compensation and conservation. Those of us who work out very, very hard, may actually conserve another 100 calories of energy over the course of the day. We might go to bed earlier or sit in our easy chair a little earlier because of a hard workout, so we'd conserved a little bit more energy.

Then maybe about a-third of this actually compensates by increasing 100 to 200 calories a day, especially carbohydrates and beverages as a result of working out hard, and boy, it's just very hard to assay these two things.

## **Changes in Total Body Fat**

So these are the two biggest contaminants we're trying to predict weight loss. But does that mean the exercise itself didn't have effects to reduce risk beyond weight loss, not at all, because it does reduce risk beyond weight loss. I mentioned earlier that we -- and this is going to be -- well, this is already in pretty good detail on the diabetes IHS website in the quick guide card section, on how to use skinfold calipers.

There are only two approved with clinical utility, skinfold calipers, Lange and Harpenden. Lange has probably been around longer than any. There is \$200 set of calipers. When you are using these calipers, you're not converting the millimeters of skinfold to a body fat percentage at all, you are actually using the millimeters of the skinfold as the outcomes measure between serial visits.

It's pretty clear now that upper extremity skinfold change is the most sensitive to exercise generated total body adiposity reduction, and hopefully in the near future, we'll be doing IHS diabetes staff workshops on how to proficiently and skillfully use -- clinically use Lange skinfold calipers.

So the right subscapular as number of studies have shown, it was the most reliable, correlate a visceral abdominal adiposity change, it's easier to measure than, of course, DEXA or MRI of the viscera in the abdominal cavity. So, simple measures, upper extremity, skinfold measures, we've had other trials showing the correlations between skillfully measured subscapular measures, and glucose intolerance and impaired fasting glucose, etcetera.

We've had a couple of relatively recent papers showing how the changes in the subscapular and the triceps site correlate very strongly with the peptide, leptin which of course is a metabolic hormone that affects metabolism and appetite.

Here is a delightful paper just published, just a month or so ago in the *American Journal of Clinical Nutrition*. You will have this in full text PDF file, I believe on the WebEx site. Anyway, these are the first ever percentiles from the third to the 97 percentile for ages one-and-a-half to 19 on what your subscapular -- this is for boys, triceps skinfold, and there will be another chart for boys, subscapular skinfold and the same for girls, subscapular and triceps skinfold. These are the new standards, easy to measure, but you've got to measure -- use the Lange calipers or the calipers very proficiently. And that's something that should not be taken lightly.

## **Intervention Strategies**

### ***Pedometry***

So just get ready, because we're going to have a lot more on this as some of the continuing education there in the IHS diabetes division in the near future. As we start to wind down this presentation, let me get a little more practical and talk a little bit about some methodologies that have done very well, in a number of IHS clinics, but also a growing number of independent clinics throughout the country, the use of pedometers, reliable, what I call clinical pedometers that have certain criteria, now I'll talk about that in just a moment.

In fact, here is Barbara Howard paper. She has written so many studies through the diabetes division on looking at a variety of lifestyle factors in American-Indians. But here is a study looking at number of different tribal units in IHS, 2600 American adults showing this daily step count averages in men and women according to age, about 5000 at the younger ages of men and a good bit less than that as they go older, the same for women. Here's the problem with this, is that 5000 or less is the sedentary lifestyle index according to CDC and a lot of the work that's been done at Arizona State University for the last 15 years.

So anything below about 5000, there are about 5000, is the sedentary lifestyle index. So it did confirm that most American-Indian adults were sedentary.

Now obviously to get them more active, to measure this, to incentivize them, pedometers do work. I like the pedometers, they are step-filtered, that means they don't measure every little sneeze or every little jerky movement you make throughout the day, because pedometers measure muscle contraction, mainly from walking.

And each walking muscle contraction works just like Metformin. In fact, on the DPP study, and the studies that we have done with the Mayo clinic between Duke and the Mayo Clinic, we have estimated that each intentional walking step worked in terms of diabetes risk reduction just about the same level as about 2500s of a milligram of Metformin. I said intentional step, there is some criteria for that; I will speak to in just a moment.

So Metformin works as an AMP kinase activator, exactly how significant muscle contractions work.

The new guidelines on using pedometers for managing cardiometabolic risk and these are relatively new; if a patient is going to use these as a risk reduction tool, on average, they've got to walk close to three miles an hour for a maximum muscle activation.

Now that three miles an hour is based on someone around 5 foot, 7-6 foot. A taller person that would be a different speed. A shorter person that would also be a slower speed. A taller person would have to walk maybe at 3.2-3.3 miles; someone at 5' or whatever, but on average, not a shuffle, but a significant not an all-out speed, but a moderate to fast walking speed, we know now is a better AMP kinase activator as measured by pedometers than very, very slow walking paces.

Any patient that increases their walking steps per day greater than 50%, I don't care where they are starting from, if they are even well below the sedentary lifestyle index, this is very significant in terms of risk reduction. If they go from 3500 steps to 7500 steps over the course of a day, that is very significant which is greater than 50%.

You see this a lot, 10,000 steps per day, but that makes a whole lot of assumptions and it makes a lot of assumptions based on what the baseline step count is per day. But overall this is held true especially in Japan.

However, the newer guidelines as of this year, for weight loss, we now know that women, let's say, women between 18 and 50 years of age, for significant weight-loss, the step count is going to have to be close to 11,000 or 12,000 steps per day if weight-loss is your only goal.

In men, it's a fair amount too. So for weight-loss, this 10,000 steps per day is going to be great for risk reduction but it probably, over the course of most days of the week, you are going to require more steps.

There are many types of pedometers, there are about a thousand manufactured pedometers literally. About 980 or so manufactured pedometers. Some of them are kind of cute, some of them can tell your horoscope even.

I like the ones that are step-filtered. I tend to use Accusplit because we use that in the accord study, I know them very well, but there are other Walk4Life and New Lifestyles also have step-filtered pedometers.

The one that I tend to use in most IHS workshops is a simple Accusplit Eagle 2720 that's step-filtered and it only gives you steps. Remember, the ones that give you all these other peripheral information such as distance and caloric expenditure, those are all projections. And pedometers do best at measuring steps for muscle contractions and that number there is the outcomes measure. That's what we want to put in the chart.

Now, one way to incentivize patients to use pedometers more is mapping out 2, 3, 4, 5, 6, 8 courses throughout your reservation, your Pueblo or your community that are known distances and you prescribe those particular tracks.

I learned this from Dr. Mary Sanders at the University of Nevada at Reno. In other words, can you see yourself prescribing a level one or course one, which is a mile-and-a-half course that's already pre-measured in terms of steps. Patient can wear the pedometer, but it's really a fairly short course, and as they get fitter, and/or if they reduce their risk significantly, they can get up to level four steps. This is like on a weekend, they could do a track at least five miles. And of course the level of difficulty is not just stopped by the distance, it's also by the terrain and grade.

So I just sort of, cartooned out these prescribed pedometer track one for maybe new onset diabetic patients that might be up to a mile, a-mile-and-a-half with minimum terrain and as they get fitter, they can go into tracks that circumvent the entire community and add as many hills as you can because hills clearly add caloric expenditure.

And tracks can be quite beautiful. I mean if you've got many of your properties and the Indian communities have just absolutely perfect terrain. I am not always saying perfect weather, but I am just saying perfect terrain and I have made a little bit of a business of helping a couple of groups out in mapping out tracks throughout their community in just absolutely wonderful environment, specially, even there in the Southwest, specially around Albuquerque or Borneo counties, a number of just absolutely gorgeous places to do this.

If you prescribe a pedometer, make it look like a prescription to make it official. We use a prescription form here and the diabetes division and an internal medicine at Duke University. We put the patient's name, the therapeutic code, we actually write the pedometer type they are going to be prescribed. They get the pedometer in the pharmacy. Can you believe that? Anyway, make it official.

### ***Household Circuit Activities***

And then lastly, just a few items from other utilitarian ways to get people to exercise beyond just working out in the gym, of course, there are ways to get calories expended and workouts of course, utilitarian which I am going to speak to, recreational sports, of course, if you can measure the number of minutes and intensity, that would certainly work.

What I am getting to here is household chore circuit exercise. You are going to see this on IHS diabetes, quick guide card website soon. This is a prescription form, and what the provider or the mid-level or the RD or the CDE puts into these blocks are household chores and each chore gets increasingly more difficult until you get to the 6 o'clock position; all the way back down to maybe some easy stretching.

And there is no time between. There is 30 seconds to get to the next chore. So you get something accomplished and you get maybe a hoe circuit and a number of studies have shown up to about 350 calories expended and you get something accomplished.

We are going to have a lot detail on this on IHS website. I can give you whatever you want now, if you are interested you can email me, I can give you the instructions for this but it works quite well.

And when I am saying household chore, I am just saying household, I am also talking about yard work, gardening, repair work, and activities of daily living. A lot of things can go into that circuit form.

There are a number of studies that show the energy cost of household chore. So here is one that one of the few really that was really done very well showing that 47 calories per minute and walking, sweeping window, cleaning, vacuuming, lawn mowing, etcetera. This is quite significant over the course of an hour, hour-and-a-half, and these should be considered prescriptive exercise if you can then include that in your return visit, your progress note.

### ***Physical Activity Encounters***

Lastly, what I call PAE. Anything that takes 90 seconds or longer. So it's not ten minutes I know, but anything that takes 90 seconds or longer, can be considered a Physical Activity Encounter. Example, I won't go into all the details, walking one block, moving furniture, appliances, but you might do this throughout the day.

And what we did a few years back in the Eastern Aleutian Tribes in the Aleutian islands, what we did for the health educators out in the inhabited islands and the Aleutian islands for the Aleuts, is that over the course of a year, each provider would actually keep a document on each patient; one single page, very straightforward, and the provider and the patient could come up with what they would use as the activity measure; step counts, pedometer minutes per week, household chore circuit, or just individual physical activity encounters; whatever measure that was, and the patient would keep a score card, and on return visits about every eight weeks, that provider would actually put in visit one, two, three over the course of the year what the outcomes measure was for the step count or whatever.

It's always a numerical number, very straightforward, very simple, had very good response to this over the last – it's just been almost five years now.

And finally I would remiss if I didn't include that one form of activity called Mindful Exercise. For those patients, especially those that are non-ambulatory, maybe they are class four obese or they have orthopedic or musculoskeletal issues, there are a number of classical forms of mindful exercise modalities, certainly more contemporary forms of exercise modalities. I keep a very large research repository on therapeutic yoga, just sort of as a hobby. But I can tell you, you're not going to injure too many people with restorative forms of hatha yoga. Very easy but significant forms of movement in muscular flexibility in stripping exercise. But at this point, what I'm also including here is select ethnic and spiritual dance routines.

If we can get our patients to imbibe more than just once or twice a year, and some of the pow wows in Native American dance routines, perhaps at least on a monthly basis. Although, there has only been sketchy energy expenditure studies, I mean very sketchy, and I am hopeful that in the next several years we'll be able to actually have enough of a grant to actually power a study looking at a variety of Native American movement routines, spiritual routine, to show in fact that the energy expenditure is very significant. And I ask that you considered these also as primary forms of cardiometabolic risk reduction activities. And we have only scratched the surface here. I am not trying to be little clinically these routines in any way; I'm just saying it's something we need to also to consider.

## **Exercise Screening for High Risk Patients**

Now last slide just reminds us that there are some new guidelines set forth by the American Heart Association and the American College of Sports Medicine. Basically what they say is in this slide here, my last slide. And that is, if your patients already have diabetes on the right or very high risk for diabetes on the right and certainly have a coronary disease, and you're going -- depending on what level of exercise you're going to commit to, then this decision tree will tell you if that patient is going to need a pre-screening exercise ECG.

Now the reason behind the Electrocardiogram is, some patients have left main coronary disease and do not know it, they don't get chest pain. The only way you would ever find this is by looking at the Electrocardiogram, specifically the ST segment and how the morphology of that ECG changes with increasing workloads on the treadmill.

So it's good at finding issues that would actually motivate ultimately the patient to do exercise even more, but maybe under certain restrictions, certain heart rate restrictions. So those patients that are at moderate risk, depending on the number of risk factors, they are going to do moderate exercise. Exercise Stress Test with EKG is not necessary, like are doing 60% or greater. It would be necessary. However, those at high risk already have disease it's even recommended with moderate exercise. However, I know that's kind of a hedge point. Not everybody is going to get that, but certainly with vigorous exercise.

Okay, this will be in detail on the IHS Diabetes Quick Guide Card website that you will see come to maturity in the next few months. This is the website for the quick guide cards right now, the only one that's up and running is the anthropometry, how to use a Gulick for waist circumference and some good information on skinfold testing as I mentioned earlier. But you're going to see a lot more under physical activity over the next few months. So I am going to close with this slide, because it is a very important reference.

I guess I say that. I'm going to close with this slide in saying that, for any of you that don't have time to ask questions, or want more detail, you are welcome to email me at this email address. Again here in North Carolina I'll be glad to send you anything you need. With that, thank you again.