A. Specific Aims

The Center for Sustainable Interventions to Increase Physical Activity (CSI-IPA) proposes to translate findings from basic research on human behavior into more effective community and population-based interventions to reduce obesity. The Center engages an interdisciplinary team of researchers to engage community and government partners to develop and refine innovative community-based interventions that will significantly alter energy balance. The proposal is innovative in that it uses non-exercise energy expenditure as a long-term target behavior for a potential stealth intervention based on human mobility.

For this proposal we propose to develop several obesity-related strategies. The intervention will primarily use sustainable economic incentives and environmental modifications to promote physical activity at the community level and through employer-based settings. We will conduct laboratory studies, formative research, early phase trials and feasibility studies to further refine the incorporation of transportation physical activity. The approach will use multi-sectorial and collaborative group from academia, government and community-based organizations to accelerate the translation of discoveries from basic biological, behavioral and social sciences to population-based interventions. The team consists of investigators from exercise physiology, urban planning, medicine, economics, transportation, psychology, policy, business, sustainability, nutrition, geographic information systems, sociology, epidemiology and system science to collaborate with community-based organizations and with city, regional, state and federal governments to produce sustainable long-term participation in active forms of transportation.

The overall aim of this proposal is to increase transportation physical activity using economics incentives among low income minorities and through employer-based economic incentives. Through this cooperative agreement we will develop and test theories about the most potent forms, frequency and duration of economics rewards and reinforcements for encouraging transportation physical activity.

More specifically, this proposal will aim to develop a more precise and targeted reward and reinforcement schedules for use in discouraging sedentariness, such as automobile use, and increase transportation physical activity. We will test the use economic incentives, tax structures, and other policies to encourage industry, local governments, and community organizations to alter environments and market products that promote physical activity.

We plan to develop a behavioral economic feasibility study to assess the acceptance of promoting transportation physical activity. We also plan to refine the intervention and measurement procedures, gain experience in and information concerning recruitment and retention of the low income minorities and employers, and to determine estimates of variability and levels of response. We will collect data on the safety, dosages, and acceptability of various economic incentives and changes to the built environment that will promote physical activity. At the end of the funding period we will have characterized an intervention that will allow us to institute a full-scale community-based randomized control trial to promote sustainable forms of active transportation in low income minorities and through employer-based settings.

Aim 1. To develop an intervention that uses economic incentives and environmental changes to increase participation in active forms of transportation in communities of different socioeconomic levels.

Aim 2. To develop an intervention that uses economic incentives and environmental changes to reduce vehicles miles traveled as a sedentary behavior in diverse communities.

Aim 3. To develop sustainable interventions that use tax structures and land-use policies to engage business, local governments and community organizations to increase participation in active forms of transportation among individuals.

As part of the transdisciplinary approach of this proposal we strongly support and state our willingness to collaborate on the development and use of standardized measurement protocols, such as identification of eligibility criteria, formative assessment methods, data analysis, and further state our willingness to collaborate with NHLBI and other NIH scientists in all aspect of the study.

B. Background and Significance

It is widely known that physical inactivity is a significant contributor to the obesity epidemic. Also, physical activity not only supports overall health, but it also helps adults prevent weight gain. What is equally critical is that the way we design our environment can make it difficult for people to be physically active. In recognition of the high cost of energy, climate change, air pollution, crime prevention, health-care cost and the obesity epidemic many cities around the US are increasingly looking for ways to design communities and transportation system that promotes non-motorized and active forms of transportation.

While we have accumulated vast amount knowledge about the determinants of energy balance, obesity continues to increase. We need more translational research to better understand how behaviors such as sedentary lifestyles can be reduced at the community level. However, the most sophisticated advances in obesity research are ultimately dependent on individual behaviors. As stated in the RFA "maintaining healthful dietary habits and a physically active lifestyle remain fundamental to preventing and treating obesity." Moreover, "even the most successful behavior change interventions are limited in their ability to induce long-term behavioral changes in most people." To this effect, The Robert Wood Johnson Foundation Active Living Research has compiled a summary of peer-reviewed research connecting the built environment with physical activity. The report also explores the environmental factors that support physical activity for transportation and examines disparities based on income and race/ethnicity. (http://www.activelivingresearch.org/files/Active_Adults.pdf). The report conclusions are the following:

1. Changes in motorized travel, the built environment and an increasing reliance on sedentary entertainment have decreased opportunities for adults to be physically active, and the declining levels of physical activity have contributed to the obesity epidemic.

2. The majority of U.S. adults do not meet the recommended physical activity guidelines, and two thirds of U.S. adults are overweight or obese, with the highest obesity rates among Native Americans, African Americans, Hispanics and women.

3. Expert evaluations conclude that adults who live in walkable neighborhoods are more physically active and indicate that land use policy should be considered an important public health issue.

4. A significant body of research shows that obesity rates are higher among adults who drive the most and live in low-walkable neighborhoods.

5. Introducing sidewalks, bike trails and traffic calming devices can lead to increased physical activity.

6. Walking for transportation is consistently related to having many destinations near homes, connected streets and high residential density.

7. People who live in walkable neighborhoods and have nearby recreation facilities are more likely to have higher levels of physical activity and to meet daily guidelines for physical activity. This relationship may be strongest among adults who live in low-income neighborhoods and communities of color.

8. People living in low-income areas and communities of color have less access to recreation facilities, and face unique environmental challenges that may make it difficult for them to engage in regular physical activity. Additional research is needed to develop strategies for increasing physical activity levels among these populations.

More recently, Dr. Charlotte Pratt from the National Heart, Lung, and Blood Institute highlighted the need to examine multilevel and multicomponent, community-based interventions in settings such as public policy, social marketing, built environment and community. The report also suggests multilevel and comprehensive intervention that targets minority populations and low –income populations, especially studies addressing the interface between individual behaviors and the environment. A key cross-cutting research recommendation was the design of studies that include natural experiments and the testing of environmental and psychosocial influences on behavioral changes.

In this proposal we are proposing to develop an innovative and sustainable behavioral intervention using a multilevel collaborative model of participation between government, community-based organizations, and researchers to better understand human behavior, and then translate this knowledge into effective interventions. We are seeking to incorporate state of the art knowledge of exercise physiology energy expenditure and behavioral and social science theory in the treatment and prevention of obesity.

B.1. Epidemiology of Physical Activity

In epidemiology physical activity can be classified in three major forms: leisure-time physical activity, occupational physical activity, and transportation physical activity. Some of the first estimates of leisure-time physical activity (LTPA) were first published by Caspersen et al., using data from the 1985 Behavioral Risk Factor and Surveillance Systems. The prevalence of no leisure-time physical activity using the telephone-based BRFSS was XX% {Caspersen}{MMWR}. Subsequently, we later published estimates of no LTPA using data obtained during phase 1 (1988-1991) of the Third National Health and Nutrition Examination Survey {Crespo, 1996}. Our findings further characterize the prevalence of no LTPA among Whites, Blacks and Mexican Americans and presented the most popular leisure time physical activities by race and gender. The most popular physical activities in all groups were mostly of utilitarian form such as walking, gardening, and social dancing (except for White men). The relationship between social class and leisure time physical activity showed that regardless of occupation, education or income, minorities had the highest burden of physical inactivity during leisure-time suggesting that current indicators of social class did not predict inactivity {Crespo, 2000}{Crespo, 2001}. Acculturation, however, was significantly related to inactivity among Mexican Americans {Crespo, 2002}. Obesity is similarly related to ethnicity and socio-economic status {Crespo, chapter in Andersen}. Some of our earlier findings have been confirmed by others and what remains consistent is that levels of leisure-time physical activity or lack thereof, have remain consistent since national surveillance systems have been monitoring physical activity {Macera}{Haskell, 2007}. Moreover, objectives measures of physical activity collected during the 200X-200X NHANES showed that barely X% of the population are meeting the recommended levels of 30 minutes of moderate to vigorous physical activity most days of the week.

Gordon et al., reported on the number of overweight and obese individuals who report engaging in physical activity to loose weight, however, only xx% were actually meeting the minimum levels of physical activity to maintain good health, let a long to produce significant energy expenditure to result in weight lost. What is clear from these results is that participation in leisure-time physical activity in the general population has not changed since we first started monitoring it in national surveillance systems. We also know that racial and ethnic minorities, women, and people of low socio-economic status are at highest risk for inactivity and obesity. The reliance on individuals to take on participation in physical activity during their leisure-time has not worked, even though most people know that exercise is good for them. The use of labor-saving devices makes it impractical to rely on people increasing their total amounts of physical activity through their occupations. We therefore need to expand our approaches to promote physical activity using different stealth interventions that facilitate accumulation of 30 to 60 minutes of physical activity in a behaviorally and economically feasible intervention.

B.2. Physical Activity and Obesity

Physical activity is an important determinant of obesity prevention and weight loss. The American College of Sports Medicine (ACSM) states that an energy deficit of 500–1000 kcal·d_1 is recommended. The Position Statement by ACSM recognizes that health benefits can be achieved with participation in a minimum of 150 min (2.5 h/week) of moderate intensity physical activity. Overweight and obese adults should progressively increase to this initial exercise goal. There are also advantages to progressively increasing exercise to 200–300 min (3.3–5 h) of physical activity a week to facilitate long-term maintenance of weight loss. While we all have to eat every day, exercising or participation in leisure-time physical activity is optional, and therefore becomes a unique behavior that requires priority in translational research to better understand the unique aspect of this behavior and the motivation involved, especially among those most affected by it e.g., low income minorities.

It is clear that the increasing rate of obesity is a reflection of the population expending fewer calories than they consume. In behavioral translational research, therefore, the only discretionary component of daily

energy expenditure that can be utilized to reduce obesity is physical activity, as other forms of energy expenditures, e.g., basal metabolic rate and thermic effect of food, are outside of the control of the individual as a behavior. From an intervention perspective the replacement of sedentary behavior by various kinds of physical activities such as leisure-time physical activity, occupational physical activity, and more importantly transportation physical activity is crucial. One potential intervention is for people to engage in walking or bicycling instead of driving a car for short trips and for commuting. This stealth intervention has economic, environmental, energy, and sustainability implication.

The hypothesis that physical activity is efficacious in weight reduction needs to be studied in different scenarios. Most of the studies demonstrating modest contribution in weight reduction from exercise were relatively short term. On the other hand, several observational studies have shown that physical activity plays a significant role in preventing long-term weight regain.

It is therefore necessary that physical activity interventions that have long-term acceptability and adherence as part of daily life be studied as part of a comprehensive translational behavioral and social research perspective. From a behavioral point of view adherence to such a behavior may be better accepted if it is perceived as having multiple benefits for the individual, the family and the community.

B.3. Transportation Physical Activity

Translational research is needed to better understand how improving access to public transportation, examining mechanism to reward people for reducing automobile use, and changing the built environment can increase walking and biking at the community level. Since, leisure-time physical activity has plateaued during the last decade and labor-saving devices have engineered physical activity out of jobs, our last hope in increasing physical activity at the population level is through transportation physical activity.

Berrigan et al., found that people who participate in active transportation are more likely to meet the physical activity guidelines than those who reported not walking or bicycling as forms of transportation. This study also found that Hispanics and other low income groups continued to be disproportionately affected by low levels of transportation physical activity {Berrigan, 2006}. Hamer and Chida found that we could expect an 11% reduction in cardiovascular diseases for commuters who walk or bike to work in a review of eight randomized trials {Hamer, 2008}. In Sweden and Australia, two cross-sectional studies found less obesity rates among active commuters than among commuters who use personal automobiles {Lindstrom, 2008}{Wen, Rissel, 2008}. It may be, however, that normal weight individuals are more likely to walk or bike to work given that the findings come from cross-sectional study design. There are examples of other countries such as Switzerland where childhood obesity is on the rise at the same time that active commuting is decreasing {Kayser, 2008}. Edwards assessed the potential benefits of increased walking with taking public transit in terms of dollars of medical cost saved and disability avoided. The study concluded that walking associated with public transit can have substantial impact on obesity, medical cost, and improvements in well-being. Use of public transit was associated with more walking by about 8.3 extra minutes per day. Reduction in obesity rates through walking is only one of several potential advantages of increased use of mass transit. The present value in reduction of medical cost per person could be around $5,500, while there is added value in reducing disability. Other positive contribution of public transit is the lower rates of injury and death among its users, more equitable access to care among vulnerable populations, reduce stress from avoidance of car commuting. More importantly, however, the study suggests that more research is needed to assess the net impact of mass transit usage on all behaviors including participation in other types of exercise, and on policies that can promote transit usage at acceptable cost, which are precisely the aims of this proposal. The article concludes with the following: “We do not know how to entice an individual to switch from car commuting to public transit, how to extend public transportation into underserved areas, and how high the marginal costs of these activities are relative to these potential marginal benefits. . .” {Edwards, 2008}

The improvements that may be achievable in transportation-related physical activity when we can make some substantial changes to the built environment are of great translational research significance. A possible environmental modification is to improve the design of neighborhoods to facilitate walking and bicycling for short trips, commuting and recreation. There are other potential social barriers to promote transportation physical activity. Women are less likely than males to cycle especially in countries with low

rates of bicycle transportation. A study in Australia found that male cyclist outnumbered female cyclist by a ratio of four to one, and this is consistent with other countries in North America. This difference has been partially attributed to the actual or perceived risks of injury or mortality associated with cycling, and may reflect on the poor bicycling infrastructure, policies and regulations, and low cycling prevalence. Garrard found that females prefer off-road facilities implying a preference for a higher degree of separation from motor vehicle traffic {Garrard, 2008}. Thus, policies and environmental changes that helps separate motor vehicle traffic is needed to attract increased number of female cyclists in urban areas.

Finally, the percent of children that actively commute to school has declined in the US, while the percent of children who are driven to school has increased. It has been hypothesized that walking to school might be of education value in establishing walking as a legitimate mode of transports, especially for short trips, and further stimulate participation in other physical activities {van der Ploet, 2008} This increased motorization of short trips has negative influence not just on obesity, but in other health and environmental aspects, including air pollution, petroleum usage, climate change, parking problems, traffic accidents and traffic congestion. Van der Ploet suggests that an interdisciplinary approach involving transportation professionals, land use planners, policy makers and public health professionals with good community engagement is needed to encourage parents to let their children walk to school. Our proposal aims to follow this principle to develop an intervention that involves an interdisciplinary team working with policy makers and community representatives to increase transportation physical activity.

B.4. Behavioral Theoretical Framework

Many theories and models have been advanced to better understand the psychology of exercise adherence.

B.4.1. Socio-Ecological Models

Social ecological models propose that adoption of exercise is related to the individual's immediate environment (e.g., proximity to parks, opportunities to engage in sports or other group games in schools or neighborhoods), which is particularly germane to inner city, minority communities (Ref).

B.4.2. Theory of Planned Behavior

The theory of planned behavior proposes that participation is related to a person's attitudes and beliefs toward exercise, and perceptions of control over exercise behavior (Ref).

B.4.3. Self-Efficacy

The self-efficacy theory (Ref) proposes that behavioral change is a function of its perceived relative costs and benefits, highlighting the importance of previous experiences, self-assessment of personal limitations, and outcome expectations.

B.4.4. Other theories

The *social cognitive theory* proposes that adoption of exercise is related to learning about exercise and observing exercise in others through social interactions and experiences (Ref).

The *self-determination theory* proposes that participation in exercise is based on social forces that influence the autonomous individual to actively choose to engage or not engage in exercise (Ref).

The *exercise habit formation theory* suggests that exercise habits can be automatically activated by the situations that normally precede the exercise behavior (Ref), a concept that may be particularly relevant to *exergaming*.

The *transtheoretical model (Ref)* proposes that there are 5 cognitive stages to the acceptance of any change with exercise behavior, highlighting the need to recognize the person's stage of readiness and to move the person through successive stages.

Social supports also impact the success of long-term exercise (Ref).

In reality, all of these considerations influence the likelihood of adopting and sustaining exercise behaviors to various degrees.

Validated psychological scales (Ref) have been developed and will be applied in this proposal. The predictive value of these indices for self-sustained exercise behaviors have also not been well studied in low-income, low-education level minority populations where such factors may be particularly relevant, but have influences that may be significantly different than those observed in other populations.

B.5. Behavioral Economics Approaches

B.6. Translating Basic Behavioral and Social Discoveries

B.7. Precede-Procede

B.7.1. Predisposing Factors

B.7.2. Enabling Factors

B.7.3. Reinforcing Factors

C. Preliminary Studies

Our proposal includes a multidisciplinary team of investigators from academia, government, community-based organizations and industry. The intervention involves the use of economic incentives in combination with social marketing and environmental changes to promote transportation physical activity. Therefore, our academic team represents multiple disciplines: Social and behavioral sciences (Mohr, Hammer, Padin, Newsom, Carder); Medical field (Smit, Wheeler); Exercise Physiology (Crespo, Brodowicz); Transportation and Urban Planning (Dill, Weigand, Strathman, Rufolo, Gleibe, Birk); Economics (Harbaugh, Ervin, Rufolo); Epidemiology (Smit, Michaels); Business/marketing (Brown); and System Science and Engineering (Gliebe, Wakelend). Implementation of this type of intervention requires local partners. Local government partners include the City of Portland, Metro (Portland's regional government), TriMet (the region's transit agency), ODOT?, and Federal? (Blumenauer?). Community partners include the Communicy Cycling Center, the Bicycle Transportation Alliance, Unitus Credit Union, Hacienda Housing, MORE??? The following sections describe the research team and partners, along with relevant preliminary studies.

We have assembled an outstanding team of external advisors with national and international expertise in physical activity and obesity, and at least one area of interest pertinent to developing the intervention (behavioral, environmental policies, economics, land-use/urban planning, public health, government, and business/worksite). Moreover, the depth and breadth of their expertise will allow us to look at the potential generalizability of the results nationally, but will allow us to learn from potential interventions and solutions currently being studied worldwide. The external advisory board consists of Dr. James Sallis, Dr. Ross Andersen, Dr. Willem van Mechelem, Dr. Larry Frank, Dr. Michael Pratt, Dr. Anne Vernez-Moudon, Dr. Enrique Jacoby, and Dr. Robert Cervero.

Portland State University has a long history of engagement exemplified by its motto "Let knowledge serve the City." The Center for Transportation Studies, the Initiative for Bicycle and Pedestrian Innovation, the Exercise Physiology Laboratory within the Center for Public Health Studies, the Center for Social and Health Inequalities, and the Center for Sustainable Process and Practices at Portland State University, and our other partners at Oregon State University, Oregon Health and Science University, and the University of Oregon have demonstrated their capacity to recruit participants and provide adequate oversight to maintain high rates participants follow up through multiple intervention and development research programs. We will describe the qualification of these investigators in other studies. Moreover our ongoing collaboration with the city, and other government agencies further support our capacity to achieve high participation rates in developing this intervention. These government agencies in collaboration with some of the investigators

listed above have carried out several preliminary studies that have shown excellent intervention development process and quality control procedures. Finally, our collaboration with several community-based organizations and businesses further provide evidence of our ability to recruit participants and to adhere to established standardized measurements protocols, effective data collection and data management procedures in developing an intervention that will result in increases in transportation physical activity. Below we will highlight preliminary studies conducted by the above investigators, government agencies, and community partners that further to support our ability to recruit and retain participants, and to adhere to highest quality data collection protocols.

C.1. Investigators

C.1.1. Carlos Crespo, Ph.D. – Professor and Director, PSU School of Community Health

Dr. Crespo's previous work experience includes working for the State University of New York at Buffalo as an associate professor and as a researcher at Roswell Park Cancer Institute as well as the Centers for Disease Control and Prevention in the National Center for Health Statistics. His responsibilities included survey planning and development of the National Health and Nutrition Examination Survey. He also worked as a public health analyst for the Office of Prevention, Education and Control of the National Heart, Lung, and Blood Institute at the National Institutes of Health. He was an assistant professor at American University in Washington D.C. His main area of research involves the epidemiology of physical activity in the prevention of chronic diseases and research on minority health issues. He has over 60 publications in the areas of exercise, minority health, obesity and nutrition, and is co-author of five textbooks on minority health and sports medicine. He is also a contributing author to more than ten government publications, including the "Surgeon General's Report on Physical Activity and Health," and the "Sixth Report on Detection, Evaluation and Treatment of Hypertension." He received the 1997 Secretary of Health Award for Distinguished Service as part of the Salud para su Corazon campaign, and in 2003 became a Minority Health Scholar at the National Institutes of Health. He is an emeritus board member of the American Council for Exercise, former member of the board of directors of CASA de Maryland, and past president of the mid-Atlantic regional chapter of the American College of Sports Medicine. Currently he serves as a senior technical adviser for the Montgomery County Latino Health Initiative, CDC external advisory committee for the First International Physical Activity and Public Health Conference, and is the current Director of a WHO Collaborating Center in Urban and Health Sustainability. He has served on the obesity task force of the States of New York, Oregon, and the Commission on Diet and Physical Activity of the Commonwealth of Puerto Rico.

C.1.2. Jennifer Dill, Ph.D. – Associate Professor, PSU School of Urban Studies and Planning

Dr. Dill is the Director of PSU's Center for Transportation Studies. Dr. Dill's research interests focus on transportation and environmental planning, travel behavior, and transportation-land use interactions. Through original data collection, she has analyzed factors that influence decisions to walk, bicycle, and use transit, including marketing programs, street connectivity, New Urbanism, and transit-oriented development (TOD), attitudes about transportation funding options, and behavior surrounding emissions inspection, vehicle registration, and vehicle scrapping programs. Another research project is examining state, regional and local government decisions to adopt innovative policies that support walking and bicycling for transportation. Her research is published in numerous peer-reviewed journals, book chapters and research reports. Prior to entering academia, Dr. Dill worked for nearly a decade as an environmental and transportation planner for public and non-profit agencies in California. Dr. Dill has a Ph.D. in City and Regional Planning from UC Berkeley, an MA in Urban Planning from UCLA, and a BS in Environmental Policy Analysis and Planning from UC Davis. Her research has been supported by the Active Living Research Program of the Robert Wood Johnson Foundation, the university transportation centers program of the U.S. Department of Transportation, Oregon Department of Transportation, Metro, City of Portland, and the National Cancer Institute.

C.1.3. Ellen Smit, Ph.D.

Dr. Smit is a nutritional epidemiologist. Her research is focused on diet, metabolism, and physical activity in relation to both chronic disease and HIV infection in diverse populations. Studies include cohort designs, multi-center studies, survey analysis of national databases, and linking of registry data sets. Courses she

has taught include Dietary Interventions for Public Health, Epidemiological Methods, and Public Health Nutrition.

C.1.4. Gary Brodowicz, Ph.D. – Professor, PSU School of Community Health

Dr. Brodowicz's academic interest areas include exercise, fitness, physical activity, and measurement. He is a fellow of the American College of Sports Medicine (ACSM), a member of the American Physiological Association, and an honorary member of the Japanese Society of Sports and Osteopathic Therapy. Dr. Brodowicz served on the Oregon Governor's Council for Physical Fitness and Sports, and has been involved with the Oregon Coalition for Promoting Physical Activity. A certified ACSM health/fitness director, he regularly works with the YMCA as a consultant for their exercise specialist workshops and certification exams, and continues to be involved in fitness assessment workshops for the Japanese Athletic Trainers Association for Certification (JATAC). He has served on the editorial board of the American College of Sports Medicine's *Health and Fitness Journal*, and also reviews manuscripts for *The Journal of Aging and Physical Activity* and *The Journal of Athletic Training*. Undergraduate courses include Exercise Physiology, Exercise Testing Techniques, and Quantitative Analysis in Health Studies; graduate courses include Physical Activity, Health, and Disease; Exercise, Nutrition, and Performance; Quantitative Research Design and Analysis; and Exercise and Women: Physiological Aspects. Dr. Brodowicz advises master's students undertaking thesis and project work related to exercise, fitness, and physical activity. He is also director of the exercise physiology laboratory and the ON TRAC fitness assessment service.

C.1.5. Lynn Weigand, Ph.D. – Director, PSU Initiative for Bicycle and Pedestrian Innovation

Dr. Weigand directs the Initiative for Bicycle and Pedestrian Innovation (IBPI) within the Center for Transportation Studies at PSU. IBPI leads innovation in research and education that promotes change to make communities safe, convenient and accessible places to walk and ride a bike. She is interested in how we shape places that support active lifestyles and foster community life in the public realm. Her primary areas of research, teaching, and work experience include community design for active living, local transportation planning, and park and open space design. She teaches courses on bicycle and pedestrian travel, design analysis and trail planning. Dr. Weigand has more than 20 years of public, nonprofit and private sector experience in community and transportation planning with the City of Portland Office of Transportation, Moore Iacofano Goltsman (MIG), Livable Oregon, and the League of California Cities. Dr. Weigand has B.A. in Speech Communication from Oregon State University, an M.A. in Communication Studies from California State University, Sacramento, a Masters in Landscape Architecture from University of Washington, and a Ph.D. in Urban Studies from Portland State University.

C.1.6. James Strathman, Ph.D. – Professor, PSU School of Urban Studies and Planning

Dr. Strathman’s research interests include regional science and transportation planning. Dr. Strathman has looked at various facets of transit operations, travel behavior, safety, and freight operations. He used Automatic Vehicle Location (AVL) and automated passenger count data from Portland's transit system to help identify causes for delays, improve bus operations, and reduce operating costs. Dr. Strathman has also looked at ways to improve the effectiveness of truck weight enforcement.

C.1.7. Anthony Rufolo, Ph.D. – Professor, PSU School of Urban Studies and Planning

Dr. Rufolo is an economist, specializing in state and local finance, transportation, urban economics, and regional economic development. Prior to joining the faculty at Portland State in 1980, he spent six years as an Economist and Senior Economist with the Federal Reserve Bank of Philadelphia. His research has appeared in such journals as the National Tax Journal, Transportation Research, Transportation Research Record, The Journal of Urban Economics, Land Economics and The Journal of Public Economics, and he is the co-author of a textbook on public finance. He has practical experience with local economic development and finance issues in addition to my research and teaching. Dr. Rufolo's experience with government forecasting and budgeting includes: Chair, Advisory Council to the (Oregon) Task Force on State and Local Revenue Restructuring, 2008, Blue Ribbon Commission on Cost Allocation, Oregon Department of Transportation, 1996, (Oregon) Governor's Council of Economic Advisors 1983-1994, City of Beaverton Budget Committee 1989-1995 (chair 1992-1994), Advisory Committee on the Budget for Tri-Met (the Portland transit system) 1991-1995 (chair 1994-95), and the Investment Advisory Committee for the City of Portland since 1992.

C.1.8. Harbaugh, Ph.D. – Oregon State University Department of Economics
Dr. Harbaugh uses methods from neuroeconomics and experimental economics to study altruism and motives for charitable giving, the economic behavior of children, and decision-making in risky situations.

C.1.9. Cynthia Mohr, Ph.D. – Associate Professor, PSU Department of Psychology
Dr. Mohr received her B.A. from Smith College in Massachusetts in 1991 and her Ph.D. in social psychology from the University of Connecticut in 1999. Before coming to PSU, she was a postdoctoral research fellow in the Alcohol Research Center at the University of Connecticut Health Center. Her research concerns the processes by which interpersonal relationships and interactions exert effects on psychological well-being and physical health. In her work, Dr. Mohr differentiates positive and negative interpersonal interactions and emotions and how they uniquely influence health, particularly alcohol consumption. Dr. Mohr is currently conducting research on these topics with an ethnically diverse sample of Portland-area residents.

C.1.10. Wayne Wakeland, Ph.D. – Professor, PSU Department of Systems Science
His dissertation was entitled, "CHANCE: a Probabilistic Model for Energy Resource Planning."In 1978, Wayne became an adjunct member of the core faculty of the Systems Science Ph.D. program, when he began teaching a sequence of courses on modeling and simulation. This sequence evolved considerably over the years (see "course information" below). In 2000, he became an Associate Professor of Systems Science.In parallel with the above teaching activity, from 1978 to 2000, Wayne held managerial positions in information systems or manufacturing at local high tech firms (Tektronix, Photon Kinetics, Magni Systems, Epson, and Leupold & Stevens). In 2000, he reduced his industry job to part-time...to allow more time for teaching. His research interests include biomedical dynamics, the software development process, criminal justice systems, sustainability, supply chain management, organizational dynamics and systems thinking, simulation & optimization methods, and teaching. The simulation languages I use include STELLA, Vensim, Arena, Extend, ProModel, Netlogo, and Simulink.

C.1.11. John Gliebe, Ph.D. – Assistant Professor, PSU School of Urban Studies and Planning
Dr. Gliebe's research interests are focused on the development of advanced travel demand modeling methods, such as activity-based models and integrated land use and transportation models. Drawing on interests in econometrics and simulation, his objective is to improve the behavioral realism of modeling practices, with the underlying goal being better tools for policy analysis. Dr. Gliebe teaches courses in urban transportation planning, travel demand modeling, and discrete choice modeling. He came to PSU after working for several years in a national travel forecasting consulting practice, where he contributed to a variety of projects involving the development of regional and statewide models for forecasting both personal and commercial travel as well as land use. B.S. 1987 (journalism) Bowling Green State University; M.R.P. 1992 (city and regional planning) University of North Carolina at Chapel Hill; Ph.D. 2004 (civil engineering) Northwestern University.

C.1.12. Paula Carder, Ph.D. – Assistant Professor, PSU School of Community Health
Dr. Carder is affiliated with the Institute on Aging. She has worked on a variety of research projects on senior housing and community-based services, including state efforts to support affordable assisted living facilities, the use of negotiated risk agreements, and medication policies and practices in assisted living. She has authored several journal articles and book chapters on assisted living practices and programs. Dr. Carder is currently on the medication management workgroup for the CEAL-UNC Community-Based Participatory Research Partnership and the planning committee for the Assisted Living Disclosure Collaborative coordinated by CEAL and the Agency for Healthcare Research and Quality. She teaches courses in long-term care policy and qualitative research methods.

C.1.13. Jason Newsom, Ph.D. – Associate Professor, PSU School of Community Health
Dr. Newsom, Associate Professor, is a social psychologist whose interests include social relationships among older adults, caregiving, health behaviors, applied statistics, and research methodology. He has particular interest in negative social interactions among older adults and their effects on mental and physical health. Dr. Newsom received is Ph.D. in Social Psychology from Arizona State University in 1993. After three years of postdoctoral work at University of Pittsburgh, he came to Portland State University in 1996. Since that time, he has served as a principal or co-investigator for research projects focusing on social exchanges, health behavior, and healthcare funded by the National Institute on Aging, the National Institute

of Mental Health, and the Agency or Healthcare Quality and research. He is currently the Principal Investigator of a grant funded by the National Institute on Aging studying the effects of negative social interactions on health and mortality.

C.1.14. Darryl Brown, Ph.D. – Professor, PSU School of Business Administration

Dr. Brown has a B.S. in Forestry from University of Montana, an MBA from University of Montana, and an Accounting Ph.D. from University of Utah. Dr. Brown is a Certified Public Accountant (Montana, inactive) and teaches accounting information systems and managerial accounting. His current research interests include measurement issues related to organizational impacts on social and natural systems. In particular, he studies corporate social and environmental reporting, the relationship business reporting and business transparency, and the relationship between social and environmental reporting and firm performance. He serves on the editorial boards of *Issues in Accounting Education*, the *Journal of Information Systems* and the *International Journal of Information Systems*.

C.1.15. David Ervin, Ph.D. - Professor, PSU Department of Economics

His research interests include: agricultural biotechnology and environmental management, business environmental sustainability, environmental policy reform, and international trade and environmental management. He has taught courses such as Natural Resource Economics and Management, Business Environment Management Economics, and Global Environmental Economics. He is also a member of the Advisory Group on Assessing the Environmental Effects of Trade, Commission on Environmental Cooperation, the Commission on Environmental Cooperation and Organization for Economic Cooperation and Development.

C.1.16. Mia Birk – Principal, Alta Planning + Design

Mia Birk has 17 years of experience in pedestrian, bicycle, trail, and greenway planning, design and implementation. She is an instructor at Portland State University, teaching Pedestrian and Bicycle Issues for graduate students in urban planning. She has developed more than 100 bicycle, pedestrian, trail, and corridor plans, and has managed the public process, design and implementation of over 500 miles of new bikeways and walkways, as well as programs such as Safe Routes to School, bicycle and pedestrian-friendly development codes, and bikeway/walkway maintenance. In addition, she is an engaging speaker and public process facilitator. Ms. Birk previously worked at an international environmental think tank, working with cities in developing countries on transportation energy conservation strategies and as the City of Portland's Bicycle Program Manager, leading Portland's transformation to the country's most bicycle friendly city. She has authored studies on such groundbreaking topics as shared lane markings and rails-with-trails.

C.1.17. Leslie Hammer – Professor, PSU Department of Psychology

Leslie Hammer is a Professor and the Director of a new Occupational Health Psychology graduate training program at Portland State University that is funded through a Training Program Grant from the National Institute for Occupational Safety and Health. She recently concluded a national, longitudinal study of dual-earner couples in the sandwiched generation funded by the Alfred P. Sloan foundation. This project involved the collection of both qualitative and quantitative data and has been noted in such lay outlets as Time Magazine and the Chicago Tribune, as well as presented at conferences and published in academic journals. Dr. Hammer also serves on the founding editorial board of the Sloan Work and Family Research Network's On-Line Work and Family Encyclopedia. Dr. Hammer's research has focused on the difficulties in coordinating the demands of work and family that stem from factors within individuals and their close relationships, as well as factors in the work organization. More recently, she has also begun to examine the concept of work-family positive spillover, including both work and well-being outcomes. Dr. Hammer's research has also examined ways in which organizations can help reduce work-family stress and improve positive spillover by implementing "family-friendly" programs and policies such as alternative work schedules, leave programs, dependent care programs, and employee assistance programs. Finally, her studies on work and family crossover effects have demonstrated the importance of considering the dyad as the unit of analysis in work-family research. Classes she teaches at both the graduate and undergraduate levels include Work and Family, Occupational Health Psychology, and Organizational Psychology. She also supervises a number of graduate student theses and dissertations. NOTE: JD shortened this one

C.1.18. Jose Padin, Ph.D. – Professor, PSU Departments of Sociology and Latino/Hispanic Studies
Dr. Padín (Ph.D., 1998, University of Wisconsin-Madison) is Associate Professor of Sociology and Director of Chicano Latino Studies at Portland State University. His teaching and research interests are third world economic development, Latin American immigration, class, racial and ethnic conflict and coexistence, and critical studies of the mass media. He is currently working on a book on how newspapers and radio are shaping images of Latin immigrants in new destinations. Mentoring McNair advisees Angie Mejía and Favoure Miller the past two years has a deep source of satisfaction.

C.1.19. Yvonne Michaels, PhD. – Oregon Health Sciences University (OHSU)

C.1.20. Claire Wheeler, MD – PSU School of Community Health
Dr. Wheeler…

C.1.21. ???Vivek Shandas, Ph.D. – Assistant Professor, PSU School of Urban Studies and Planning ???

C.2. Preliminary Studies by the Investigators

C.2.1. Measuring Bicycle Behavior
Dr. Dill recently completed a study that measured bicycling behavior of 166 adult bicyclists in the Portland region using global positioning system (GPS) technology. The procedures and tools developed to collect and analyze GPS data will be useful in this study. The GPS data (individual points) was converted to routes and linked to the street and bicycle network, thus allowing the investigators to determine what facilities were used, travel speeds and distances, and travel uphill and downhill. In addition, the first stage of the project involved a random phone survey of adults regarding their bicycling behavior and barriers for bicycling. Those findings will be useful in developing our intervention strategies.

C.2.2. Long term Evaluation of Individualized Marketing Programs for Travel Demand Management
Dr. Dill and Dr. Mohr are conducting a long-term evaluation of the City of Portland's SmartTrips program, using the Theory of Planned Behavior (TPB) framework. SmartTrips is a neighborhood-based, individualized marketing program that aims to reduce motor vehicle use, particularly by promoting walking, bicycling, and transit. Methods included pre- and post-surveys of neighborhood residents on travel behavior, attitudes, and motivations. The investigators have developed robust measures of the components of TPB relevant to changing travel behavior, from driving to more physically-active modes.

C.2.3. Implementation of Active Living Policies by Local Governments and Transportation Agencies
Dr. Dill is involved in two projects that aim to better understand how and why some public agencies adopt polices that are intended to create a built environment that that supports physical activity and active living, while others do not. The first project, which will be completed in summer 2009, was funded by RWJF and focuses on city and county zoning and planning. The second project, which will be completed in late 2009, focuses on state and regional transportation agencies. The findings from both studies will help us understand the generalizability of the interventions proposed in this study.

C.2.4. Mohr's study using PDAs for recording behavior

C.2.5. Add another here

C.2.6. Add another here

C.2.7. Add another here

C.2.8. Add another here

C.2.9. Add another here

C.2.10. Add another here

C.3. External Advisory Board

INSERT Discussion of role of Advisory Board.

NOTE: Probably need to shorten descriptions of board members

James F. Sallis is Professor of Psychology at San Diego State University and the Program Director of Active Living Research. He received his doctorate in clinical psychology in 1981 from Memphis State University, with an internship at Brown University. He was a post-doctoral fellow in cardiovascular disease prevention and epidemiology at the Stanford Center for Research in Disease Prevention. Dr. Sallis is a nationally and internationally recognized authority on physical activity interventions and behavioral research. He has made major contributions in the areas of measurement, identifying correlates of physical activity, intervention, and advocacy. He has extensive experience with measurement development, interventions, ethnically diverse populations, school programs, adolescent health, and project management. Dr. Sallis has worked with multiple community agencies and has written about community youth physical activity promotion. He is a frequent consultant to government agencies, research programs, health organizations, and corporations throughout the United States and internationally. He served on the editorial committee for the 1996 U.S. Surgeon General's Report Physical Activity and Health and is on the editorial boards of several journals. Dr. Sallis has authored over 250 scientific publications, is co-author of Physical Activity and Behavioral Medicine (Sage, 1999) and a health psychology textbook, Health and Human Behavior (McGraw-Hill, 1993).

Dr. Ross Andersen, McGill U Ross Andersen, Ph.D. joined McGill University in 2007 as a Tier I Canada Research Chair and is a Professor in the Department of Kinesiology and Physical Education at McGill University. He and has also been on the Faculty at the University of Pennsylvania School of Medicine and Johns Hopkins School of Medicine. His research has focused on the role that physical activity plays in weight management. His work has been funded by the American Hearth Association and the National Institutes of Health to examine strategies to improve exercise adherence and to examine the dose of exercise required to promote long term weight control. Dr. Andersen has numerous publications and presentations in the area of physical activity and weight management, including publications in the Journal of the American Medical Association, Annals of Internal Medicine, Obesity Research, Medicine, Science in Sports and Exercise and many other peer-reviewed journals. He has authored three text books and several book chapters and serves on the editorial board for several research journals. He is known for his work in introducing Lifestyle Physical Activity to overweight adults to promote weight maintenance and long term adoption of physical activity.

Dr. Willem van Mechelem, Vrie University, Amsterdam Dr. Willem van Mechelen, MD, PhD, FACSM (1952) was born and raised in Amsterdam, the Netherlands. After completion of his training as a PE-teacher he worked for 9 years at an Amsterdam high school. He combined this job with studying medicine at the University of Amsterdam. After his certification as an MD in 1982 he started working at various out-patient clinics as a sports and occupational physician. He also started in that year his scientific career with a part-time appointment at the Faculty of Human Movement Sciences of the Vrije Universiteit in Amsterdam. He earned his PhD in Human Movement Sciences in 1992. Currently, he is employed by the VU University Medical Centre in Amsterdam as a full professor of Occupational and Sports Medicine. In this capacity he is the vice-head of the Department of Public and Occupational Health and the director of Research Centre Body@Work TNO VUmc (www.bodyatwork.nl). He leads a group of about 45 persons who conduct primary care research in the area of work, physical activity, sport and health. Willem van Mechelen is a board certified occupational physician, epidemiologist and human movement scientist. He is a member of a great number of (inter-)national committees and advisory boards. He also is a member of the editorial board of 8 international peer-reviewed journals.

Dr. Larry Frank, UBritish Columbia Dr. Frank is the recently appointed J. Armand Bombardier Chairholder in Sustainable Transportation at the University of British Columbia in the School of Community and Regional Planning and Institute for Resources, Environment and Sustainability. He specializes in the interaction between land use, travel behavior, air quality, and health. He has co-authored two books in the past year on these topics: Health and Community Design, The Impacts of The Built Environment on Physical Activity and Urban Sprawl and Public Health, coming out this June. Both of which are published by Island Press www.islandpress.org. In June, The American Journal of Preventive Medicine published his study, Obesity Relationships with Community Design, Physical Activity, and Time Spent in Cars documenting for the first time relationships between travel habits, neighborhood design characteristics, and the odds of being obese. This study was featured in Time Magazine, on CNN, ABC news, and over 200 media outlets worldwide. Dr. Frank recently completed a 5 year $4.6 million research program funded by the US Department of Transportation, U.S. Environmental Protection Agency, U.S. Centers for Disease Control and Prevention, Georgia DOT, and the Georgia Regional Transportation Authority known as SMARTRAQ. This study tested the effects of land use and transportation decisions on travel choices, physical activity, and air quality. He is currently working to establish a program for through the Bombardier Lab at UBC that engages local agencies on similar issues of transportation, the environment, and health in the Vancouver region.

Dr. Michael Pratt, CDC Michael Pratt coordinates physical activity research as the leader for the research and development team within the Physical Activity and Health Branch at the Centers for Disease Control and Prevention (CDC). He is also the Principal Investigator of CDC's World Health Organization Collaborating Center for Physical Activity and Health Promotion, and serves as a senior advisor to the Robert Wood Johnson Foundation-funded national program office for Active Living Research. He completed both a master's degree in exercise physiology and his medical degree at the University of Washington in Seattle. He received medical residency training at the Mayo Clinic in Minnesota and at CDC, and earned a master's degree in public health at the University of Minnesota. He is board certified in general preventive medicine and public health and is a Fellow in the American College of Preventive Medicine and the American College of Sports Medicine. Dr. Pratt's research interests include environmental and policy approaches to increasing participation in physical activity, the economic impact of physical inactivity, physical activity epidemiology, and physical activity counseling by health professionals. He has published numerous articles and spoken widely on the health aspects of physical activity.

Dr. Anne Vernez Moudon, U Washington Dr. Moudon instructs students in urban design and research methods. Her work focuses on urban form analysis, land monitoring, neighborhood and street design, and non-motorized transportation. Her current research is supported by the US and Washington State departments of Transportation, the Puget Sound Regional Council, the Federal Highway Administration, and the Centers for Disease Control and Prevention. She has consulted for many communities nationally and internationally to develop urban design guidelines for new construction which respect the character of the existing landscape and built environment, and which support non-motorized transportation. Courses she has taught include: URBDP 479 The Urban Form URBDP 576 Pedestrian Travel, Land Use, and Urban Form URBDP 598 Urban Design and Public Health

Dr. Enrique Jacoby, WHO Berkeley Dr. Enrique Jacoby, Regional Advisor on Nutrition, Unit of Non-Communicable Diseases, PAHO, is a medical doctor with a Master's degree in public health from Johns Hopkins University. Dr. Jacoby serves as PAHO's focal point in the anti-obesity campaign. Some activities related to his present post are: The organization of the Regional conference on the implementation in the Americas of the WHO Global Strategy on Diet, Physical Activity and Health, Costa Rica, April 2006; Co-Principal Investigator of a research project The evaluation of the impact of the urban built environment on the physical activity level of Bogotá residents; and the development of the PLANUT software, that can help nutrition experts develop dietary recommendations that maximize nutrition while keeping cost low, takes into consideration local food prices. His technical expertise also extends to the design and evaluation of public health nutrition programs; good quantitative and qualitative analytical skills and extend expertise in the development of public health communication campaigns. Before joining PAHO Dr. Jacoby was Principal Investigator at the Instituto de Investigación Nutricional (IIN) in Lima, Peru and consultant to the Office of Epidemiology, MOH, Peru. He was also visiting researcher in the Department of Pediatrics, School of Medicine UC at Davis, California, 1995-97.

Dr. Robert Cervero. UC Berkeley Robert Cervero is Professor of City and Regional Planning, University of California, Berkeley. He is the author of five books in the urban transportation field, including The Transit Metropolis (Island Press, 1998), Transit Villages for the 21st Century (McGraw-Hill, 1997), Paratransit in America (Praeger, 1997), America's Suburban Centers (Unwin-Hyman, 1989), and Suburban Gridlock (Rutgers, 1986), as well as numerous articles and research publications. He recently authored Transit Oriented Development in the United States: Experiences, Challenges, and Prospects (National Academy Press, 2004) under the national Transit Cooperative Research Program. Professor Cervero is currently conducting an evaluation of car-sharing in San Francisco and conducting case-based research on transportation and sustainable urbanism. He is also active on the international scene, presently advising and conducting research in Bogota, Colombia and Xi'an, China. He recently won the 2003 Article of the Year for the Journal of the American Planning Association. Professor Cervero is a Fellow with the Urban Land Institute and the World Bank Institute, and serves on the editorial boards of several international journals.

Dr. Wendell Taylor – UT Houston Wendell C. Taylor is a tenured Associate Professor of Behavioral Sciences and Health Promotion at the University of Texas Health Science Center at Houston, School of Public Health, Center for Health Promotion and Prevention Research. He is also an Adjunct Associate Professor in the College of Education and Graduate Studies at the University of Houston and Associate Professor in the Communications Department at Texas Southern University. Dr. Taylor received his A.B. from Grinnell College, his M.S. in psychology from Eastern Washington University, his Ph.D. in social psychology from Arizona State University, and his M.P.H. from the University of Texas Health Science Center at Houston, School of Public Health. In addition, he completed a two year post-doctoral fellowship in health promotion and health education at the Center for Health Promotion Research and Development, University of Texas. Dr. Taylor has received outstanding faculty awards for research and scholarship. He has been the principal investigator of grants from the National Heart, Lung, and Blood Institute; National Cancer Institute; American Heart Association, and the Robert Wood Johnson Foundation. Currently, he serves on the American Cancer Society's Psychosocial, Behavioral, and Policy Research Committee and the Medical and Research Advisory Committee for The Council on Alcohol and Drugs Houston. His research interests include health promotion in adolescents, physical activity determinants and interventions, health behaviors in underserved communities, and drug abuse prevention. Dr. Taylor has authored and co-authored book chapters and scientific publications in scholarly journals; he co-edited a book published by the American Psychological Association, Division of Health Psychology, entitled Health-Promoting and Health-Compromising Behaviors Among Minority Adolescents.

C.4. Government Partners

For this proposal we are working closely with local, regional, state and national government collaborators that have implemented various programs to provide multimodal forms of transportation. These approaches have not been geared toward reduction of obesity but rather to maximize the use of public transportation, minimize congestion, reduce pollution, and improve energy efficiency. Portland State University has a long history of partnering with local government in multiple projects and research opportunities through the Center for Transportation Studies, School of Urban Studies, School of Community Health, Initiative for Bicycle and Pedestrian Innovation, the Institute on Aging, Institute of Metropolitan Studies, and others. This partnership reflects on the University motto to "Let Knowledge Serve the City" and a nationally recognized service-learning philosophy. Below we will highlight a few programs that have a direct relevance to the development of an intervention to increase participation in transportation physical activity.

C.4.1. City of Portland

The City of Portland has a long history in implementing policies, programs, and projects that aim to reduce motor vehicle use and increase walking, bicycling, and transit. This project will build on three specific areas of effort: Infrastructure, Social Marketing, and Employer-based Programs

C.4.1.1. Infrastructure

Need to describe, including Bicycle and Pedestrian Master Plans, bike boulevards, signage, etc.

C.4.1.2. Social Marketing

The City of Portland has undertaken a series of innovative household-based, individualized marketing programs aimed at reducing drive alone trips. The programs are based on the TravelSmart© concept, originated by Socialdata, a German-based company. TravelSmart has been used extensively in Australia, where it was shown to significantly reduce drive alone trips by employing in-depth surveying and targeted marketing. The TravelSmart concept was first tested in the U.S. in 2003 in the Hillsdale neighborhood of Portland. Those results were positive, and the City implemented TravelSmart the next year along the Interstate corridor. The following year the City developed its own program, SmartTrips, based on the TravelSmart concept. SmartTrips programs targeted Eastside Portland in 2005, Northeast Portland in 2006, Southeast Portland and Milwaukee in 2007, and Southwest Portland in 2008. Residents in the targeted neighborhoods receive personalized information from the City about different travel options (walking, cycling, transit, and car sharing) and can participate in guided walks, rides, and other events. The program is based on the strategy of showing people how to use alternative modes and rewarding them for doing so.

With all of these programs, the City conducted pre- and post-surveys of random samples of neighborhood residents (repeated cross-sectional surveys). The post-surveys are conducted immediately following the project. The surveys collect data about all of the trips a person made that day. All of the programs to date have shown a reduction in the share of trips made driving alone and an increase in the share of trips made by walking and bicycling. For the Northeast project, the City also surveyed residents of a control neighborhood. The results for the programs so far have consistently shown a decrease if drive-alone vehicle trips. For example, the residents in the Northeast target area made 24.3% fewer drive alone trips in the post-survey, compared to 11.5% fewer trips made by residents in the control neighborhoods.

C.4.1.3. Employer-based Programs

Another target group of this proposal is to develop interventions to promote transportation physical activity through employer-based approaches. TRIP is a program from PDOT to make it easier for employers to maximize the economic incentives available to them while promoting use of public transportation, and thus reduction in time spent seating in the automobile while in traffic, a target sedentary behavior of this proposal. Presently an employer may give the entire annual amount of a transit pass tax-free to an employee. In doing so, the employer can actually lower their Federal Income Tax costs, FICA and state taxes, as well. But not every business can afford to pay for the entire amount of the transit passes.

C.4.2. Metro – Rex Burkholder

JD needs to write about RTOprograms, particularly Employer-based programs and Individualized Marketing

C.4.3. TriMet

Need to discuss PassPort program and new rail projects (potential environmental changes to examine)

C.4.4. Multnomah County – Consuelo Saragoza

INCLUDE????

C.4.5. State – ODOT – check with Dill and Strathman

INCLUDE????

C.4.6. Federal

C.5. Community Partners

C.5.1. BTA

C.5.2. Community Cycling Center

http://www.communitycyclingcenter.org/

C.5.3. Unitus Credit Union

http://www.unitusccu.com/bike/faq.html

C.5.4. Hacienda Community Development Corporation

C.5.5. ZipCar??

D. Research Design and Methods

D.1. Defining the Intervention (6 months – 1 year)

During this stage, applicants may conduct foundational studies to refine understanding of the basic biological, behavioral or social science research finding(s) or concepts being used in relation to the particular intervention (e.g., physical activity behaviors) and/or population of interest. These experimental, observational and/or formative studies must be related to the development of the proposed intervention(s), (e.g., to elucidate the behaviors being targeted for intervention, the characteristics of individuals for whom the intervention is being developed, and/or the psychophysiologic processes involved in the intervention process being studied).
The types of studies to be proposed for this stage include:
1. Laboratory or field experiments or observational studies necessary to develop the intervention of interest, including studies of behavioral, cognitive and/or emotional responses to stimuli to deconstruct and quantify the behavioral responses that will form the basis of an intervention, psychophysiologic research to delineate biological and behavioral processes underlying the relationship of psychosocial risk factors and obesity-related behaviors, and/or studies to delineate how an intervention can best be targeted to subgroups of respondents based on particular psychological, behavioral, or physiological characteristics of these respondents; and/or
2. Formative research, involving ethnographic interviews, focus groups, cognitive testing, and other accepted qualitative research methods designed to engage the community of participants in the development of strategies (user-centered design), explore the acceptability of the approach being used, and assess attitudes, norms, values, and meanings of relevance to the population being targeted in order to guide development of the intervention.
In addition to the above types of studies, secondary analyses of existing data (qualitative or quantitative) may be used as an additional (but not the sole) source of information to aid in defining the intervention and to guide later stages of the intervention development process.

During this stage we are proposing a series of foundational studies that will help us refine our intervention of increasing transportation physical activity using economic incentives, marketing and social suppport, and environmental changes in communities of diverse socioeconomic status and through employer-based approaches. We will use a series of field experiments that will allow us to elucidate the behaviors we are targeting for intervention, understand the characteristics of the community for whom we are developing our intervention and the processes involved in developing the intervention.

D.1.1. Field Experiments

During this stage we are proposing some laboratory and field experiments to deconstruct and quantify amounts of physical activity related to different forms of transportation physical activity such as bicycling, walking or any other forms of active form of transportation and the amount of sedentary behavior targeted (driving a motor vehicle). We will also begin to operationalize the economic incentives to facilitate the targeted behavior.

D.1.1.1. Measuring transportation physical activity

PIs: Dill and Brodowicz; Co-I: Crespo, Michaels, Smit, Mohr

We will investigate the use of both objective and self-report measures of people's transportation physical activity (TPA), primarily walking and bicycling. Objective measures include the use of technology, such as

pedometers, accelerometers, GPS units, and GPS-enabled mobile phones. These measures are generally thought to be more accurate and realiable, though drawbacks may include cost, participant burden and acceptance, and technical failures. Self-report measures include re-call surveys (phone, paper, or in-person) and diaries (paper and electronic). While these methods are susceptible to error due to people's inaccurate memory, they can sometimes elicit supplemental information not available through technology, such as the person's motivation for the activity. In addition, the use of personal digital assistants (PDAs) to collect such data in "real time" can improve accuracy. Combining both objective and self-report measures is also an option. The research team will first review the most recent research on these topics. They will then conduct limited field experiments on methods not covered adequately by existing research. For example, we would test some of the newest GPS technology.

This study will address the following questions:

- What measures of physical activity should be used, e.g., minutes a week, calories a day, METs?
- What GPS technologies (GPS-only units and mobile phones) are now available?
- How well do the technologies (pedometer, accelerometer, GPS) capture physical activity? Does this vary by type of activity, e.g. walking vs. bicycling?
- How well do self-report methods capture physical activity? Can technologies, such as PDAs, improve accuracy of self-report methods?
- How could self-report measures supplement objective measures using technology?
- Should heart rate monitors be used in combination with other technologies?
- How acceptable are the devices to participants?

The field tests will first use project staff and graduate students to test technical feasibility. Second phase tests will involve people from the target populations and will focus on acceptability, in addition to technical feasibility.

D.1.1.2. Measuring vehicle travel

PI: Rufolo Co-I: Dill, Strathman, Gliebe
Driving a personal vehicle is the sedentary activity targeted by this intervention. In addition to the health benefits of reducing this sedentary behavior, there are global benefits to reducing private motor vehicle travel, including reduced emissions and traffic congestion. These benefits may make the intervention more politically and economically feasible, by broadening the range of support and possible funding avenues (e.g. cap-and-trade programs targeted at reducing greenhouse gas emissions).

This study will address the following questions:

- What measures of vehicle travel are most important? Two common options include vehicle miles traveled (VMT) and vehicle hours traveled (VHT). VMT is commonly used in evaluating transportation and environmental outcomes. However, VHT may be more relevant for measuring health outcomes of sedentary behavior.
- Can vehicle use for an individual be accurately measured by measuring the activity of the vehicle? In households with more than one driver, a vehicle may be driven by more than one person. The study will need to distinguish outcomes for individuals, not just vehicles.
- How accurate are self-report methods? Self-report measures may include asking people to read and record their odometer's output.
- How well do non-GPS technologies measure vehicle travel?
- How well do GPS technologies measure vehicle travel? In-vehicle GPS units have been shown to accurately measure vehicle travel (CITATION). However, such units do not distinguish who is driving. Therefore, should personal GPS units be used to measure both driving and TPA?
- Could self-report measures be used to supplement in-vehicle technologies?

D.1.1.3. Testing the technical feasibility of economic incentive mechanisms

PI: Strathman; Co-I: Harbaugh, Rufolo

The main outcome of this experiment is to develop a mechanism to deliver economic incentives and rewards to increase active forms of transportation and reduce time spend in an automobile. For this field experiment we have discussed with the local Community Credit Union that currently offer bicycle loans to further refine our ability to economically incentivize and reward participation in active transportation. We will refine the use of a debit card for use in bicycle shops, mass transit, and other selected stores. The amount of funds transfer into the debit card will be based on findings from the formative research (see below) and modeling techniques created during years 2-3 of the proposal. During this field experience the main exercise is the Information Technology component that can be operationalized with the bank. Other potential mechanisms include gift cards where the investigators can upload additional funds during specific times (weekly, monthly, etc.). Dr. Harbaugh has worked on other behavioral economic incentives projects and will be instrumental in assisting with optimizing rewards delivery. We will work with the participants to identify other preferred mechanisms to receive incentives such as coupons, vouchers, checks, cash.

Need to add something about disincentives, e.g. parking charges, parking cash-out

Insert background on employer tax incentives

Preliminarily we want to develop a partnership to upload funds into a dedicated card to deliver monthly incentives and reward.

- What mechanisms are in place to deliver economic incentives? (e.g. smart cards, gift cards, tax incentives, rebates, etc)
- What kind of information would we want to obtain through potential economic incentives mechanisms (e.g., what people buy with the incentives, where they buy things, etc.)?

D.1.2. Formative Research

D.1.2.1. Focus Groups

PI: Carder, Co-I: Padin, Dill, Wakeland, Gliebe (?)

This study will use focus groups to answer the following questions:

- What is the acceptability of increasing physical activity in the respective groups by promoting active forms of transportation using potential monetary incentives?
- What are the barriers to promoting active forms of transportation?
- What are the attitudes toward physical activity, active transportation and economic rewards?
- What are the social or cultural norms toward physical activity, active transportation and economic rewards?
- What is the meaning of relevance toward physical activity, active transportation and economic rewards?
- How much money will influence changes in travel behaviors or what other incentives may be used to promote physical activity or active forms of transportation?
- What mix of quantitative and qualitative data are necessary for better developing a system dynamic analysis.

The findings from the focus groups will provide information that can be later used for modeling techniques to develop a transportation physical intervention. Separate focus groups will be conducted for residents of low-income neighborhoods, residents of middle-income neighborhoods, and representative from work-sites.

D.1.2.2. Ethnographic Interviews

PI: Padin, Co-I: Carder, Dill, Wakeland

Ethnographic interviews will be conducted with residents of Hispanic, Asian? and African-American to answer the following questions:

- What is the acceptability of increasing physical activity in the respective groups by promoting active forms of transportation using potential monetary incentives?
- What are the barriers to promoting active forms of transportation?
- What are the attitudes toward physical activity, active transportation and economic rewards?
- What are the social or cultural norms toward physical activity, active transportation and economic rewards?
- What is the meaning of relevance toward physical activity, active transportation and economic rewards?
- How much money will influence changes in travel behaviors or what other incentives may be used to promote physical activity or active forms of transportation?
- What mix of quantitative and qualitative data are necessary for better developing a system dynamic analysis.

D.1.2.3. Interviews with Government and Policy Makers

PI: Dill, Co-I Weigand, Strathman

Interviews with TriMet, Metro, City of Portland, Washington Co, or Beaverton City, ODOT.

- What existing programs (e.g. individualized marketing) are available to increase transportation physical activity?
- What programs are available to promote use of public transportation?
- How can this study coordinate with those activities to test our research questions?
- What plans exist to implement environmental changes that will improve the walking and bicycling environment in specific neighborhoods that may be targeted for future study?
- What technologies or other programs exist that might incorporate economic incentives?

D.1.2.4. Interviews with Community Partners

PI: Crespo, Co-I: Weigand, Dill

Interviews with Community Cycling Center, Bicycle Transportation Alliance, Hacienda Community Development Corporation, African American Health Coalition, Latino Health Network.

- What programs currently exist that promotes physical activity
- What is the likelihood that the organization will support developing an intervention that promotes active forms of transportation?
- What is the likelihood that the organization will support developing an intervention that reduces the use of automobile for utilitarian trips?

D.1.2.5. Interviews with Employers

PI: Ervin; Co-I: Brown, Dill

Interview with small, medium and large employers.

- Are the businesses aware of existing economic incentives to promote public transportation?
- Are the existing incentives enough for businesses to support additional economic rewards to promote commuting by other means besides personal automobile?
- What are the corporate values regarding health, sustainability, and productivity?

D.1.2.6. Interviews with Health Care Insurers

PI: Ervin; Co-I: Brown

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D.1.2.7. Generalizability and Comparability Analysis

PI: Weigand Co-I: Birk, Dill

NOTE: JD will work on this section, drawing on current work/knowledge. The purpose of this formative research is to learn if other cities around the US are ready to develop similar interventions proposed here, and their readiness for adoption. This component will also allow us to see what other interventions are being developed in cities in other countries such as Netherland, Denmark. While examples of Amsterdam and Copenhagen exist and are well known within the group, there may other similarly sized cities that can may be in the process of implementing new mechanism to promote active forms of transportation.

- Interviews with other cities around the US, and interviews with cities around the world.
- Are cities taking into account transportation physical activity within their sustainability efforts?
- Are cities thinking of economic rewards to reduce automobile use?
- Are cities planning to start incorporating the concept of bike boulevard in their transportation planning?
- Are cities thinking the social sustainability and equalities when planning and implementing multimodal forms of transportation?

In the Netherlands city of Amsterdam, around 40% of journeys are by bicycle, and planners at the Directorate Infrastructure Traffic and Transport have adopted a bicycle policy that blends segregated bicycle lanes with in-traffic, "bicycle boulevard-style" cycling. The general rule is that cyclists can integrate safely with traffic traveling at or below 30 km/h (19 mph), but that segregated bike lanes should be installed along roads with a higher speed limit. With these policies in place, Amsterdam remains one of the more active cycling cities in the world.

D.2. Characterizing the Intervention's Effects (2 – 3 years)

This stage consists of safety, "proof of concept" and small-scale efficacy studies that translate the concepts and findings from previous basic science research into specific, novel interventions in the areas of dietary behavior and physical activity. In this stage, applicants should propose any one or more of the following types of studies which are aimed at developing, refining and characterizing the intervention:

1. Phase I studies to determine the safety of the intervention or intervention components, and Phase II research that investigates: effects of the intervention on the outcomes of interest; effects of individual components of an intervention versus combinations; effects of varying an intervention's content, timing, mode of delivery, duration and frequency of contact; and dose-response relationships (effects of varying the intensity of an intervention or its components on outcomes of interest).
2. Studies using adaptive designs and pre-specified decision rules based on participant characteristics and responses to treatment to customize the intervention strategy to the individual, evaluate for whom a treatment should be employed, or when it should change over time in order to maximize its effects.
3. Studies using modeling techniques and systems science approaches (e.g., network analyses and systems dynamics approaches) to develop interventions and suggest how, when and where they should be targeted within a social group, family, health care or other system to achieve maximum benefit.

D.2.1. Characterizing the Intervention

D.2.1.1. Modeling Techniques and System Science to Characterize Intervention

PI: Gliebe, Co-I: Wakeland

DESCRIPTION

- ??
- ??

D.2.1.2. Determine what economic incentives should be employed

PI: Harbaugh; Co-I: Strathman, Crespo, Dill

DESCRIPTION

- Form of the economic incentives be (money, credit, things, gifts)?

- How to deliver economic incentives (card, check, coupon, credit)?
- What is the frequency of the economic incentives (weekly, monthly, quarterly)? How much or what is intensity of the incentives (amounts $50, $100, $200)?
- For how long does the economic incentives need to be given (6 months, 1 yr, 2 yrs)
- How to take into account miles driven into algorithm to provide economic incentives?
- Who are the most appropriate target group for economic incentives?

D.2.1.3. Assessing neighborhoods for interventions

PI: Birk, Co-I: Weigand, Dill, Michaels, Shandas

DESCRIPTION

- Conduct walkability and bikeability assessments of potential neighborhoods for interventions
- Assess transit accessibility of potential neighborhoods
- Assess socio-demographic characteristics of potential neighborhoods

D.2.1.4. Identifying employment sites for interventions

PI: Ervin; Co-I: Brown, Dill, Weigand, Birk

DESCRIPTION

- What specific employers would be willing to participate?
- What opportunities are there near the employment sites for walking, bicycling, and transit use?

D.2.2. Testing the effects of the intervention on the outcomes of interest

D.2.2.1. Testing responses to types of economic incentives

PI: Dill; Co-I: Gliebe, Wakeland, Newsom, Smit, Carder, Strathman, Rufolo, Mohr

DESCRIPTION

Conduct pilot tests with recruited individuals of 3-5 potential forms of economic incentives

- What are the changes in travel behavior?
- Identify implementation issues

D.2.2.2. Finalize target behaviors

DESCRIPTION

Exec Committee

- Increase Physical Activity – increase use of bicycle, walking, and public transportation for utilitarian trips.
- Reduce sedentariness – reduce automobile use
- Plan intervention to further characterize the type and form of delivery of economic incentives to be used for promoting transportation physical activity.
- Identify specific environmental changes e.g., bike boulevards, trails, to be tested as part of the intervention..
- Decide which businesses are to be targeted? Small, medium, large?
- Decide what is a small business, medium size employer/businesses, or large business/industry?
- Decide what types of business economic incentives are to be used for the employer
- Decide what types of economic incentives are available to the employees

- Decide if economic incentives through employer-based approaches work best if just working with the employer, the employee, or both employer and employee.

From RFA: Protocol and manual of procedures development. At the beginning of the intervention development process, Investigators will be expected to develop, and then to refine during subsequent stages, an intervention protocol and an intervention procedures manual. These documents will include a detailed description of the rationale, theoretical basis and basic science findings guiding development of the intervention; a set of proposed procedures to be developed, evaluated and finalized during subsequent stages; description of the development or adaptation of relevant measures including diagnostic, screening and outcome assessment tools; and description of quality control procedures and measures to be used to ensure and assess intervention fidelity, including intervention delivery and adherence to the protocol. Components of the intervention to be developed should be in operation in the manual of procedures in as much detail as appropriate commensurate with its present state of development. These documents (protocol and manual of procedures) are to be finalized at the end of the intervention development period.

D.3. Assessing Feasibility and Refining the Intervention (1 - 2 years)

In this stage, applicants will conduct pilot/feasibility studies to ensure the intervention procedures can be performed in the specific populations and settings of interest, to refine the intervention, and to gather data in preparation for future RCTs of the intervention. These studies may use combinations of qualitative (focus groups, ethnographic interviews) and quantitative (small-scale pilot studies) methods to determine the acceptability and feasibility of the intervention within the populations and setting(s) of interest, and to evaluate the effects of tailoring interventions to subpopulations of interest.
These studies may also be used to refine intervention and measurement procedures, gain experience in and information concerning screening, recruitment and retention of the target population (e.g., estimates of yield, pre-testing of screening/recruitment procedures), determine estimates of variability and levels of response in the target population, obtain preliminary information about sustainability and cost-effectiveness of the intervention, and engage community residents and leadership in preparation for future large-scale randomized trials of the intervention.

Conduct pilot/feasibility study to ensure intervention procedures can be performed in the specific populations (low income, minorities, middle class) and setting of interest (employer-based)

D.3.1. Development and Implementation of Neighborhood-based Economic Incentives Intervention

PI: Crespo; Co-I: Harbaugh, Strathman, Dill

Refine intervention to assure optimal level of participation at one or more economic rewards e.g., income based, minimum amount, based on cost to the program, based on environmental impact, etc.

- Refine intervention to select best mechanism to deliver economic rewards (coupons, vouchers, card).
- Refine intervention to decide how to best add economic incentives by using different criteria such as amount of physical activity, less miles driven, or combination.
- Implement economic incentives in combination with individualized marketing (Smart Trips) and changes in the physical environment

D.3.2. Development and Implementation of Employer-based Intervention

PI: Ervin; Co-I: Hammer, Brown, Dill

DESCRIPTION

- Refine intervention to assure the right economic incentives for employer are in place to promote active commuting e.g., tax incentives, cost-benefit using parking saving, health benefits, obesity prevention, morale, fitness improvement.
- Refine intervention to assure the right economic incentives for employee are in place to promote active commuting

D.3.3. Generalizability and Comparability Analysis

PI: Weigand; Co-I: Birk, Dill

The purpose of this formative research is to learn if other cities around the US are ready to develop similar interventions proposed here, and their readiness for adoption.

Interviews with other cities around the US, and interviews with cities around the world.

- Are cities taking into account transportation physical activity within their sustainability efforts?

- Are cities thinking of economic rewards to reduce automobile use?
- Are U.S. cities planning to start incorporating the concept of bike boulevards, cycle tracks, or other innovative infrastructure improvements?
- Are cities thinking the social sustainability and equalities when planning and implementing multimodal forms of transportation?

D.4. Project Timeline

include a timeline or flow chart showing types, sequence, and duration of each study

NOTE: The first column in this table is filled in using references/links to the headings above. Therefore, please do not edit directly. Right-click to "update field" if the heading have changed.

Year	Year 1				Year 2				Year 3				Year 4				Year 5			
Quarter	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
D.1.1 Field Experiments																				
Measuring transportation physical activity																				
Measuring vehicle travel																				
Testing the technical feasibility of economic incentive mechanisms																				
D.1.2 Formative Research																				
Focus Groups																				
Ethnographic Interviews																				
Interviews with Government and Policy Makers																				
Interviews with Community Partners																				
Interviews with																				
D.4.1.1. Interviews with Health Care Insurers PI: Ervin; Co-I: Brown • • •																				
D.4.1.2. Generalizability and Comparability Analysis PI: Weigand Co-I:																				
NEED TO COMPLETE																				