

Final Progress Report for Research Projects Funded by Health Research Grants

Instructions: Please complete all of the items as instructed. Do not delete instructions. Do not leave any items blank; responses must be provided for all items. If your response to an item is “None”, please specify “None” as your response. “Not applicable” is not an acceptable response for any of the items. There is no limit to the length of your response to any question. Responses should be single-spaced, no smaller than 12-point type. The report **must be completed using MS Word**. Submitted reports must be Word documents; they should not be converted to pdf format. Questions? Contact Health Research Program staff at 717-783-2548.

1. **Grantee Institution:** Temple University – of the Commonwealth System of Higher Education
2. **Reporting Period (start and end date of grant award period):** 01/1/2009 -12/31/2012
3. **Grant Contact Person (First Name, M.I., Last Name, Degrees):** Germaine Calicat, MLA
4. **Grant Contact Person’s Telephone Number:** 215.204.7655
5. **Grant SAP Number:** 4100047651
6. **Project Number and Title of Research Project:** 12 - *Enhancing Diabetic Foot Education by Viewing Personal Plantar Pressures*
7. **Start and End Date of Research Project:** 1/1/2009 – 6/30/2011
8. **Name of Principal Investigator for the Research Project:** Jinsup Song, DPM, PhD
9. **Research Project Expenses.**

9(A) Please provide the total amount of health research grant funds spent on this project for the entire duration of the grant, including indirect costs and any interest earned that was spent:

\$ 51,018

9(B) Provide the last names (include first initial if multiple individuals with the same last name are listed) of **all** persons who worked on this research project and were supported with health research funds. Include position titles (Principal Investigator, Graduate Assistant, Post-doctoral Fellow, etc.), percent of effort on project and total health research funds expended for the position. For multiple year projects, if percent of effort varied from year to year, report in the % of Effort column the effort by year 1, 2, 3, etc. of the project (x% Yr 1; z% Yr 2-3).

Last Name	Position Title	% of Effort on Project	Cost
Zoltick, E	Research Assistant	5%	4,257
Walsh, J	Consultant, Scientific Programming	5%	5,075

9(C) Provide the names of **all** persons who worked on this research project, but who *were not* supported with health research funds. Include position titles (Research Assistant, Administrative Assistant, etc.) and percent of effort on project. For multiple year projects, if percent of effort varied from year to year, report in the % of Effort column the effort by year 1, 2, 3, etc. of the project (x% Yr 1; z% Yr 2-3).

Last Name	Position Title	% of Effort on Project
Song, J	PI	5%

9(D) Provide a list of **all** scientific equipment purchased as part of this research grant, a short description of the value (benefit) derived by the institution from this equipment, and the cost of the equipment.

Type of Scientific Equipment	Value Derived	Cost
Novel Pedar Insoles, 4 pairs	Provide in-shoe plantar pressure	7,800
Step Activity Monitors (35)	Accurate monitor of daily activities	15,219
Computer upgrade	Acquired a PC to permit plantar pressure assessment and patient education	1,907

10. Co-funding of Research Project during Health Research Grant Award Period. Did this research project receive funding from any other source during the project period when it was supported by the health research grant?

Yes No

If yes, please indicate the source and amount of other funds:

NIH Career Development Grant (K23DK081021). Awarded amount: \$674,497. Grant Period: Sept. 2009 – August 2013.

11. Leveraging of Additional Funds

11(A) As a result of the health research funds provided for this research project, were you able to apply for and/or obtain funding from other sources to continue or expand the research?

Yes No

If yes, please list the applications submitted (column A), the funding agency (National Institutes of Health—NIH, or other source in column B), the month and year when the

application was submitted (column C), and the amount of funds requested (column D). If you have received a notice that the grant will be funded, please indicate the amount of funds to be awarded (column E). If the grant was not funded, insert “not funded” in column E. Do not include funding from your own institution or from CURE (tobacco settlement funds). Do not include grants submitted prior to the start date of the grant as shown in Question 2. If you list grants submitted within 1-6 months of the start date of this grant, add a statement below the table indicating how the data/results from this project were used to secure that grant.

A. Title of research project on grant application	B. Funding agency (check those that apply)	C. Month and Year Submitted	D. Amount of funds requested:	E. Amount of funds to be awarded:
None	<input type="checkbox"/> NIH <input type="checkbox"/> Other federal (specify:_____) <input type="checkbox"/> Nonfederal source (specify:_)		\$	\$

11(B) Are you planning to apply for additional funding in the future to continue or expand the research?

Yes X No _____

If yes, please describe your plans:

See answer to question #12.

12. Future of Research Project. What are the future plans for this research project?

The proposed diabetic foot education appears to increase the awareness of at-risk subjects with diabetes temporarily (about 3 months). Over the course of one year (co-funded NIH grant), the proposed education increased patient-initiated medical visits by two fold, compared to the control group. However, one time education at the baseline failed to increase and maintain the adherence to daily foot self-care. We plan to test efficacy of group-based education to reinforce adherence and improved outcomes

13. New Investigator Training and Development. Did students participate in project supported internships or graduate or post-graduate training for at least one semester or one summer?

Yes _____ No X

If yes, how many students? Please specify in the tables below:

	Undergraduate	Masters	Pre-doc	Post-doc
Male				
Female				
Unknown				
Total				

	Undergraduate	Masters	Pre-doc	Post-doc
Hispanic				
Non-Hispanic				
Unknown				
Total				

	Undergraduate	Masters	Pre-doc	Post-doc
White				
Black				
Asian				
Other				
Unknown				
Total				

14. Recruitment of Out-of-State Researchers. Did you bring researchers into Pennsylvania to carry out this research project?

Yes _____ No X

If yes, please list the name and degree of each researcher and his/her previous affiliation:

15. Impact on Research Capacity and Quality. Did the health research project enhance the quality and/or capacity of research at your institution?

Yes X No _____

If yes, describe how improvements in infrastructure, the addition of new investigators, and other resources have led to more and better research.

The K23 grant provides up to 75% of PI's time but has limited research support. The Health Research Grant Award was critical in obtaining required instruments (see question 9). By providing resources (scientific instruments and software developments), this grant allowed Dr. Song (PI) to conduct the proposed NIH K23 research.

16. Collaboration, business and community involvement.

16(A) Did the health research funds lead to collaboration with research partners outside of your institution (e.g., entire university, entire hospital system)?

Yes No

If yes, please describe the collaborations:

Through subsequent NIH grant award, this study allowed collaboration with Gary Foster, PhD (director of Center of Obesity Research and Education) and Guenther Boden, MD. Drs. Foster and Boden are serving as a mentor and co-mentor, respectively, for Dr. Song (PI). The collaboration also permitted a completion of another study (Effects of weight loss on foot structure and function in obese adults).

16(B) Did the research project results in commercial development of any research products?

Yes No

If yes, please describe commercial development activities that resulted from the research project:

16(C) Did the research lead to new involvement with the community?

Yes No

If yes, please describe involvement with community groups that resulted from the research project:

17. Progress in Achieving Research Goals, Objectives and Aims.

List the project goals, objectives and specific aims (as contained in the grant agreement). Summarize the progress made in achieving these goals, objectives and aims for the period that the project was funded (i.e., from project start date through end date). Indicate whether or not each goal/objective/aim was achieved; if something was not achieved, note the reasons why. Describe the methods used. If changes were made to the research goals/objectives/aims, methods, design or timeline since the original grant application was submitted, please describe the changes. Provide detailed results of the project. Include evidence of the data that was generated and analyzed, and provide tables, graphs, and figures of the data. List published abstracts, poster presentations and scientific meeting presentations at the end of the summary of progress; peer-reviewed publications should be listed under item 20.

This response should be a DETAILED report of the methods and findings. It is not sufficient to state that the work was completed. Insufficient information may result in an unfavorable performance review, which may jeopardize future funding. If research findings are pending

publication you must still include enough detail for the expert peer reviewers to evaluate the progress during the course of the project.

Health research grants funded under the Tobacco Settlement Act will be evaluated via a performance review by an expert panel of researchers and clinicians who will assess project work using this Final Progress Report, all project Annual Reports and the project's strategic plan. After the final performance review of each project is complete, approximately 12-16 months after the end of the grant, this Final Progress Report, as well as the Final Performance Review Report containing the comments of the expert review panel, and the grantee's written response to the Final Performance Review Report, will be posted on the CURE Web site.

There is no limit to the length of your response. Responses must be single-spaced below, no smaller than 12-point type. If you cut and paste text from a publication, be sure symbols print properly, e.g., the Greek symbol for alpha (α) and beta (β) should not print as boxes (□) and include the appropriate citation(s). DO NOT DELETE THESE INSTRUCTIONS.

I have applied for this Health Research Grant Award while my second NIH submission was being reviewed. My goal was to proactively prepare for an even stronger grant application without the delay that I have experienced for the second submission. Since the preliminary data was limited in sample size and a short follow up period, the purpose of this proposal was to conduct a larger preliminary study and to secure additional funds to acquire equipments I needed to complete the proposed NIH grant. Fortunately, my NIH career development grant was funded without requiring the third submission. Nevertheless, this grant provided critical equipments and software development, which the NIH career development grant did not fully provide.

The immediate purpose of this project was to (1) explore the efficacy of a novel patient education strategy, compared to a standard diabetic foot education and (2) to prepare for an even stronger NIH career development grant application by having stronger preliminary data, as recommended by the NIH grant review panel. It is well recognized that diabetic foot complications are a serious and costly problem, and improved patient education is critically needed to reduce the burden of diabetic foot disorders.

In this pilot study, the efficacy of an enhanced patient education strategy, compared to a standard diabetic foot education, was explored in a randomized control trial. The proposed enhanced diabetic foot education uses personal, computer-animated, multicolored, plantar pressure maps. This pilot project included 40 high-risk diabetic subjects. All subjects received a conventional foot care education and plantar pressure measurements. However, subjects randomized to the test group received additional, enhanced diabetic foot education based on their footprints. A presentation of abnormal barefoot plantar pressure and how that pressure may be alleviated with proper shoes is postulated to motivate high-risk diabetic patients with peripheral neuropathy (loss of feeling in the feet) to take a more active role in caring for their feet. All participants received customary palliative foot care and diabetic shoes and were evaluated at baseline, 1-month, and 3-month. If the proposed visual diabetic

foot education yields a more effective strategy, the subjects in the test group, as compared to the control group, are anticipated to show better personal daily foot care and greater understanding of peripheral neuropathy. The proposed diabetic foot education has a great potential to be an effective educational tool especially for those underserved minority communities, where health literacy is often a major challenge.

Forty (40) at risk diabetic subjects were enrolled, randomized to either control or intervention group, and followed for 3 months. Ten additional participants were enrolled than originally planned (30) to account for potential drop out. Characteristics of subjects at baseline are summarized in Table 1.

Table 1: Baseline characteristics of study participants

	Total	Control	Intervention
N (Male)	40 (25)	20 (9)	20 (16)
Age (years)	53.1	53.0	53.3
Education (years)	14.1	13.6	14.4
Duration of Diabetes	9.8	12.2	7.5
Weight (pounds)	216.9	208.6	225.3
Height (cm)	176.1	174.3	178.1
Body Mass Index	31.9	31.3	32.5
Malleolar Valgus Index (%), left	12.5	13.2	11.9
Malleolar Valgus Index (%), right	11.7	11.2	12.2
A1C	8.9	9.2	8.5
Number of Subjects in Risk Category			
1 (peripheral neuropathy)	12	5	7
2A (neuropathy+foot deformity)	21	10	11
2B (peripheral arterial disease)	4	3	1
3A (foot ulcer history)	1	1	
3B (previous amputation)	2	1	1

Subjects in the control and intervention groups had similar age, educational level, body mass index, hindfoot malalignment as measured by malleolar valgus index, and distribution of severity of diabetic foot risk categories. There were differences in gender and duration of diabetes. However, such demographic characteristics are expected given the small sample size.

Among 20 subjects in the control group, 19 and 16 subjects completed 1-month and 3-month evaluations, respectively, while all 20 subjects in the intervention completed all three evaluations. Subjects in the control group lost 2.9 pounds (1.4%) and 4.8 pounds (2.3%) at 1-month and 3-month evaluations, respectively, as compared to the baseline. Similarly, subjects in the intervention group lost 1.1 pounds (0.5%) and 4.1 pounds (1.8%), at 1-month and 3-month evaluations, respectively.

A sample of foot care behavior findings is presented in Table 2 and illustrated in Figure 1. While all subjects reported improved foot care behavior (that is, daily foot inspection, see Figure 1a) at visit 2 (1-month follow up), even greater difference was noted for foot inspection response at

visit 3 (3-month follow up). Whereas subjects who received the standard education returned to the response of the baseline, subjects in the treatment group maintained ‘correct’ foot care behavior at visit 3. Similarly, subjects who received standard education maintained similar foot care behavior (that is, avoidance of barefoot walk indoor, see Figure 1b) in all visits. However, subjects who received the individualized foot education by viewing their own footprint showed progressively improved behavior (that is, avoidance of walk barefoot) over time - 40% at baseline, 60% at 1-month, and 75% at 3-month.

Table 2: Summary of Self-Reported Foot Care Behavior Questionnaire

% of subjects who answered correctly to:	Visit 1		Visit 2		Visit 3	
	C	T	C	T	C	T
A1. Examine your feet daily?	70.0%	60.0%	78.9%	90.0%	62.5%	90.0%
A7. Walk barefoot indoors?	60.0%	40.0%	57.9%	60.0%	62.5%	75.0%
B7. Treat calluses with a blade?	85.0%	70.0%	89.5%	100.0%	87.5%	95.0%
B8. Wear sandals or slip-ons?	25.0%	50.0%	10.5%	45.0%	43.8%	50.0%

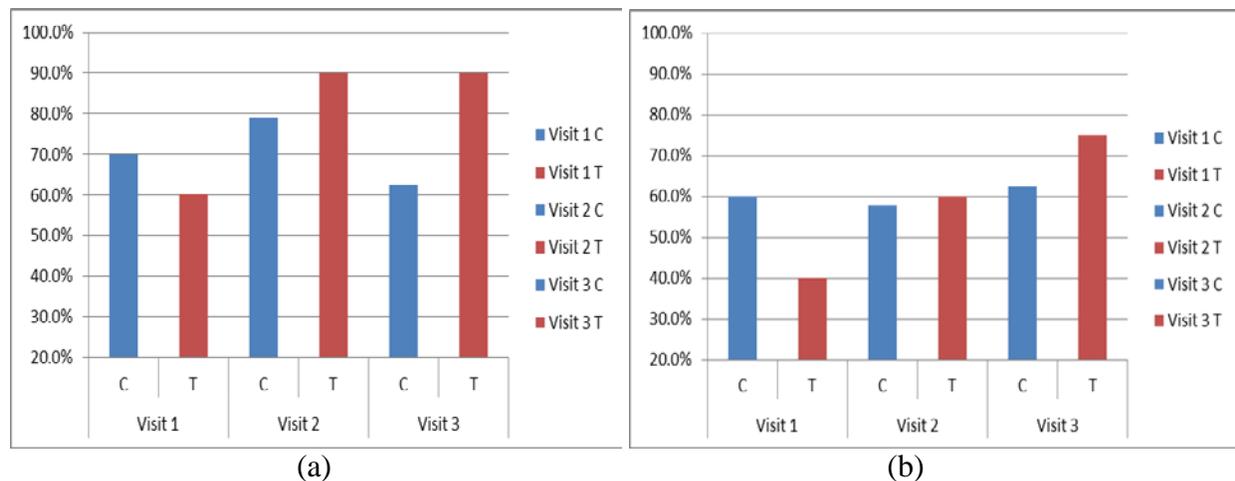


Figure 1: Percentage of subjects in the control (C) or intervention (T) group who reported that they inspected their feet daily (Figure 1a) and never walk barefoot indoor (Figure 1b).

The ultimate purpose of this project is to examine the efficacy of a novel patient education strategy, compared to a standard diabetic foot education. The effectiveness of the diabetic foot education was assessed by examining at the following: (1) personal daily foot care as measured by foot self-care behavior scores; (2) subjects’ understanding of peripheral neuropathy as assessed by the Patient Interpretation of Neuropathy Questionnaire; (3) occurrence of foot complications; and (4) peak barefoot plantar pressures. By design, this pilot study was limited by small sample size, short follow up period, and reliance on self-reported behavior assessments.

The primary objective of this pilot study was to assess feasibility and to determine if additional study would be warranted. Results of this preliminary study suggest that the proposed novel foot care patient education may yield improved foot care behavior in at-risk diabetic subjects as compared to the standard patient education. With the support of scientific instrumentations and infra-structure as entailed in this project, investigators successfully completed the aforementioned objectives and obtained a 4-year grant support from NIH to evaluate the utility of using personal plantar pressure as an educational tool in larger sample size over 1-year follow up period.

A portion of this data was presented as a poster in 2011 Diabetic Foot Conference (DFCon), entitled “Enhancing diabetic foot education by viewing personal plantar pressure: preliminary results”.

18. Extent of Clinical Activities Initiated and Completed. Items 18(A) and 18(B) should be completed for all research projects. If the project was restricted to secondary analysis of clinical data or data analysis of clinical research, then responses to 18(A) and 18(B) should be “No.”

18(A) Did you initiate a study that involved the testing of treatment, prevention or diagnostic procedures on human subjects?

Yes
 No

18(B) Did you complete a study that involved the testing of treatment, prevention or diagnostic procedures on human subjects?

Yes
 No

If “Yes” to either 18(A) or 18(B), items 18(C) – (F) must also be completed. (Do NOT complete 18(C-F) if 18(A) and 18(B) are both “No.”)

18(C) How many hospital and health care professionals were involved in the research project?

 2 Number of hospital and health care professionals involved in the research project

18(D) How many subjects were included in the study compared to targeted goals?

 30 Number of subjects originally targeted to be included in the study
 40 Number of subjects enrolled in the study

Note: Studies that fall dramatically short on recruitment are encouraged to provide the details of their recruitment efforts in Item 17, Progress in Achieving Research Goals, Objectives and Aims. For example, the number of eligible subjects approached, the number that refused to participate and the reasons for

refusal. Without this information it is difficult to discern whether eligibility criteria were too restrictive or the study simply did not appeal to subjects.

18(E) How many subjects were enrolled in the study by gender, ethnicity and race?

Gender:

22 Males
18 Females
 Unknown

Ethnicity:

1 Latinos or Hispanics
39 Not Latinos or Hispanics
 Unknown

Race:

1 American Indian or Alaska Native
1 Asian
24 Blacks or African American
 Native Hawaiian or Other Pacific Islander
7 White
 Other, specify: _____
7 Unknown

18(F) Where was the research study conducted? (List the county where the research study was conducted. If the treatment, prevention and diagnostic tests were offered in more than one county, list all of the counties where the research study was conducted.

Research participants were recruited from the Greater Philadelphia area via newspaper advertisements and announcements posted in Temple Healthcare System. The analysis of the data collected was performed in Philadelphia County.

19. Human Embryonic Stem Cell Research. Item 19(A) should be completed for all research projects. If the research project involved human embryonic stem cells, items 19(B) and 19(C) must also be completed.

19(A) Did this project involve, in any capacity, human embryonic stem cells?

 Yes
 x No

19(B) Were these stem cell lines NIH-approved lines that were derived outside of Pennsylvania?

 Yes
 No

19(C) Please describe how this project involved human embryonic stem cells:

20. Articles Submitted to Peer-Reviewed Publications.

20(A) Identify all publications that resulted from the research performed during the funding period and that have been submitted to peer-reviewed publications. Do not list journal abstracts or presentations at professional meetings; abstract and meeting presentations should be listed at the end of item 17. **Include only those publications that acknowledge the Pennsylvania Department of Health as a funding source** (as required in the grant agreement). List the title of the journal article, the authors, the name of the peer-reviewed publication, the month and year when it was submitted, and the status of publication (submitted for publication, accepted for publication or published.). Submit an electronic copy of each publication or paper submitted for publication, listed in the table, in a PDF version 5.0.5 (or greater) format, 1,200 dpi. Filenames for each publication should include the number of the research project, the last name of the PI, the number of the publication and an abbreviated research project title. For example, if you submit two publications for PI Smith for the “Cognition and MRI in Older Adults” research project (Project 1), and two publications for PI Zhang for the “Lung Cancer” research project (Project 3), the filenames should be:

- Project 1 – Smith – Publication 1 – Cognition and MRI
- Project 1 – Smith – Publication 2 – Cognition and MRI
- Project 3 – Zhang – Publication 1 – Lung Cancer
- Project 3 – Zhang – Publication 2 – Lung Cancer

If the publication is not available electronically, provide 5 paper copies of the publication.

Note: The grant agreement requires that recipients acknowledge the Pennsylvania Department of Health funding in all publications. Please ensure that all publications listed acknowledge the Department of Health funding. If a publication does not acknowledge the funding from the Commonwealth, do not list the publication.

Title of Journal Article:	Authors:	Name of Peer-reviewed Publication:	Month and Year Submitted:	Publication Status (check appropriate box below):
1. None				<input type="checkbox"/> Submitted <input type="checkbox"/> Accepted <input type="checkbox"/> Published

20(B) Based on this project, are you planning to submit articles to peer-reviewed publications in the future?

Yes _____ No x

If yes, please describe your plans:

The sample size and results of this pilot were deemed insufficient for publication in major peer review journal. By generating critical preliminary data suggesting feasibility/potential

benefit of the novel diabetic foot education, this pilot study enhanced chances for the PI securing 4-year NIH grant.

21. Changes in Outcome, Impact and Effectiveness Attributable to the Research Project.

Describe the outcome, impact, and effectiveness of the research project by summarizing its impact on the incidence of disease, death from disease, stage of disease at time of diagnosis, or other relevant measures of outcome, impact or effectiveness of the research project. If there were no changes, insert “None”; do not use “Not applicable.” Responses must be single-spaced below, and no smaller than 12-point type. DO NOT DELETE THESE INSTRUCTIONS. There is no limit to the length of your response.

None

22. Major Discoveries, New Drugs, and New Approaches for Prevention Diagnosis and Treatment. Describe major discoveries, new drugs, and new approaches for prevention, diagnosis and treatment that are attributable to the completed research project. If there were no major discoveries, drugs or approaches, insert “None”; do not use “Not applicable.” Responses must be single-spaced below, and no smaller than 12-point type. DO NOT DELETE THESE INSTRUCTIONS. There is no limit to the length of your response.

None

23. Inventions, Patents and Commercial Development Opportunities.

23(A) Were any inventions, which may be patentable or otherwise protectable under Title 35 of the United States Code, conceived or first actually reduced to practice in the performance of work under this health research grant? Yes _____ No X

If “Yes” to 23(A), complete items a – g below for each invention. (Do NOT complete items a - g if 23(A) is “No.”)

- a. Title of Invention:
- b. Name of Inventor(s):
- c. Technical Description of Invention (describe nature, purpose, operation and physical, chemical, biological or electrical characteristics of the invention):
- d. Was a patent filed for the invention conceived or first actually reduced to practice in the performance of work under this health research grant?
Yes _____ No _____

If yes, indicate date patent was filed:

- e. Was a patent issued for the invention conceived or first actually reduced to practice in the performance of work under this health research grant?

Yes _____ No _____

If yes, indicate number of patent, title and date issued:

Patent number:

Title of patent:

Date issued:

- f. Were any licenses granted for the patent obtained as a result of work performed under this health research grant? Yes _____ No _____

If yes, how many licenses were granted? _____

- g. Were any commercial development activities taken to develop the invention into a commercial product or service for manufacture or sale? Yes _____ No _____

If yes, describe the commercial development activities:

23(B) Based on the results of this project, are you planning to file for any licenses or patents, or undertake any commercial development opportunities in the future?

Yes _____ No _____ **X** _____

If yes, please describe your plans:

24. Key Investigator Qualifications. Briefly describe the education, research interests and experience and professional commitments of the Principal Investigator and all other key investigators. In place of narrative you may insert the NIH biosketch form here; however, please limit each biosketch to 1-2 pages. *For Nonformula grants only – include information for only those key investigators whose biosketches were not included in the original grant application.*

BIOGRAPHICAL SKETCH

NAME Jinsup Song, D.P.M., Ph.D.	POSITION TITLE Assistant Professor; Director, Gait Study Center		
EDUCATION/TRAINING <i>(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)</i>			
INSTITUTION AND LOCATION	DEGREE <i>(if applicable)</i>	YEAR(s)	FIELD OF STUDY
Carnegie-Mellon University, Pittsburgh, PA	B.S.	1989	Biology
Pennsylvania College of Podiatric Medicine, Philadelphia, PA	D.P.M.	1997	Podiatric Medicine
Drexel University, Philadelphia, PA	Ph.D.	1998	Biomedical Science
University of Pennsylvania Health System at Presbyterian Medical Center, Philadelphia, PA		1997-1999	Podiatric Residency

A. Positions and Honors. List in chronological order previous positions, concluding with your present position. List any honors. Include present membership on any Federal Government public advisory committee.

July 1999 – present: Assistant Professor, Dept. Podiatric Medicine and Orthopedics, Temple University School of Podiatric Medicine. 148 N 8th Streets, Philadelphia, PA

July 2001 – present: Reviewer for Musculoskeletal Rehabilitation Sciences study section for the NIH/Center for Scientific Review

July 2005 – present: Director, Gait Study Center, Temple University School of Podiatric Medicine

Professional Memberships:

- 1995 - Member, Gait and Clinical Movement Analysis Society
- 1999 - Member, American Diabetes Association
- 2003 - Member, International Society of Biomechanics
- 2006 - Member, American Podiatric Medical Association
- 2009 - Member, Association of Rheumatology Health Professionals

B. Selected peer-reviewed publications (in chronological order). Do not include publications submitted or in preparation.

Selby-Silverstein L, Hillstrom H, Palisano R, Kugler F, Lundberg L, Harris T, Song J, and Furmato J: "Gait of Children with Down Syndrome and Effects of Foot Orthoses", *Pediatric Physical Therapy*, 4(4), 1992.

Song J, Hillstrom HJ, Secord D, Levitt J: "Foot Type Biomechanics: Comparison of Planus and Rectus Foot Types" *JAPMA* 86(1) 16-23, 1996.

Gonda E, Bauer GR, Hillstrom HJ, Song J, Cho HH, and Lundberg LA. "Stability of the Offset V-Osteotomy: Test Jig Development and Saw Bone Model Assessment" *J Am Pod Med Ass* 92(2) 82, 2002.

Zifchock RA, Davis I, Hillstrom H, Song J: The effect of gender, age, and lateral dominance on arch height and arch stiffness. *Foot and Ankle International* 27(5), 2006.

Liu X, Kim W, Schmidt R, Drerup B, Song J: Wound measurement by curvature maps: a feasibility study. *Physiol Meas*, 27(11), 2006.

Butler RJ, Hillstrom H, Song, J, Richards CJ, Davis IS: Arch height index measurement system: establishment of reliability and normative values. *JAPMA* 48(2), 2008.

Shultz, S.P., M.R. Sittler, R.T. Tierney, H.J. Hillstrom, and J. Song, Effects of pediatric obesity on joint kinematics and kinetics during 2 walking cadences. *Arch Phys Med Rehabil*, 2009. 90(12): p. 2146-54.

Rao S, Song J, Kraszewski A, Backus S, Ellis SJ, Deland JT, Hillstrom HJ: The effect of foot structure on 1st metatarsophalangeal joint flexibility and hallucal loading. *Gait and Posture* 34(1), 2011

Hillstrom, H.J., J. Song, A.P. Kraszewski, J.F. Hafer, R. Mootanah, A.B. Dufour, B.S. Chow, and J.T. Deland, 3rd, Foot type biomechanics part 1: Structure and function of the asymptomatic foot. *Gait Posture*, 2012.

Mootanah, R., J. Song, M.W. Lenhoff, J.F. Hafer, S.I. Backus, D. Gagnon, J.T. Deland, 3rd, and H.J. Hillstrom, Foot Type Biomechanics Part 2: Are structure and anthropometrics related to function? *Gait Posture*, 2012.

Shultz, S.P., M.R. Sittler, R.T. Tierney, H.J. Hillstrom, and J. Song, Consequences of pediatric obesity on the foot and ankle complex. *J Am Podiatr Med Assoc*, 2012. 102(1): p. 5-12.

Hafer, J.F., M.W. Lenhoff, J. Song, J.M. Jordan, M.T. Hannan, and H.J. Hillstrom, Reliability of plantar pressure platforms. *Gait Posture*, 2013.

Joshi, R., J. Song, R. Mootanah, S. Rao, S.I. Backus, and H.J. Hillstrom, Structure and function of the foot, in *Foot and ankle sports medicine*, D.W. Altchek, et al., Editors. 2013, Lippincott Williams & Wilkins: Philadelphia. p. 11-29.

Song, J., R. Joshi, R. Mootanah, S. Rao, A.P. Kraszewski, S.I. Backus, and H.J. Hillstrom, Plantar pressure assessment of the athlete, in *Foot and ankle sports medicine*, D.W. Altchek, et al., Editors. 2013, Lippincott Williams & Wilkins: Philadelphia. p. 30-43.

- C. Research Support.** List selected ongoing or completed research projects (federal and non-federal support). Begin with the projects that are most relevant to the research proposed in this application. Briefly indicate the overall goals of the projects and your role (e.g. PI, Co-Investigator, Consultant) in the research project. Do not list award amounts or percent effort in projects.
(Skip this question if you are an NIH intramural employee.)

Enhancing Diabetic Foot Education by Viewing Personal Plantar Pressures.
Principal Investigator: Jinsup Song, D.P.M., Ph.D.
NIH/NIDDK K23
Role: Principal Investigator

Enhancing Diabetic Foot Education by Viewing Personal Plantar Pressures: A Pilot Study
Principal Investigator: Jinsup Song, D.P.M., Ph.D.
Temple University/Dept of Health – Pennsylvania
Role: Principal Investigator

Development of a Geometric Forefoot Model: A Tool for Clinical Decision Making
Principal Investigator: Howard J. Hillstrom, Ph.D.
NIH/NICHHD R03
Role: Clinical Scientist – Co Investigator

Next Generation Baby Shoe.
Principal Investigator: Howard J. Hillstrom, Ph.D.
Stride Rite
Role: Clinical Scientist – Co Investigator