Now you've seen statistics all over, from everybody and it's wonderful that 65% of the cancer survivors and now we see that demographic over and over and over again, they are living longer than 5 years and ends the statistics of 2007. There is truly an age demographic to this where cancer survivors almost 60% of them are 65 or older and runs into the 30s for 40 to 64, the 4.5 20 to 39 and then the pediatric and adolescent cancer survivors.

And so their physical status as they present to us is a confluence of many different things. There are health and social issues, you have to look at their functional capacity, impairments that they have coming to you at that time of diagnosis, education, what will they understand? And some of that can be cultural as well. And then we do need to think about a whole myriad of comorbid conditions. Now what we heard first thing this morning too you know there may be some actual psychological issues at that point too, not just as perhaps sometimes even myself would more think of only on the physical perspective.

So we have all these different people that come to us, what about this 13 year old student who is a soccer athlete and he is diagnosed with lymphoma? We have our 23 year old student who is first diagnosed with breast cancer, we could have a 32 year old teacher with colorectal cancer, a 55 year old lawyer diagnosed with prostate cancer or our 65 year old interior designer who was diagnosed with ovarian cancer. Each one of these persons has their unique profile because of where they are in life and needs for function. And when we think about it I don't want to consider this return to work issue, we are not going to - I'm not going to spend a lot of time on about talking at all, but I think about that all the time. And you know we had an excellent talk about long term issues. For our 13
year old what does that 13 year old looking at what his reserve might be in 10 years, or what if he -
when he's playing soccer he has a concussion, what impact could in that particular example could his
prior cancer treatment affect now having a totally different second diagnosis which we need to
maybe think about.

Okay, so this is just reiterating some of the excellent presentations we've had before, but with a
diagnosis of cancer there is the specific pathophysiology of cancer, the whole myriad of things that
we've heard over and over with cancer treatment. There is that sleep dysregulation, fatigue, pain,
comorbid disease again and cancer - I mean exercise intolerance, there could be a decreased capacity
in their oxygen cascade and just overall deconditioning issues. And certainly we as physical
therapists we need to get better at really backtracking even if they do come and see you 15 years
later and it is just in their medical history, we need to know what type of cancer they had, what stage
they were when they were diagnosed, and where it was. And there is just a couple of examples here
that because these can have very different issues whether and we know that colon, lung and
pancreatic cancer the diagnosis can really be ravaging on those particular systems.

Okay, and again cancer treatment, we need to be really thinking long and hard about the surgery,
what happens, the extent if there was a resection, radiotherapy can have tremendous secondary
problems as far as physical capacity is concerned. You know it could be lung damage, it could be
shortness of breath issues that really I'm going to need to be thinking about as well as reacting.
Chemotherapy there of course has been mentioned again and again because of the cardiotoxicity and
then of course there is a whole range of presentations for decreased sensation. And we'll talk a little
bit more and there are certain drugs that are just very well known that really cause this particular problem. So this is how I tend to look at this. You have an individual and where they are, and that person gets the diagnosis. And then there is treatment and then they are into survivorship.

Okay, so who makes the first move to refer? And when are referrals typically made? And in many instances I think the first move to make the referral is probably the people in this room, the people who identify that and see that there are issues. And when referrals are made most literature right now and you do have some references I will always look at it as perhaps during treatment, at the end of treatment when there may starting to be some significant problems or sometimes as post-treatment and not by the oncologist.

And as Dr. McMichael had mentioned there is starting to be a surveillance prospective model for treatment. And the goal is to reduce or prevent any functional decline or impairment at all stages of the disease management. It is so important that a referral be made at the time of diagnosis so that you absolutely can capture baseline information, what their physical performance has been and if there tends to be any particular issues that's the time to start addressing them, not when there is added complications because of the cancer related treatment. And that is also the most prolific time for as physical therapy to start doing education about what exercises they can continue to do and thinking in terms of lifelong health and wellness perspective because they are going to be in treatment perhaps at very different times but you will have that information continuum if they actually are getting into the surveillance prospective model. And as has been pointed out the two areas where this has been most successful is in breast cancer because of upper extremity range of
motion improvement and capturing a decrease in lymph edema because that leads to as we know it can be significant problem and pain.

Okay, so what we really to be looking at is our exercise prescription which is based on that particular individual. We want to look at their endurance or aerobic capacity. We do want to see what they are doing with their walking and balance, what their mobility is, what their range is. Strength is huge, it's a huge issue and again just like us all you want to work on your posture and grip strength surprisingly has a tremendous correlation to overall physical performance. And so it's an easy measure that you can repeat several times throughout the entire process. And this - there is one that was put out in 2010 by Schmitz et al from the American College of Sports Medicine believe it or not, they gave exercise guide - specific exercise guidelines for cancer survivors. So there is - and their particular recommendations in 2010 had looked at during treatment as well as after treatment and how to prevent, so there is one particular reference out there for that.

And as also Dr. Miller just pointed out too about the transition period when they are going from active treatment into their long term survivorship. The importance there is that we again we could monitor what their status is, we could look at taking care of ameliorating some things, we are not going to eliminate everything as was also presented by Dr. McMichael, but we are going to minimize or ameliorate their disability. And physical therapy can be very important in decreasing any fragmentation of their functional performance, so that their care post treatment actually can be the most optimal and after discharge we can give very good specific information about what they need for their ongoing exercise as they will go to community and wellness, whether it involves tai
chi, yoga, gym, going to a gym, all of those things, or therapeutic aquatics or going to a pool. All of those can be extremely important post formal exercise that they continue.

Okay, so I'm going to talk about specifically three models of physical therapy intervention. Fatigue, you've heard of this over and over and over again, that is the most overwhelming experience that these cancer survivors face. And pain, nonpharmacologic intervention for pain, hm I think that actually should have been part of the first presentation to be quite honest with you because we all know that pain can have a negative effect on depression, right. Well physical performance can not only help mood but it can actually have real positive impact on pain and balance.

Okay, so cancer related fatigue is - has been defined as a persistent objective sense of tiredness related to cancer or cancer treatment that interferes with their usual function. And the National Comprehensive Cancer Network identifies 7 specific features with cancer related fatigue. There is pain, emotional distress, sleep disturbance, anemia, poor nutrition, deconditioning or the presence of other comorbidities, all of those contributing to the cancer related fatigue. It is complex, it is multifactorial and it oftentimes in at least 80% of the cancer patients it is the most common complaint. Truly it has been not mapped out specifically what the pathophysiology is, okay, but some of the proposed pathways are literally proinflammatory cytokines, circadian dysregulation or hypothalamus, pituitary, adrenal access dysregulation. And that, that particular HPA access in all of us really has far-reaching regulations for how we feel, our mood, our appetite and so to me what kind of jumps out at me is that hm, that hypothalamus, all right it's involved in that access, what about the circadian dysregulation, hypothalamus reticular activating system? So there is something
really relevant going on there that I need to think about, that we need to be thinking about as having a literal pathology implication.

So for the types of exercise that have been found to have a positive impact on cancer related fatigue it actually runs a spectrum of aerobic training, interval training and resistance training. And I listed several studies but all of these studies that you have the references and the data too all have demonstrated a significant reduction in cancer related fatigue in a structured program and eventually getting them to that second step out into the community.

In December of 2013 at the San Antonio Breast Cancer Symposium research was presented by Dr. Courneya and he is from the University of Alberta, and at his facility they took 300 individuals that were receiving ongoing chemotherapy for their breast cancer and they developed a 3 arm research paradigm and in each arm they had 300 individuals. And the 3 groups were divided into 30 minutes of doing aerobic exercise 3 times a week, a second arm did 30 minutes of aerobic exercise 3 times a week plus 30 minutes of resistance training, strength training and a third group just did 60 minutes of aerobic exercise 3 times a week. All three treatment groups reported decreased fatigue, decreased pain and decreased endocrine systems like the night sweats, those kind of things.

The groups with the aerobic and resistance and 60 minutes aerobic training they actually reported the greatest change in pain and endocrine systems. But the 60 minute group reported the most significant decrease in their cancer related fatigue. So I think partially the take home message for this which is very exciting is that all of the groups improved, so that depending on the level of what
someone could actually tolerate there was an action but we for - these were not sorted out by you know differences, so something more aggressive actually had doing the 60 minutes of aerobic training actually had the most significant. So sometimes what I need to take home as a therapist, sometimes we need to push them a little bit more and monitor them of course. But I thought that was very exciting.

So as far as cancer related fatigue is concerned exercise programs can definitely be designed, and they have been shown at the very least that they are safe, which I know sometimes has been a question. But they are safe and effective for all cancer survivors. Although this was a breast cancer program, and it does seem that a significant proportion needs to address an aerobic component for the cancer related fatigue.

All right, cancer pain. All right, so Dr. Zhao and his colleagues reported at the 2012 Annual Meeting of the Association of Supportive Care in Cancer that pain is highly prevalent and persistent and dynamic in patients who have cancer. Baseline pain severity is an indicator of how complex it's going to be for all of the healthcare providers to manage the individuals. And as our patients evolve they may have acute response with pain and chronic response with cancer pain, and therefore it can be immediately postsurgical, it could be you know the radiation fibrosis that Dr. McMichael talked about, it could be related to the specific problems with chemotherapy and if they started out with some issues with pain whether it's back pain or arthritis, those could - those only add to the complexity of what we are doing.
All right, so with some of these areas that definitely have some really positive research is in the area of lymph edema, managing lymph edema and managing it early can have a significant impact on pain as well as maintaining a range of motion. Oh, head and neck cancers, we saw some you know pictures this morning and that's why we really need to actually work first on preventing the head and neck pain from head and neck cancer survivors, and working on cervical shoulder strength and range of motion and there is information that if approached and treated early that you - we can have the - physical therapy could have a real positive impact on decreasing head and neck cancer pain with their treatment.

All right, so here is something that we really haven't talked about yet it's the aromatase inhibitors and it is a usual adjuvant treatment for post-curative resection of hormone receptive positive breast cancer if the person is postmenopausal. And it can - patients are now being asked to continue on their AI for up to 10 years. But the interesting thing about AI is with so many of the other chemo treatments or adjuvant treatment it can be - there can be some cardiovascular issues, there can be weight gain, there can be mood changes and long term, now we are looking at people who are postmenopausal, it can be osteoporosis, that can be huge. They can have hot flashes, oh great, and significant for me and I've seen it and I'm sure all of you have in one way or another is the musculoskeletal arthralgia syndrome, that is one of the most prevalent reasons why they will stop taking their AI therapy whether it's counterproductive for them or not because it hurts.

So it can actually start, the syndrome can actually start 2 to 3 months after taking AI, and 50% of the individuals who do take AI by the report they will actually have a reduction in pain in the first 6
months. And it feels like they have pain and stiffness and achy and they will tell you that they have swelling in their joints and you may say well they can't see that, but their perception, they feel it. And it can happen anywhere. It can happen in the wrist, in the hand, back, hip, knee, ankle or all of it.

So this to me was actually such a positive thing to find, again from the 2013 San Antonio Breast Cancer Symposium, the Yale Cancer Center presented an AI study called HOPE, HOPE Program, Hormone and Physical Exercise Program. And They took 121 women who were currently taking AI after their breast cancer and they were - these 121 women were all experiencing the arthralgia syndrome, okay. And they were randomized into two groups, education regarding the importance of exercise and a supervised exercise program, okay. And both of them completed - well group 2 actually completed a 2 times a week program for 12 months, which is significant, with 80% of those participants, half of the group, going to completion. And at the conclusion of the 12 months the second group had made significant decrease in their arthralgia and joint pain and weight loss and improved aerobic capacity. I guess that shouldn't surprise any of us right? But that is to me that's incredibly striking. Instead of just saying to these people that are having AI you know well you know you need to keep taking it, we need to give them a physical performance evaluation and followthrough. And I need to make sure that you know they are continuing their exercise program because it's significant.

So as far as cancer pain is concerned exercise programs can have a very positive impact at all of those points, whether it's a postsurgical reason, whether it's now triggered into a myofascial problem,
whether it has to do with skeletal or muscle pain, myalgia, joint pain, the arthralgia and our women's health therapists you know really deal very well with pelvic pain and lymph edema. And so in all of these this should trigger for all of us a thinking that if any of these are even beginning to present that we need to get them to therapy so that we can address this as soon as possible.

Okay, now balance, people usually think about this I think when there is trips or falls, okay. But this is where having baseline balance information even prior to them starting the treatment provides very important information regarding what their status is and then I can have much more of an impact if there are several deficits beginning to occur. And it provides - looking at that baseline information provides a mechanism for early intervention throughout that entire cancer treatment. And of course I can begin facilitating training to prevent decline and it's - remember now we are thinking there are some osteoporosis issues here on top of just being a cancer survivor, there is a risk for falls and unfortunately fractures could occur.

All right, so some of the adverse effects of you know treatment are all of the cancer related fatigue, cardiorespiratory toxicity, myopathies, sarcopenia, cachexia, myelosuppression, their bone health and pain, but in all of these I want us to start thinking about what becomes the component of their problem for balance. Each one of these whether it's cardiorespiratory toxicity could have a tremendous impact upon so what's the component that's leading to balance problems even in these particular seeming disparate symptoms or presentations?
So we all know about the neurotoxic effect of the chemo-induced peripheral neuropathy, and chemo-induced peripheral neuropathy can affect sensory, motor, autonomic and it can cause a vestibulopathy. I don’t know if you think about this much but the 8th cranial nerve is a peripheral nerve so it actually you know is something new to start thinking about our little cranial nerves as well.

Now as far as postural control concerns Taxane has definitely been demonstrated to decrease postural control in 30 to 60 year old age group, so think about that. If we've got a 40 year old person who is already because of the Taxane and Dr. Miller said this repeatedly once something is given it cannot be erased. So we have to think about what is the reserve perhaps in the Taxane treated population, even if it's not immediate. And chemo-induced peripheral neuropathy is dose dependent and it is cumulative and the sensory nerves are affected more than the motor nerves, more than the autonomic nerves. And why is that? Because the long fiber sensory nerves have the least amount of myelin, have the least amount of covering. They can be affected the most and most significantly. And all of these can cause demyelinization, axonopathies and they can differ. Chemos are going to affect each one of these on the dorsal root ganglia and each of them are going to affect different ones, and we need to be thinking about the affect and we'll go over that in a little bit.

So different areas of the nerve as I was mentioning are dependent on neurotoxic drugs. The peripheral polyneuropathy, those are some of the drugs that actually have the persistent peripheral polyneuropathy. And actually this is the one where the long axons are damaged. The patient's perception of the decrease in sensation is the worst while they are on the drug and when the drug
starts - the treatment, the chemotherapy is ending approximately 80% of them will get better. Actually usually that happens about 6 months. There are 20% then, that means that they have a significant neuropathy afterwards. That's still a lot as far as I'm concerned. But even a little bit of neuropathy that persists over time can be causing a particular you know - particular problems later.

The ones that affect the dorsal root ganglia, okay, that is neuropathy that is slowly acquired throughout that dose dependent treatment. Sensory loss is usually experienced after treatment cessation, and a particular cancer individual may not report the sensory loss until 6 months or even a year after and this is what's called the costing effect and it's something that you know I'm looking out for when I now have a patient that a year, 18 months later they are filling out their health history when the cancer is checked and I'm asking what did you have? Was it surgery, chemotherapy, radiation? They tell me chemotherapy and patients can often get very close to their drug's names, it may not be completely correct but if I'm realizing it's one of the drugs that can cause costing effect I am much more in tune to following up because I know that unfortunately it can persist even longer over time.

And again here is our vestibular toxicity. Cisplatinum is definitely known to be ototoxic even in humans. But the studies that have been done thus far looked only at the cochlear toxicity, but in the rat model it definitely a dose dependent toxicity occurred both to the cochlear and the vestibular system and I think that as more studies are actually done in humans we're going to find that this is part of the reason somebody might be telling you not only do they have balance problems but they might be telling you they have dizziness as well as a pathophysiology related to the chemo.
So the presentation is numbness, tingling, they can have that neuropathic pain, they can have a change in thermal sensitivity, it can be either hot or cold, it be the extremes of both, they don't like it too cold and they don't like it too hot. They can have decreased deep tendon reflexes and definitely you can have muscle weakness with all of this. And some of that can be you know a motor component to the peripheral neuropathy.

So again what is the best intervention? Early screening, you know identify their status and impairment. And in physical therapy we use a self report called the Activity Specific Balance Confidence Scale. And it's something that is easy to repeat and lets me know what the individual thinks about their participation model and right then and there even at the screening time if there are impairments present we can start initiating training and education right at that time. And as far as balance is concerned we tend to look at three types of balance. We look at it as static, transitional and dynamic balance where is the problem? If it's when they are not moving that's a - it could be you know doing Romberg, tandem Romberg, single leg stance. Transitional balance when they go from not moving to moving that could be issues with stairs, just even standing up from a chair aside from things like orthostatic hypotension. And dynamic, we want to know walking, can they multitask, can they look around their environment, can they do turns, can they do lateral moves, can they do backwards, all of those things.

And during treatment we can monitor any new symptoms, and again we can repeat our Activity Specific Balance Confidence Scale and we can go right back to looking at those three particular
types and continue to emphasize the importance of exercise. And after treatment again we can follow-up on all of those areas and perhaps they had no problems whatsoever from transitional balance before and it's becoming a problem. And with the right candidate we educate them regarding yes, these symptoms are emerging and this is as a result of what, whether it's the dorsal root ganglion toxic drugs or whatever. And again with this group we want to keep them knowing why they need to keep doing their exercises and then we are emphasizing community and wellness programs for them.

So evidence for physical therapy along the entire spectrum from diagnosis to posttreatment is there okay, and a rehabilitation approach which also Dr. McMichael talked about really addresses the diverse and changing needs of all of our individuals with cancer. And the healthcare team certainly we've got the oncologist, the primary care physician, the physiatrist, our physicians assistants, and very importantly our nurses but in PT there is such a diversity that we can actually look at what that particular individual needs. Is our soccer player somebody that we need to send back to the Sports and Orthopedic person because that's the trouble that they are having on top of their cancer, they need that addressed. We certainly do neurology, women's and men's health. We have vestibular therapy, we have occupational therapy, very important as well, and speech and language pathology. We really need to be thinking and coalescing a individual team for our person, so that person who are over the time span are dealing with this will be able to say at this point now I need to return back to the occupational therapist, I have work related issues which are different than where I started from. Or I have my school related issues. What resources do we need to marshall at that particular time?
and you know as Dr. Von London told you, I work for the UPMC Centers for Rehab Services and we do have - and I'm from outpatient but we do have diverse services and we do have wonderful home health as well. So we really can be thinking along the terms from acute right straight through outpatient home health, whatever the individual needs. And I do have information at that back table on where we have sites. We have information on women's and men's health team and the neuro team. And here we go. Yeah, yeah, now seriously what can we do to improve our health? I'm thinking there should be a number 10 even on there, yeah. It's exercise, exercise, exercise. And it really is important for all of us.