

Physical Activity Guidelines Advisory Committee Meeting 3

Sponsored by the U.S. Department of Health and Human Services (HHS)

March 23, 2017

Meeting Attendees

Physical Activity Guidelines Advisory Committee: Abby King, PhD (Co-Chair); Ken Powell, MD, MPH, FACSM (Co-Chair); David Buchner, MD, MPH, FACSM; Wayne Campbell, PhD; Loretta DiPietro, PhD, MPH, FACSM; Kirk Erickson, PhD; Charles Hillman, PhD; John Jakicic, PhD; Kathleen Janz, EdD, FACSM; Peter Katzmarzyk, PhD; William Kraus, MD, FACSM; Richard Macko, MD; David Marquez, PhD, FACSM; Anne McTiernan, MD, PhD, FACSM; Russell Pate, PhD, FACSM; Linda Pescatello, PhD, FACSM; and Melicia Whitt-Glover, PhD, FACSM

Co-Executive Secretaries: Richard Olson, MD, MPH; Katrina Piercy, PhD, RD, ACSM-CEP; Janet Fulton, PhD, FACSM; Deb Galuska, PhD; Rachel Ballard, MD, MPH; Richard Troiano, PhD

Federal Staff: Holly McPeak, MS; Alison Vaux-Bjerke, MPH; Sarah Prowitt, MPH; Emily Bhutiani, MS; and Stephanie George, PhD, MPH, MA

Invited Speaker: Bill Haskell, PhD (joined via conference call)

Meeting 3 Summary

Thursday, March 23rd, 2017

(8:00am)

Call to Order, Roll Call, and Opening Remarks

Dr. Olson, Designated Federal Officer, Office of Disease Prevention and Health Promotion (ODPHP), U.S. Department of Health and Human Services (HHS), welcomed the Committee members as he called to order the third public meeting of the 2018 Physical Activity Guidelines Advisory Committee. He reminded the public that the nine subcommittees have been meeting weekly or bi-weekly since the last public meeting in October 2016, to accomplish their work. He also reviewed the agenda for the day's proceedings.

Introduction of Subcommittee Presentations

Dr. King and Dr. Powell, Co-Chairs of the Committee, began with a reminder of the importance of examining physical activity in the public health context. Dr. Powell reviewed the content discussed and decisions reached at previous public meetings of the Committee. He noted the Committee would view presentations on each subcommittee's first systematic literature search, prioritize subsequent systematic review questions, and discuss issues affecting more than one subcommittee during this public meeting. Dr. Powell stressed that all work of the subcommittees is currently in draft form and that conclusions and evidence grades will not be considered final until after the full Committee reviews and discusses each question. Dr. Powell reviewed the rubric the Committee agreed upon for grading the evidence they are examining and closed by reminding the Committee and public of future public meetings in July and October 2017.

Subcommittee Presentations

The subcommittee chairs presented a progress update of their subcommittees' work since the previous public meeting in October, including draft conclusions and evidence grades for the first questions. Following each presentation, the Committee members asked questions and discussed the work of each subcommittee.

Subcommittee Presentations

SC 5 Exposure. Dr. Kraus presented the results of the Exposure Subcommittee's first systematic literature search of systematic reviews and meta-analyses. This search addressed the following two questions:

1. What is the relationship between physical activity and all-cause mortality?
2. What is the relationship between physical activity and cardiovascular disease mortality?

Dr. Kraus reviewed the definition of dose which "can be measured in terms of a single component of activity (e.g. frequency, intensity, duration) or as the total amount." He presented graphs from the subcommittee's findings that demonstrated the relationship between dose-response and all-cause mortality. He also reported that the findings indicate there is not a lower or upper threshold amount of physical activity to attain health benefits.

The Exposure Subcommittee presented the following draft conclusions:

1. There is a strong dose-response inverse relationship between amount of moderate-vigorous physical activity (MVPA) and both all-cause and cardiovascular mortality.
2. The shape of the curve is nonlinear with the greatest benefit seen early in the dose-response relation.
3. There is no lower limit for the relation of MVPA and risk reduction. Risk appears to continue to decrease with increased exposure up to 3-5 times the current recommended levels of MVPA.
4. New data are consistent with those used to develop the 2008 Physical Activity Guidelines.
5. The effects appear to apply to all races and ethnicities, both men and women, and throughout adult life.

The Exposure Subcommittee assigned a draft evidence grade for its first two questions as 'strong.'

During the Committee discussion, Dr. McTiernan inquired whether the studies included were conducted recently as the U.S. population has become more sedentary. In response, Dr. Kraus noted that most of the systematic reviews and meta-analyses included were from recent years and, as such, likely capture changes in baseline behavior of the U.S. population; however, he intends to re-visit the literature to verify. Dr. Pate commented that since most of the studies relied on self-report data, the dose-response curve may be different from what would be found using objectively collected measures. He questioned whether this difference was addressed in the literature. Dr. Kraus responded by stating that while this is something he can re-visit in the captured literature, self-report may actually provide a better picture of dose-response in the U.S. population since it is not currently standard practice to use accelerometers to capture physical activity data. Additionally, Dr. Kraus noted that while most of the data utilized to generate the dose-response curves were self-report, the data are consistent. Finally, following an

inquiry by Dr. Whitt-Glover on types of physical activity captured in the studies, Dr. Kraus clarified that the doses presented in the graphs represent ‘leisure-time physical activity’ and therefore do not accurately account for other types of physical activity such as occupational physical activity or walking for transportation.

SC 2 Brain Health. Dr. Erickson presented the results for the Brain Health Subcommittee’s first systematic literature search of systematic reviews and meta-analyses. This search addressed the following question:

1. What is the relationship between physical activity and cognition?

Dr. Erickson reported that the subcommittee reviewed studies that included different modes of physical activity – walking and or resistance training for adults, and playtime for children. Results show that mode of physical activity appears to be an important factor when examining the effects of physical activity on brain health following acute bouts of exercise. Dr. Erickson mentioned that both randomized controlled trials (RCTs) and prospective observational studies were included in the meta-analyses.

The Brain Health Subcommittee presented the following draft conclusions:

1. There is a significant body of research on the effects of physical activity on cognition and brain outcomes.
2. This research spreads across many different cognitive disorders, which demands different types of interventions and different outcomes (e.g., academic achievement to dementia diagnoses).
3. The subcommittee is working from a ‘bottom-up’ perspective by first examining the evidence in each category and then will make a summary statement across populations.
4. Physical activity appears to have a consistent positive effect on cognitive function across the lifespan and levels of impairment.
5. There is evidence for some effect moderators such as dose (duration, intensity) and sex; however, there is little evidence for socioeconomic status (SES) or race/ethnicity effects.

The Brain Health Subcommittee has not yet assigned an evidence grade for its first question.

During the Committee discussion, Dr. Kraus inquired about the timing of cognitive measures with respect to the administered bout of exercise, as well as the translation of acute effects of exercise on brain function into chronic effects. In response, Dr. Erickson noted that the specific timing of cognitive measures (e.g., during exercise, 30 minutes after exercise, hours after exercise, etc.) varies between studies and does influence the observed effect. Dr. Erickson also commented that more research is needed to determine when acute effects of physical activity evolve into chronic effects and the sustainability of effects during a follow-up period. Dr. Hillman added that within the acute effects literature, the effect appears to last about one hour following an acute bout of exercise. The strength and duration of the effect differ depending on type of activity as well as cognitive domain assessed. Dr. Pate inquired about the specificity of the conclusions that the Brain Health Subcommittee will be able to make regarding specific cognitive domains. Dr. Erickson responded that while he is confident about making a broad qualitative statement about this topic, effects on specific cognitive domains will have to be addressed individually, noting gaps in the literature, particularly with respect to age group differences. Finally, in response to Dr. McTiernan’s question regarding control for social contact, Dr. Erickson noted that most RCTs utilize an active control group (e.g., education or stretching) to control for social contact.

SC 8 Sedentary Behavior. Dr. Katzmarzyk presented the results of the Sedentary Behavior Subcommittee's first systematic literature searches of a combination of systematic reviews and meta-analyses, as well as recent original research articles. This search addressed the following three questions:

1. What is the relationship between sedentary behavior and all-cause mortality?
2. What is the relationship between sedentary behavior and mortality from cardiovascular disease?
3. What is the relationship between sedentary behavior and mortality from cancer?

Dr. Katzmarzyk presented the subcommittee's operationalized definition of sedentary behavior: "any waking behavior characterized by an energy expenditure ≤ 1.5 METs while in a sitting or reclining posture." He reported that most of the included studies measured sedentary behaviors via self-report. Almost all studies reviewed showed a stronger association between sedentary behavior and all-cause mortality among individuals with low levels of physical activity than those with higher levels of physical activity. He stated that a similar relationship exists for both cardiovascular disease mortality and cancer-related mortality. Additionally, Dr. Katzmarzyk noted that there is evidence that high levels of physical activity have the potential to offset the effects of sedentary behavior. Specifically, the effects of sedentary behavior appear to be attenuated with 60-75 minutes/day of moderate intensity physical activity according to one meta-analysis of self-reported data.

The Sedentary Behavior Subcommittee reached the following draft conclusions and assigned conclusion-specific draft evidence grades for its first question:

1. Strong evidence demonstrates a significant relationship between greater time spent in sedentary behavior and higher all-cause mortality rates. Draft evidence grade: 'strong'.
2. Strong evidence demonstrates the existence of direct, curvilinear dose-response relationship between sedentary behavior and all-cause mortality with an increasing slope at higher levels of sedentary behavior. Draft evidence grade: 'strong'.
3. Limited evidence suggests that the relationship between sedentary behavior and all-cause mortality does not vary by age, sex or ethnicity. Draft evidence grade: 'limited'.
4. There is insufficient evidence available to determine if the relationship between sedentary behavior and all-cause mortality varies by socio-economic status. Draft evidence grade: 'grade not assignable'.
5. Strong evidence demonstrates that the relationship between sedentary behavior and all-cause mortality varies by levels of MVPA. Draft evidence grade: 'strong'.
6. There is insufficient evidence available that bouts or breaks in sedentary behavior are important factors in the relationship between sedentary behavior and all-cause mortality. Draft evidence grade: 'grade not assignable'.

During the Committee discussion, Dr. DiPietro and Dr. King asked for clarification of the difference between TV viewing and sitting related to mortality outcomes. In response, Dr. Katzmarzyk noted while it is difficult to consistently compare across studies, TV viewing appears to have a stronger association with all-cause mortality than sitting. He noted that this strong association may be due to better recall of TV viewing compared to general sitting and/or behaviors associated with TV such as eating. Dr. Katzmarzyk also commented that the observed relationship between sedentary behavior and mortality outcomes hold true when body mass index (BMI) and chronic disease status are controlled for. He also

clarified that studies included in the first literature search measured daily sedentary behavior time and no studies reported accumulated sedentary behavior time beyond weekly sitting. Dr. Katzmarzyk also noted that while the current evidence is convincing that excessive sitting is associated with all-cause mortality, the literature will likely not allow the subcommittee to quantitatively define 'excessive sitting.' Finally, in response to Dr. Powell's inquiry regarding underlying mechanisms explaining the observed effects, Dr. Katzmarzyk noted that future research should explore the physiological mechanisms that describe the relationship between sedentary behavior and mortality.

SC 9 Youth. Dr. Pate started his presentation noting the timeliness and pertinence of addressing the topic of physical activity in children younger than six years of age. He then presented an update of the Youth Subcommittee's systematic literature review of original research for the following question:

1. In children younger than six years of age, what is the relationship between physical activity and health outcomes?

While presenting the analytical framework for the first literature search of systematic reviews and meta-analyses, Dr. Pate noted that no studies from this initial search met inclusion criteria. As such, the subcommittee decided to undertake a review of the primary research literature, and information extraction from the articles identified for inclusion is currently underway. Dr. Pate noted that the subcommittee is currently reviewing the literature on cardiorespiratory fitness, metabolic health outcomes, and body weight. He presented a preliminary summary of the subcommittee's review of the effect of physical activity on bone health in early childhood.

The Youth Subcommittee presented the following draft conclusions:

1. Higher levels of physical activity are associated with better bone-related outcomes in children under 6 in studies that examine overall physical activity as well as specific physical activity exposure (e.g., gymnastics).
2. No conclusion regarding a specific dose-relationship can currently be reached.

The Youth Subcommittee has not yet assigned an evidence grade for these conclusions for its first question.

The Youth Subcommittee also shared its plan to approach its second question, including the analytical framework and inclusion/exclusion criteria.

2. What is the relationship between physical activity and health outcomes in youth?

During the Committee discussion, Dr. Macko inquired if the Youth Subcommittee will examine how socioeconomic and psychosocial factors influence the effects observed in this age group. Dr. Pate responded that the subcommittee intends to examine the literature for these issues. Additionally, in response to Dr. Erickson's question regarding the impact of siblings on the relationship between physical activity and health outcomes in youth, Dr. Pate noted that he is not aware of literature that examines this topic specifically. In response to inquiries regarding brain health outcomes in youth, Dr. Hillman reminded the Committee that the Brain Health Subcommittee will examine this topic area. Finally, Dr. Pate clarified that the Youth Subcommittee's second question will include the entire 'youth' age range of 0-17 years of age in an effort to examine all developmental stages of youth without specific age cut-points.

Break

SC 7 Promotion of Physical Activity. Dr. King presented the results of the Promotion of Physical Activity Subcommittee's first systematic literature search of systematic reviews and meta-analyses. This search addressed the following questions:

1. What types of physical activity interventions are effective for physical activity change at different levels of impact? (levels include: individual, built/neighborhood environment; community settings; policy and legislative; information technology)
2. What interventions are effective for reducing sedentary behavior?

Dr. King reported that the subcommittee is reviewing studies published since 2011 rather than 2000, as previously planned, given the large amount of scientific literature in this area. The subcommittee will review findings from systematic reviews that include changes in levels of physical activity as well as maintenance of physical activity behaviors. Dr. King noted that the subcommittee intends to evaluate the effect of neighborhood/built environment interventions on physical activity using a soon to be released systematic review from the Community Guide (CDC) on this topic.

The Promotion of Physical Activity Subcommittee has not drafted conclusions or assigned evidence grades for its first two questions.

During the Committee discussion, Dr. DiPietro and Dr. Macko inquired about the inclusion of specific types of studies (e.g., larger scale 'natural' interventions or insurance-driven interventions). Dr. King noted that she hopes the literature will capture these and, if not, they may have to do an additional search to ensure such articles are included. Dr. King also noted that although the literature captures articles from various countries, there does not appear to be noticeable country differences in terms of interventions; however, the subcommittee intends to examine this potential differentiating factor. In response to a question from Dr. Powell, Dr. King clarified that articles measured physical activity either as a continuous variable (e.g., minutes of physical activity) or as a dichotomous variable (e.g., meeting vs. not meeting the current Guidelines). Finally, following an inquiry by Dr. Pescatello, Dr. King explained that since the cost-effectiveness of interventions is an area of interest to the research community as well as the public, the subcommittee will extract this information from articles when available and examine the evidence accordingly.

SC 4 Cardiometabolic Health and Weight Management. Dr. Jakicic presented the process of the Cardiometabolic Health and Weight Management Subcommittee's first systematic literature review search of original research. This search addressed the following question:

1. What is the relationship between physical activity and the prevention of weight gain?

Dr. Jakicic stated that the subcommittee's first question required a systematic review of original research given that the literature search for systematic reviews and meta-analyses resulted in none which fully addressed its question. Dr. Jakicic reported that the majority of scientific literature the subcommittee reviewed shows a positive association between higher levels of physical activity and prevention or attenuation of weight gain. The subcommittee intends to examine the studies which did not show a relationship to determine any unique characteristics that might lead to this lack of association.

The Cardiometabolic Health and Weight Management Subcommittee presented the following draft conclusions and conclusion-specific draft evidence grades for its first question:

1. Engagement in greater amounts of physical activity is associated with prevention or minimizing weight gain. Draft evidence grade: in the range of moderate to strong.
2. Engagement in lower amounts of sedentary behavior may be associated with prevention or less weight gain or lower body weight. Draft evidence grade: 'limited'

During the Committee discussion, Dr. Kraus noted the limitation of self-report epidemiological literature with regard to energy balance. Dr. Jakicic responded that while self-reported physical activity does not allow the subcommittee to answer questions regarding energy expenditure objectively, it does capture how people behave in a free-living environment and thus proves very useful in addressing the subcommittee's first question. Dr. Macko commented on the list of prioritized questions and asked whether dyslipidemia would be addressed. In response, Dr. Jakicic stated that there have not been substantial gains or changes in the physical activity-dyslipidemia literature and, as such, it is a lower priority question.

SC 1 Aging. Dr. DiPietro presented the Aging Subcommittee's first systematic literature search of systematic reviews and meta-analyses. This search addressed the following question:

1. What is the relationship between physical activity and risk of injury due to a fall?

The Aging Subcommittee reviewed two main types of studies: interventions specifically designed to prevent falls and studies designed to examine the relationship between physical activity and risk of injury from falls. She indicated the findings show a strong and consistent risk reduction with higher levels of physical activity. She also emphasized the importance of multi-component exercise programs in reducing risk of injury due to fall.

The Aging Subcommittee presented the following draft conclusion:

1. Participation in multicomponent group or home-based fall prevention physical activity and exercise programs can reduce the risk of injury from falls, including severe falls, those requiring medical care, and fractures among community-dwelling older adults.

The Aging Subcommittee assigned a draft evidence grade for this conclusion as 'strong.'

During the Committee discussion, Dr. DiPietro reported that the Aging Subcommittee will next focus on determining the amount and type of physical activity needed to achieve the greatest benefit in terms of reduction of fall risk and risk of injury due to a fall. Dr. Kraus inquired about an estimated impact on reduced health-care costs associated with preventing injury due to fall. Dr. Campbell, a member of the Aging Subcommittee, confirmed that unfortunately this outcome is not captured in the systematic reviews and meta-analyses. Drs. Campbell and DiPietro also clarified that while the multi-component physical activity programs are the exposure measured in RCTs, epidemiologic studies tend to measure general physical activity. In response to a question from Dr. Katzmartyk, Dr. DiPietro noted that the literature regarding the potential for physical activity to reduce risk of injury due to fall is insufficient to determine the mechanism by which injury prevention occurs (e.g., improved balance reducing incidence of falls or improved bone strength reducing injury if an individual does fall).

Lunch Break

SC 3 Cancer-Primary Prevention. Dr. McTiernan presented the Cancer-Primary Prevention Subcommittee's first systematic literature search of systematic reviews and meta-analyses. This search addressed the following question:

1. What is the relationship between physical activity and cancer incidence?

Dr. McTiernan reported that the subcommittee started by examining breast and colorectal cancer incidence, but will also examine 16 other cancer types. Dr. McTiernan reported that the evidence reviewed showed increased levels of physical activity reduced the risk of both breast and colorectal cancer.

The Cancer-Primary Prevention Subcommittee presented the following draft conclusions for breast cancer:

1. There is strong and consistent evidence from over 65 studies conducted worldwide that physical activity reduces breast cancer risk by 10-20% when comparing the most to least physically active.
2. There is also evidence for a clear dose-response effect that is linear to about 20-30 MET-hours/week of MVPA, particularly among post-menopausal women.

The subcommittee presented the following draft conclusions for colorectal cancer:

1. Physical activity is associated with reduced risk for colon, but not rectal, cancer.
2. Dose-response analysis from 10 studies indicates that a dose of 20 MET-hours/week in leisure-time physical activity provides maximal risk reduction.

The Cancer-Primary Prevention Subcommittee assigned a draft evidence grade of its conclusions for its first question as 'strong' for both groups of cancer.

During the Committee discussion, Dr. Marquez asked for clarification of the effect modification based on race/ethnicity. In response, Dr. McTiernan clarified that the effect size was similar in African Americans in the examined studies; however, due to the small number of African Americans included in the studies, the effect was not statistically significant. As such, the subcommittee noted non-statistical significance but still feels that a similar effect size indicates that risk reduction from physical activity is applicable across all races/ethnicities. Additionally, in response to a question from Dr. Kraus, Dr. McTiernan clarified that studies included in the systematic literature review typically addressed the relationship between physical activity and specific cancer types rather than cancer incidence in general. Finally, in response to a question posed by Dr. Campbell, Dr. McTiernan noted that the subcommittee will more clearly define 'highest' vs 'lowest' dose of physical activity based on the literature by referencing the specific MET-hours/week of physical activity that provide the greatest benefit.

SC 6 Individuals with Chronic Conditions. Prior to his question presentation, Dr. Buchner updated the Committee on the status of prioritizing which additional chronic conditions the subcommittee will cover. The subcommittee has prioritized individuals with osteoarthritis, individuals with hypertension, and individuals with type 2 diabetes. Additional areas of interest include asthma in children and stroke in adults.

Dr. Buchner then presented the Individuals with Chronic Conditions Subcommittee's first systematic literature review search of systematic reviews and meta-analyses. This search addressed the following question:

1. Among cancer survivors, what is the relationship between physical activity and (1) all-cause mortality; (2) cancer-specific mortality; and (3) risk of cancer recurrence or second primary cancer?

Dr. Buchner presented the findings specific to breast cancer, and colon and colorectal cancer.

The Individuals with Chronic Conditions Subcommittee presented the following draft conclusions:

1. Physical activity after diagnosis is associated with decreased all-cause and breast-cancer specific mortality in women with breast cancer.
 - a. A dose-response effect of this relationship is likely.
 - b. Risk of recurrence was not addressed in the studies.
2. Physical activity after diagnosis is associated with decreased all-cause and colon/colorectal cancer specific mortality.
 - a. A dose-response effect is likely.
 - b. Risk of recurrence was not addressed in the studies.
 - c. There was limited inclusion of minorities.
 - d. The evidence is limited with respect to tumor stages (most excluded stage IV, metastatic) and treatment characteristics.

The Individuals with Chronic Conditions Subcommittee assigned a draft evidence grade of 'moderate' for its conclusions of the first two cancer groups examined in its first question.

During the Committee discussion, Dr. Pescatello questioned why the evidence was judged moderate given that the strength of the associations in the studies was strong. Dr. McTiernan, a member of the Chronic Conditions Subcommittee, noted that the subcommittee assigned a grade of moderate to the evidence given that studies did not adequately control for treatment type and completion of treatment. Dr. Katzmarzyk requested clarification on the definition of 'cancer survivor.' Dr. McTiernan clarified that the National Cancer Institute defines 'cancer survivor' as an individual after the time of cancer diagnosis; however, she noted that it will be important for the subcommittee to confirm this definition in the included studies. Dr. Katzmarzyk also suggested that the 'sedentary' group from the cancer studies reported be categorized as 'inactive' given that the Committee has defined sedentary behavior separately. Finally, Dr. Janz suggested that the Chronic Conditions Subcommittee confirm that the MET-hours dose found is for leisure-time moderate and vigorous physical activity as opposed to total activity that includes transportation or occupational physical activity.

After the subcommittee presentations, Dr. Haskell was invited to speak to the Committee.

Determining Physical Activity Guidelines Targets Presentation and Committee Discussion

Dr. Haskell, Chair of the 2008 Physical Activity Guidelines Advisory Committee, was invited to share his perspective of how to determine a physical activity target for the Committee's scientific report; he was not able to attend the meeting in person so joined via conference call. The 2008 Committee recommended 150 – 300 minutes per week of moderate-intensity aerobic physical activity based on its

review of the science. The target is based on the dose-response or amount of physical activity needed to achieve health benefits (e.g., reduction in risk of mortality and chronic diseases). The Committee will need to decide a target based on the synthesis of the evidence from its systematic literature reviews. Dr. Haskell outlined the complexity of determining a physical activity target and presented several graphics to the Committee.

Dr. Haskell's first figure plotted hazard ratio of mortality by leisure-time physical activity. The figure showed that those who engaged in no leisure-time physical activity had the greatest risk of mortality, while those who participated in any amount of physical activity had greatly decreased risk of mortality. This finding implies there is no lower threshold amount of physical activity for health benefits. The figure reinforces the first Guideline, which recommends that adults avoid physical inactivity. This figure highlights why the target recommended by the 2008 Committee was chosen – approximately 70% of the benefit of being physically active is achieved within this range. Additionally, there does not appear to be an upper threshold amount of physical activity for health benefits. The second figure he presented showed the same relationship but was plotted as a spline curve, which illustrated the opportunities for defining a target amount. Dr. Haskell reiterated that he was not suggesting the Committee adopt the same target as the 2008 Committee. Instead, he suggested the Committee critically review the current science and consider which findings would be most helpful in determining a target.

Dr. Haskell presented a third figure, developed by Dr. Powell, which plotted the relative risk of several different health outcomes by hours per week of moderate-to-vigorous physical activity based on the 2008 Scientific Report. The figure depicts the curved line representing the dose-response for all-cause mortality. For the other outcomes only a single point is shown because the shape of the dose-response curve for these other outcomes is not known. The points for the other outcomes suggest that the shape of the dose-response curve for each condition is likely to vary. Breast and colon cancer, for example, likely have shallower curves with smaller overall reductions in risk, whereas type 2 diabetes and falls have deeper curves with larger overall reductions in risk. These variations in the shape of the dose-response curves, if confirmed by research, may lead to different suggestions for a target dose.

Dr. Haskell pointed out that many practitioners and the public do not understand the current recommendations. He reiterated that the 150 minutes per week of moderate intensity physical activity is not the minimum, maximum, or 'optimal' amount of physical activity for health benefits. Instead the 150-300 minutes per week is a public health target—the amount of physical activity at which many adults achieve substantial health benefit and risk reduction of chronic disease. He reminded the Committee that its role is to provide HHS with the scientific evidence to inform the Guidelines. The role of HHS is to develop and effectively communicate the Guidelines. Dr. Haskell ended his presentation by again emphasizing that the science affirms that any amount of physical activity is better than none.

Dr. Pescatello asked how to best frame the target recommendation, given most Americans are not currently meeting the 150 minutes per week target. Dr. Haskell noted that the Committee may ultimately recommend a different target, but encouraged the Committee to not reduce the target amount based on the ability of Americans to meet it. He noted the message any physical activity is better than none is often lost.

The Committee then discussed how to come to a consensus about a target amount, given the differences in dose-response for various health outcomes (e.g., cancer, quality of life, mortality, etc.). Additionally, the Committee is examining sedentary behavior, which was not addressed by the 2008 Committee but may impact the target the Committee recommends. Dr. Macko noted that one review

found that 60-75 minutes per day attenuated or eliminated the risk of all-cause mortality due to sedentary behavior. Dr. Haskell responded that the Committee may consider a supplemental recommendation for sedentary behavior. Dr. Katzmarzyk raised the point that risk reduction for cancer and weight gain requires more physical activity than the current target of 150 minutes per week which corresponds with the threshold for cardiovascular disease risk reduction. Dr. Haskell agreed that the dose-responses of cancer and heart disease are vastly different, given their respective disease mechanisms. He noted that supplementary interventions might be necessary to see a risk reduction similar to that of cardiovascular disease due to physical activity alone.

As the Committee discussed the different dose-response effects between health outcomes, Dr. McTiernan suggested that the subcommittees look at the amount of physical activity necessary to reduce risk of their specific health outcomes. Dr. Janz asked about the recommendation of two days per week of muscle strengthening activity. Dr. Haskell noted that the scientific literature showed muscle-strengthening activity reduced the risk of chronic diseases.

The issues discussed will serve as a starting point as the Committee further decides how best to determine a target amount of physical activity for its Scientific Report.

Committee Discussion

Transition from Youth to Adult Guidelines. At the previous public meeting in October, Dr. Janz outlined the differences between the current youth and adult Guidelines, and the Committee decided to explore the young adult transition period. Dr. Janz reported that findings from each subcommittee's questions that include ages 18-34 are being flagged for further review. A working group comprised of Drs. Janz, Campbell, Katzmarzyk, and Powell will work with the subcommittees to review the articles including this age group from the existing searches, but do not plan to add an additional systematic literature review search. Dr. Janz explained that this age range is tentative, and the working group will determine whether the strength of the evidence warrants an additional recommendation or is better categorized as an emerging area where future research is needed.

Dr. Janz noted that several Committee members raised the issue that, when reviewing the literature, the working group should consider the effects of physical activity in the young adult population as a new paradigm. The physical activity literature for youth focuses on healthy development, while for adults the focus is disease prevention. The young adult transition working group will take a hybrid approach to reviewing the literature, considering both development and health outcomes. Dr. Janz outlined several topic areas for possible review including weight status, metabolic health, brain health, and bone health. Dr. Janz highlighted that this time period in life includes social transitions as well, which may independently affect physical activity levels.

Dr. Pate made the point that the adult Guideline includes the range of 150-300 minutes of moderate intensity aerobic physical activity and that the upper end of this range corresponds closely to the youth Guideline of 60 minutes per day. He noted that the transition is not necessarily abrupt, and suggested that some decline in physical activity with age may be natural. Dr. Buchner noted that the target is largely based on the risk of mortality, which is lower in young adults. Dr. Kraus pointed out the messaging of physical activity for youth centers on sport and play, while for adults physical activity is presented as an obligation for improving health. He noted that the lack of transition of messaging from youth to young adults should be considered in terms of promotion of physical activity. The working

group will proceed with its initial review of the articles including ages 18-34 pulled from the findings of the existing searches.

Pregnancy. Dr. Powell provided an update to the Committee on the topic area of pregnancy, which he and Dr. DiPietro will be working on with the support of consultant, Dr. Kelly Evenson. After discussions with several outside experts familiar with this literature, the group concluded that the evidence did not warrant a significant revision to the current Guidelines. As such, Dr. Powell reported that the pregnancy working group would not be conducting a systematic literature review search, but would be utilizing three documents instead: the 2008 Physical Activity Guidelines Advisory Committee Report, an American College of Obstetrics and Gynecology report, and a 2017 systematic review with meta-analysis by Da Silva. Additionally, Dr. Powell noted the group would be covering weight gain during pregnancy and post-partum, including infant weight at birth. Drs. Powell and DiPietro plan to fill in some existing gaps, provide quantitative estimates of the size of the effects whenever possible, and search for more information about dose.

Dr. Campbell asked if the pregnancy working group would be focusing on the child after delivery or would solely be focusing on the mother. Dr. Powell responded that the group would be looking mainly at the relationship between physical activity and the mother during pregnancy and the postpartum period, but, while the group was interested in time of delivery (e.g. preterm delivery) and birth weight, it would probably not be dealing with issues related to maternal behavior and health outcomes in the child. Dr. McTiernan asked whether adverse effects would also be included. Dr. Powell noted that physical activity typically positively affects adverse conditions (e.g., gestational diabetes, pre-eclampsia etc.) and clarified that the group would be focusing on normal pregnancies only.

Fitness. Dr. Kraus provided an update on the role of fitness in the Committee's scientific report. Drs. Kraus, Erickson, Janz, Pate, and Powell are drafting an operationalized definition for physical fitness within the Scientific Report. Dr. Kraus presented three questions the group is looking to address:

- What is fitness?
- How do we measure it?
- What is its role as an exposure, a mediator, or an outcome of the benefits of exercise on human health?

Dr. Kraus emphasized that term 'fitness' was broader than cardiorespiratory fitness or musculoskeletal fitness; the group is deciding what aspects 'fitness' should be included within the Scientific Report. Dr. Haskell will be providing input to the discussion as a consultant.

Question Prioritization & Public Health Targets. Dr. Powell confirmed that the list of prioritized questions presented at the October meeting will guide the Committee's systematic literature review searches moving forward. Dr. Powell reiterated that the prioritized question list took into consideration the status and progress of the Committee's questions thus far, the public health value of the questions, and the Committee's time and resources available to answer the questions. The Committee agreed to move the question addressing the relationship between physical activity, sleep, and circadian rhythms up in the prioritized question list for the Brain Health Subcommittee to address. Dr. Powell commented that the question of weight gain during pregnancy and post-partum will be addressed by the pregnancy working group instead of the Cardiometabolic Health and Weight Management Subcommittee. Additionally, the Committee discussed including weight status as a cross-cutting topic for all questions and will examine the literature to determine whether the findings vary by weight status.

Dr. Powell re-introduced the topic of dose-response and public health targets for physical activity for Committee discussion. Presenting the figure plotting risk reduction by hours/week of MVPA previously presented during Dr. Haskell's presentation, Dr. Powell asked the subcommittees to consider creating a similar estimate for their specific health outcomes. He acknowledged that there may be issues completing this task for the subcommittees addressing emerging topics (e.g., brain health and sedentary behavior). Dr. Pate noted that, in addition to mortality, the Committee is addressing more immediate outcomes such as quality of life and fitness that could similarly be graphed.

Finally, Dr. Powell asked the subcommittees to consider whether there was a 'threshold amount' of physical activity to improve their specific health outcomes. The Committee reviewed several different graphics and discussed how the subcommittees' findings will influence the physical activity target. Dr. Powell shared a figure which showed a non-linear dose-response relationship for cardiovascular disease mortality and encouraged the Committee to think critically about the possibility of non-linear dose-response relationships. The Committee also discussed the role of acute bouts of physical activity which can affect brain health and blood glucose control; these effects are transient so physical activity must be repeated in order to reap the health benefits. Dr. Powell agreed that acute bouts and their transient effects are important, and that the Committee should address these whenever possible, though that may mean highlighting them as needs for future research. Dr. Pate furthered the discussion with the inclusion of the acute effects on behavioral outcomes, mood, and reduced anxiety—which may be important for the development and maintenance of physical activity behaviors. Dr. Powell thanked the Committee for considering these topics as it continues its work.

Wrap-Up Discussion and Next Steps

Drs. King and Powell noted the Committee is continuing its work in subcommittees until the next public meeting.

Dr. Olson adjourned the third public meeting of the 2018 Physical Activity Guidelines Advisory Committee and stated that the Committee will reconvene in July 2017.

Meeting Adjourned

(4:15pm)