



UCOA Meeting Agenda May 10, 2018

12:00 PM – 1:30 PM

Member and Community Partners Quarterly Meeting

HealthInsight Conference Room

756 East Winchester Street (6600 S), Suite 200

(Free parking west and north of office building)

Join from Zoom: <https://healthinsight.zoom.us/j/611867141>
Dial: 669 900 6833 or 646 558 8656 - Or 1 877 369 0926 (Toll Free)
Meeting ID: 611 867 141

Lunch Provided by HealthInsight Utah and UCOA

Agenda

- 12:00 Welcome and Introduction Andrew Jackson
- New Members Municipal Leadership – Glenn Wright
Public Safety – *(still interviewing TBA)*
 - New Community Partners
- 12:10 Executive Director Report R Ence
- Thank you to intern Carly Ann Kuhn
 - Legislative Day - Feb 7 debrief: location, event, etc.
 - Leg session post mortem – prep for new bill filings All
 - Committee activation – initial objectives – *see briefing*
 - UCOA/Partner projects – *see briefing*
- 12:40 Community Partner Conversations
- Caregiving projects
 - Caregivers in medical care team C North
 - Provider training gaps L Ellington
 - Crescendo Music Therapy E Christensen
 - Relay Utah L Dean

(Public and partner comment and input welcomed throughout)

01:20 Partner and Public Input

- Other updates
- Event announcements

01:30 UCOA Meeting Adjourned

Next UCOA Meetings:

Aug 9, 2018 – Thursday, 12:00 – 1:30 PM

BHC Education Center 24 S 1100 E # 205 SLC

Nov 8, 2018 – Thursday, 12:00 – 1:30 PM

AARP Utah Conference Room 6975 S Union Park Ave #320 Midvale

Committee (virtual) meetings in June - July

Other important dates:

May 15, 2018 – Tuesday, 8 AM to 6 PM

U4A Senior Fraud Conference in Richfield

Utah Commission on Aging

Executive Director Report

Key UCOA Engagements

- End of Life Summit – over 100 attended 3rd annual event on end of life conversations, stakeholder roles, palliative care, brain health assessments.
- University of Utah Center on Aging Annual Research Retreat focus on arts in aging – lectures ranging from poetry to dance and its impact on quality of life
- Falls Prevention Alliance successful joint venture and legislative event; active website – *see briefing*
- BankSafe Initiative – AARP’s national initiative kicks off May 16 in Washington DC. Utah is a pilot state and will have 3 bank and 5 credit union institutions participate in the training pilot
- Utah POLST Registry Committee – collaboration has commitment for match funding requirements and finalizing intergovernmental transfer agency contract; hope to apply within the next week or two for grant
- Utah Legal Services/APS/UCOA Dept of Justice Grant – underway and still looking for real stories to share
- Arts and Aging/EngAGE Utah - Music & Memory Utah Coalition (*see briefing notes*)
- Communications Projects
 - Podcast Launch “The Rap on Aging” – 4 episodes in the can, 3 published – offer your input on highest priority topics; new logo
 - Facebook
 - Updated website is live

Please submit story ideas to zjanice.evans@gmail.com or rob.ence@utah.edu

Please share the results on all these media assets

UCOA Committees Relaunch

Leads will offer meeting times during next two months. Anyone free to join the conversations. Committees are public policy, community resources, research & academia, and communications. Objectives include:

- Strategic focus
- Partner engagement and inclusiveness
- Democratize knowledge – accessible, rural reach, influencers
- Advocacy promotion, legislation, good public policy
- Predictive modeling, innovation, practices, collaboration

Community Partners

Relay Utah – L Dean



Never Miss Another Word – State Phone Program Provides Hearing Assistive Phones

www.Relay.Utah.Gov

“Would you repeat that number, please?”

“I can’t hear you, would you speak a little louder?”

“I’m sorry, I’m going to have to have you speak with my daughter. I can’t hear you.”

If this is your experience talking the on the phone, or of your loved one, you are not alone. About 1 in 10 Utahns experience some degree of hearing loss. Relay Utah, a state program managed by the Utah Public Service Commission, was established more than 20 years ago for just this reason.

Hearing assistive phones and other technologies are provided at no cost to anyone who is currently receiving public assistance or is on Medicaid. And hundreds of people received phones from Relay Utah just last year and are now enjoying the independence and connections with family and friends once again.

WITH NUMEROUS PHONES AND TECHNOLOGIES, ONE TO FIT EACH NEED

- ***Amplified Phone.*** One of Relay’s most popular phones, an amplified phone increases the volume and also adjusts the tone of the incoming voice. The tone adjustment capability is especially helpful if you have a hard time particularly with hearing a male voice or vice versa a female voice. The anti-feedback filter makes every word clearer and easier to understand without feedback and distortion, even with hearing aids. And corded or cordless models are available.

- ***Amplified ‘Talking Telephone’ for Visually/Hearing Challenged.*** This user-friendly phone is for hard of hearing individuals that are also blind or have partial sight. It has a big button, tactile keypad and has “talking” caller ID. The phone also vocalizes numbers, menu commands, the date and time.

- ***CapTel®.*** “CapTel” is a caption telephone. This means that in addition to amplifying volume and tone, the words a caller is saying are also captioned and displayed on a large display screen. With CapTel you can listen and read the conversation at the same time. The combination of these two features makes it easier for individuals who really have hard time hearing to not miss parts of a conversation.

RELAY UTAH DEMO CENTER

Try the hearing assistive phones to see what works best for you at the Relay Utah Demo Center:

168 N. 1950 W. Ste. 103
Salt Lake City 84116

Open Monday through Friday; schedule an appointment by emailing Jodi Goodenough at jgoodenough@utah.gov or by calling 801-715-3470 (v/tty).

Alzheimer's Coordinating Council – L Meinor

Few updates from the Alzheimer's and Related Dementias Coordinating Council:

- Plans are underway for the Second Annual Cognitive Care Conference to be held on October 5, 2018. The training will be offered for healthcare professionals/medical students as well as Social work and nursing students/professionals. The second track will be presented to informal and family caregivers.
- Dementia Dialogues Train the Trainer will be offered August 15-16th for social workers, case managers and nurses. This training will qualify individuals to conduct Dementia Dialogues as an instructor for groups across the state.
- "Positive Approach to Care"- 2-day Trainer Certification on June 7-8th at University of Utah. This certification is designed for individuals who wish to train others in the PAC philosophy providing dementia related awareness, knowledge and skill development in a classroom, support group or community setting.
- Alzheimer's and Coordinating Council meeting will be held July 19th from 10-12:00 at UDOH.
- Legislative funding request- \$1,000,000 targeted to the Department of Human Services and Utah Department of Health.

Utah Working Interdisciplinary Network of Guardianship Stakeholders (WINGS) – K Abuzyrova

Utah Working Interdisciplinary Network of Guardianship Stakeholders (WINGS) under the leadership of the Utah State Courts is addressing judicial education in the field of guardianship and advance life planning with assistance from the Elder Justice Innovation grant of the American Bar Association Commission on Law and Aging and National Center for State Courts.

Court received permanent funding from the legislature in this last session for the Court Visitor Volunteer Program, that is a guardianship reporting and monitoring program.

U4A (Utah Association of Area Agencies on Aging) - All

Registration is now available for the Elder Abuse Conference “Break the Silence” scheduled May 15, 2018 at the Snow College Campus in Richfield, Utah.

<https://utahelderabuse.org/>

This conference is designed to promote education, discussion and solutions for the issues being faced by our Elders and Caregivers in Utah today. This conference is developed for advocates, direct service providers, law enforcement, legal/financial professionals, health and social work professionals.

Paul Greenwood-San Diego County District Attorney will be the Keynote speaker.

Special Guest Speakers:

- Sandy Markwood-Chief Executive Office of National Association of Area Agencies on Aging (n4a)
- Kit Gruelle-Domestic violence and sexual assault victim advocate will be a Guest Speaker.

Falls Prevention - S Aerts

The Falls Prevention Alliance is in the early stages of developing a pilot project using cHIE to link Medicare Advantage plans with Gold Cross 911 non-transport data for falls. The Utah Department of Health is expanding Tai Chi classes to senior centers in Utah, Davis and Salt Lake County. Stepping On workshops, in addition to being offered at traditional settings such as libraries and Senior Centers, are now being offered at Jordan Valley Medical Center and several Intermountain Healthcare facilities. Rob Ence, Kristy Cottrell, Marianne Christensen, and Sally Aerts will be presenting Utah’s multi-faceted fall prevention efforts at the National Association of Area Agencies on Aging annual conference in July. Visit our website at www.ucoa.utah.edu/fpa

Preparing Seniors for Emergencies Pilot – L Milne

With the cooperation of Tracey Gibson at the Millcreek Senior Center, I have presented two quarterly programs to the seniors there. The first was a presentation of the S.A.F.E. Neighborhoods program in the Millcreek area. Presentation two was a *show n tell* on how to prepare age-appropriate 96-hour emergency kits for: 1) on-foot evacuation; 2) auto evacuation; and, 3) sheltering in place. The third program, scheduled for Wednesday July 11th at 1:30 will introduce the idea of a Neighborhood Support Network for senior safety and how to create it on one's own street. The fourth program will be presented on Wednesday October 10th, same time, and will be a demonstration on how seniors can make connections with younger, stronger neighbors who could offer some support to them in times of crisis.

Millcreek Center has purchased first aid kits as a gift for those who attend the full hour in July. Additional incentives are going to be offered as well.

University of Utah Gerontology Interdisciplinary Program – J Eaton

The Association for Gerontology in Higher Education (AGHE) awarded our Master's Degree program the AGHE Program of Merit designation. This status lasts five years and recognizes high quality programming that is consistent with globally vetted gerontology criteria to ensure that students receive the knowledge and skills necessary for employment in the workforce. Specific commendations include:



- PhD trained faculty representing a variety of disciplines
- Competency based Gerontology curriculum
- Innovative leadership and ideas for growth
- Strong relationship with local communities
- Required internship and practice hours
- Outcomes-based assessment

For more information, visit us at: <http://nursing.utah.edu/gerontology/>



Music & Memory Utah Coalition

Crescendo Music – The Gleeful Choir – E Christensen

Gleeful choir is up and running. We had our first performance on April 5th at the U of U Gerontology Dept. Creative Aging retreat. We are scheduled to perform again on May 30th at the National Health and Fitness day put on by SLC Aging. The entire event is from 1 - 4. We are scheduled to sing from 2:30 - 2:45, Veridian Event Center 8030 S. 1825 W. West Jordan. KSL did a great story on our choir, highlighting some of our members, <http://ksltv.com/393922/power-music-lyrics-notes-open-doors-dementia-patients-special-choir/>.

We currently have 10 members. We would love help in recruiting more! More info can be found on our website, gleefulchoir.com. We can also be found on Facebook.

Creative Aging in Utah – K Crossley

A 2017 survey shows that creative aging programs involving professional teaching artists are now offered by the state's leading arts organizations, such as, Utah Symphony and Opera, Ballet West, Repertory Dance Theatre, and Ririe-Woodbury Dance Company. Many of Utah's major universities, local arts councils, and community-based organizations offer more than 20 creative aging and lifelong programs that serve more than 5,000 older adults throughout Utah.

The Arts Council of Washington County has sponsored The Creative Age Symposium in 2016 and 2017, with plans underway for 2018. The conference features presentations from national and state leaders in arts education, healthcare and policymaking, examining the importance of various art disciplines for older adults in improving their cognitive abilities, their mobility and balance, and improvements in their overall wellness and happiness in their senior years.

Music & Memory Update – L Rodgers, West Region Program Coord

More than 100,000 nursing home residents have benefited in one or more ways from access to their favorite music: **Reduced antipsychotic**, anxiolytic and antidepressant medications; Significant **decrease in falls**; Improved **pain management**; Fewer **hospital visits**. Current focus is on expanding to other settings, including where the program is effective. Program can also be of great benefit in transitions between settings. For a **look at growth, settings, results and new efforts** see our [2017 Impact Report](#).

Research (see following attachment) – J King

NOTE: Research for internal use now – not for distribution.

The manuscript mentioned in the previous meeting has been published in the Journal of Prevention of Alzheimer's Disease.

No link is provided as the journal told us that the manuscript would be available on their website this past Friday. To date, this has not happened. As such, I have attached a copy of the manuscript for your review. As it is not an open access manuscript, please do not post to any websites and keep only for personal use.



JOIN THE CHOIR!



WHO: Persons living with dementia and their care partner

WHEN: Tuesdays from 1:30 - 3:00

WHERE: Congregation Kol Ami
2425 East Heritage Way, SLC

FREE OF CHARGE!
NO EXPERIENCE NECESSARY
REHEARSALS BEGIN MARCH 13, 2018

For more information and registration:
email: emily@musictherapyutah.com
www.gleefulchoir.com
call: 435-840-5661



Jewish Family Service
www.jfsutah.org



National
Endowment
for the Arts
arts.gov



Increased Functional Connectivity After Listening to Favored Music in Adults With Alzheimer Dementia

J.B. King^{1,2}, K.G. Jones¹, E. Goldberg³, M. Rollins², K. MacNamee⁴, C. Moffit⁴, S.R. Naidu⁵, M.A. Ferguson⁶, E. Garcia-Leavitt⁷, J. Amaro⁷, K.R. Breitenbach⁸, J.M. Watson^{4,9}, R.K. Gurgel^{5,10}, J.S. Anderson^{1,2,11}, N.L. Foster^{7,12}

1. Interdepartmental Program in Neuroscience, University of Utah, Salt Lake City, UT, USA; 2. Department of Radiology and Imaging Sciences, University of Utah, Salt Lake City, UT, USA; 3. Jewish Family Services of Utah, Salt Lake City, UT, USA; 4. Department of Psychology, University of Utah, Salt Lake City, UT, USA; 5. Department of Communication Sciences and Disorders, University of Utah, Salt Lake City, UT, USA; 6. Berenson-Allen Center for Noninvasive Brain Stimulation, Division of Cognitive Neurology, Department of Neurology, Harvard Medical School and Beth Israel Deaconess Medical Center, Boston, MA, USA; 7. Center for Alzheimer Care, Imaging, and Research, University of Utah, Salt Lake City, UT, USA; 8. Genetic Science Learning Center, University of Utah, Salt Lake City, UT, USA; 9. Department of Psychology, University of Colorado Denver, Denver, CO, USA; 10. Department of Otolaryngology, University of Utah, Salt Lake City, UT, USA; 11. Department of Bioengineering, University of Utah, Salt Lake City, UT, USA; 12. Department of Neurology, University of Utah, Salt Lake City, UT, USA

Corresponding Author: Jeffrey S. Anderson, 1A71 School of Medicine, 50 N Medical Drive, Salt Lake City, UT 84132, andersonjeffs@gmail.com

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Abstract

BACKGROUND: Personalized music programs have been proposed as an adjunct therapy for patients with Alzheimer disease related dementia, and multicenter trials have now demonstrated improvements in agitation, anxiety, and behavioral symptoms. Underlying neurophysiological mechanisms for these effects remain unclear.

METHODS: We examined 17 individuals with a clinical diagnosis of Alzheimer disease related dementia using functional MRI following a training period in a personalized music listening program.

RESULTS: We find that participants listening to preferred music show specific activation of the supplementary motor area, a region that has been associated with memory for familiar music that is typically spared in early Alzheimer disease. We also find widespread increases in functional connectivity in corticocortical and corticocerebellar networks following presentation of preferred musical stimuli, suggesting a transient effect on brain function.

CONCLUSIONS: Findings support a mechanism whereby attentional network activation in the brain's salience network may lead to improvements in brain network synchronization.

Key words: Personalized music, dementia, supplementary motor area, fMRI, functional connectivity.

Introduction

Individualized music programs have been proposed as adjunct treatments for a large and growing population of individuals with Alzheimer disease and related dementias (1). Approaches to formal interventions utilizing personalized music therapy consist of identifying favorite music of an individual through interviews with the individual, friends, and family, and training on a personalized music device, as well as observation of symptomatic improvement and evaluation for other causes of agitation or anxiety (2).

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Specific benefits from listening to personalized or favorite music, rather than background or “relaxation” music, have been shown (3, 4).

Several studies have investigated symptomatic improvements associated with personalized music therapy or listening programs. While an intervention that was not personalized for individual participants involving live music did not show benefit on levels of depression or quality of life (5), in contrast, personalized music programs have resulted in improvements in depression (6, 7), anxiety (6-9), agitation (10, 11), and behavioral symptoms (9, 12), although mixed results have also been observed (13, 14). In a retrospective study examining over 25,000 patients in long-term care facilities, those with individualized music programs showed decreased rates of antipsychotic medication, decreased anxiolytic medication, and reduced behavioral problems (15).

Even in patients with advanced dementia, music recognition appears to be a relatively spared domain of memory function (16). Memory of musical selections is preserved in patients with impaired verbal memory (17). There may be integration of music and autobiographical memory in the medial prefrontal cortex, facilitating retrieval of personally salient episodic memories when listening to familiar musical excerpts (18). Familiarity of music is directly related to engagement of brain resources in response to music (19), and positive valence of musical selection also enhances how memorable music may be (20).

Brain mechanisms for symptomatic benefits from individualized music programs are not well understood. Early reports of symptomatic improvement through personalized music therapy proposed a “Progressively Lowered Stress Threshold Model” as a conceptual framework (3, 21). This hypothesis posited that impaired sensory perception and processing lowered a stress threshold and heightened anxiety, and that familiar

or personally meaningful music might be more easily perceptible than unfamiliar or background stimuli, resulting in decreased anxiety. More recent studies of emotive content of music have emphasized the role of brain reward circuits and dopamine responses as a mechanism for pleasure associated with listening to favorite music (22). Alternatively, benefits may be secondary to effects on brain attentional systems or through stimulation of brain regions associated with autobiographical stored memories. To discriminate among putative neurophysiological mechanisms, we performed functional brain imaging in a cohort of patients with mild Alzheimer disease.

Methods

All experimental procedures were performed following informed consent for research participants in accordance with protocols approved by the University of Utah Institutional Review Board and the Code of Ethics of the World Medical Association for protection of human subjects in scientific research.

Participant Selection and Characteristics

A total of 22 individuals participated in the evaluation and scanning portion of the study. After all data was collected, fMRI scans were visually inspected and pre-processed to account for head motion. Subjects with high motion during the resting-state (<100 motion-free volumes, $n=4$) or visible artifacts on BOLD images ($n=1$) were excluded from further processing, giving a final subject pool of $n=17$. Of these participants, there were 11 males and 6 females with a mean age of 71.82 ± 5.96 years.

Personalized Music Training

Each individual completed a period of personalized music training that consisted of meeting with the patient and caregivers, identifying favorite songs and music styles, training of patient and caregivers on an iPod device with personalized music, and confirmation over at least 3 weeks following the training that patients had used the device independently following the training.

Preferred Music for Participants

Participants submitted a list, in advance, of music that had personal significance to them. From each song, 20 second segments were selected to be played for the participant during a scan. The 20 second selections were taken from the most iconic and recognizable moments in each song. For popular music selections (i.e. country, jazz, rock, etc.), show tunes, and other modern lyrical songs selections were taken from the chorus, the first verse, or the opening of the song. For instrumental popular music,

selections were taken from the refrain, introduction, or at the beginning for an iconic solo. For pieces of western art music (baroque, classical, romantic, etc.) selections were taken from easily recognizable statements of the main or secondary theme in exposition and recapitulation sections, as well as strongly defined introductions to developmental sections, and climactic cadential moments with loud dynamics. Lastly, choral selections were made similarly to popular music (choruses and introductions), but sometimes selections came from instrumental interludes with clear statements of a main theme.

Auditory Evaluation

We measured pure tone averages (PTA) in a sound booth. Subjects with a four-frequency (0.5, 1, 2, and 3 kHz) PTA greater (worse) than 40dB HL were not considered for the imaging portion of the study. This cutoff was chosen so that only subjects with relatively normal hearing or only mild hearing loss were included in the study. Subjects with hearing thresholds worse than 40dB HL could potentially confound the imaging data as we evaluate the central processing of sound because they lack peripheral (cochlear) acuity to deliver the stimulus to the brain.

For those subjects with a PTA less than 40dB HL, we measured standard word recognition scores to test peripheral auditory function. As per previously published protocols, we also administered three behavioral central auditory tests based on their standardization, ease of use, likelihood of being affected by dementia, and testing of different central auditory skills (23). The tests included the Synthetic Sentence Identification with Ipsilateral Competing Message test (SSI-ICM) (24) and two dichotic tests involving speech: the Dichotic Sentence Identification test (DST) (25) and the Dichotic Digits Test (DDT) (26). The sequence of test presentation was randomized to prevent an order effect.

MRI Acquisition

Imaging was performed in the sagittal plane on Siemens Trio 3T MRI Scanner with Siemens 32 channel head coil. Structural imaging consisted of MP2RAGE sequence (TR = 5 s, TE = 2.91 ms, TI = 700 ms, GRAPPA acceleration factor = 2, $1 \times 1 \times 1$ mm resolution). Functional imaging consisted of one task fMRI sequence (8 minutes duration) and 2 resting-state fMRI sequences (10 minutes duration each). Resting-state fMRI acquisitions were acquired with participants' eyes open and instructions to "allow your mind to wander and let thoughts pass through your mind." fMRI sequences were acquired using multiband acquisition (multiband factor = 8, TR = 800 ms, TE = 33 ms, $2 \times 2 \times 2$ ms resolution).

Structural MRI Processing

The FreeSurfer imaging analysis environment (v6.0.0), which is documented and freely available for download (<http://surfer.nmr.mgh.harvard.edu/>), was used to process structural scan data to obtain subject-specific subcortical regions of interest given characteristic volume loss in dementia patients and risk of volume averaging with the ventricles using a voxelwise atlas-based approach to region selection (27). A detailed description of the FreeSurfer pipeline can be found on the FreeSurfer website.

fMRI Music Task

A passive listening task consisted of 24 blocks of 20 seconds each presented in random order with instructions to listen to the musical selections. 8 blocks each of the music selection presented forward, 8 blocks with the same selections presented in reverse, and 8 blocks of silence were presented. Four preferred musical selections were chosen from each subject's favorite musical selections by a professional classical composer (KB) to include iconic clips of the selected music (as detailed above). Song clips and reversed selections were created using Logic Pro X software.

Activation maps for forward music > silence, reverse music > silence, and forward music > reverse music were obtained for each subject using a general linear model in the SPM12 software suite (Wellcome Trust, London) following postprocessing that included motion correction (realign: estimate and reslice), coregistration to MP2RAGE image (coregister: estimate), normalization to MNI space (normalize: estimate and reslice), and smoothing (FWHM: 6 mm kernel). Second level estimates were obtained across 17 subjects using 2-direction t-tests for each of the three selected contrasts. Statistical significance was assessed using cluster-defining threshold of $p < 0.001$ with familywise error corrected cluster-level significance to account for multiple comparisons.

Resting-state fMRI Processing

A postprocessing pipeline was selected to optimize correction for head motion and physiological artifacts, and physiological waveforms from heart rate and respiration were explicitly recorded for each subject during each resting state acquisition to use as regressors. Motion correction, coregistration, segmentation, and normalization of MP2RAGE and BOLD to MNI template was performed in SPM12 software (Wellcome Trust, London) for MATLAB (Mathworks, Natick MA). Phase-shifted soft tissue correction (28) was used to regress physiological waveforms as well as regressors obtained from 6 detrended subject motion parameters, degraded

white matter, degraded cerebrospinal fluid, and soft tissues of the face and calvarium. Censoring of frames showing greater than 0.2 mm (motion scrubbing) was performed as a final step prior to analysis with concatenation of remaining frames (29). No significant differences were seen in root-mean-square head motion between initial and final resting state acquisitions for each subject using paired t-test across subjects.

Region of Interest Selection

Resting-state fMRI data were analyzed using brain parcellations at 2 levels of granularity. Average time series were extracted from each of 7 distributed brain networks associated with the cortical parcellation of Yeo et al. (30) and cerebellar parcellation of Buckner et al. (31). Cerebellar time series were extracted from left-lateralized and right-lateralized voxels in each of the 7 networks. Each network was treated as a single region of interest, and BOLD time series was averaged across all voxels for each of the 7 networks for each of the 740 volumes in each of the 2 runs for each subject after excluding the first 20 volumes of each run.

A finer parcellation consisted of 333 regions in the cerebral cortex (32). Fourteen subject-specific subcortical regions were added using FreeSurfer-derived segmentation (33) of bilateral thalamus, caudate, putamen, amygdala, hippocampus, pallidum, and nucleus accumbens, segmented independently for each subject. Fourteen cerebellar regions were also added (31) comprising left- and right-hemispheric representations of a 7-network parcellation. This combined parcellation scheme covering cortex, subcortical structures, and the cerebellum comprised a total of 361 regions. Average BOLD time series were extracted for each volume in each run for each subject.

Results

Auditory Testing Results

The average pure tone thresholds for the right and left ears were 24.9dB and 24.6dB, respectively, indicating normal peripheral hearing (average <25dB or the volume of a whispered voice). Average dichotic sentence scores for the right and left ears were 91% and 45%, respectively. Average dichotic digit scores for the right and left ears were 94% and 90%, respectively. Average Synthetic Sentence Identification test results with a 20dB, 0dB, and -20dB signal-to-noise ratio were 91%, 71%, and 40%, respectively.

Imaging Results

Participants listened to favorite musical selections, personalized for each individual, compared to the same

Table 1. Significant activation associated with fMRI music contrasts

Music Forward > Silence						
Region	p-Value (Cluster, FWE)	T-Statistic	Voxels	MNI: X	Y	Z
Left Auditory Cortex	8.9 e-16	12.82	2169	-56	-2	-6
Right Auditory Cortex	4.4 e-16	9.99	2224	56	-8	-6
Right Inferior Frontal	0.015	6.45	166	50	20	18
Supplementary Motor Area	0.012	5.82	175	6	2	70
Right Premotor Cortex	0.020	5.67	156	50	-2	44
Left Cerebellum	0.022	5.59	152	-22	-72	-32
Music Reverse > Silence						
Region	p-Value (Cluster, FWE)	T-Statistic	Voxels	MNI: X	Y	Z
Left Auditory Cortex	5.38 e-14	10.19	1710	-62	-16	6
Right Auditory Cortex	2.49 e-14	8.41	1770	56	4	-8
Music Forward > Music Reverse						
Region	p-Value (Cluster, FWE)	T-Statistic	Voxels	MNI: X	Y	Z
Supplementary Motor Area	0.00036	5.72	295	-8	2	60

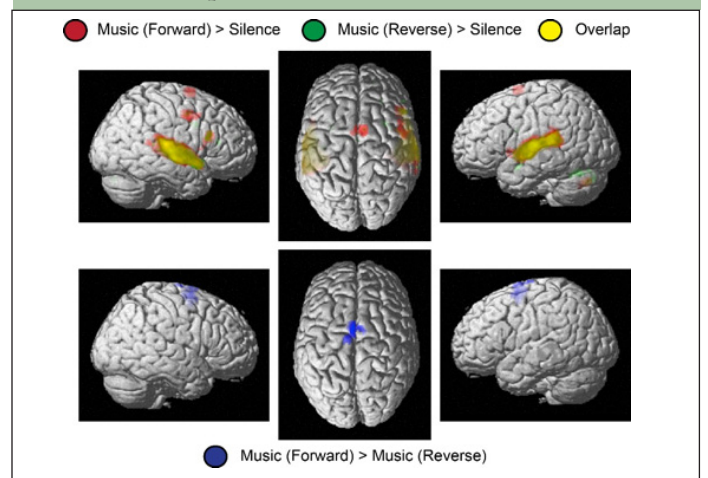
selections played in reverse. When selections were played in reverse, auditory content was preserved while iconic motifs, language, and familiarity of the music was disrupted. Functional activation associated with forward and reversed musical stimuli is shown in Figure 1. Both forward and reverse musical stimuli elicited activation within bilateral auditory cortex and areas of left lateral frontal lobe, and cerebellum. There was specific activation seen in the bilateral, left greater than right, supplementary motor area for musical stimuli played forward, with a significant cluster for forward vs. reverse stimuli. Details of activated regions are displayed in Table 1.

To evaluate functional connectivity before and after the music task, we performed 10-minute resting-state fMRI acquisitions and calculated functional connectivity between mean time series of 7 brain networks from a previously published parcellation of the cerebral cortex (30) and cerebellum (31). The cerebellar time courses were calculated separately for left and right cerebellar hemispheres. Mean functional connectivity for each pair of cortical and cerebellar network time series was calculated as the correlation coefficient between the time series. A paired t-test across subjects was performed to identify network functional connectivity that differed significantly after the music task compared to before the music task, with results shown in Figure 2.

Significantly higher functional connectivity was observed after the music task for the visual network compared to somatomotor, salience, and executive networks, and for numerous cerebellar and corticocerebellar network pairs as shown. All results were corrected for multiple comparison corrections using false discovery rate approach. No network pairs showed

significantly decreased functional connectivity after the music task.

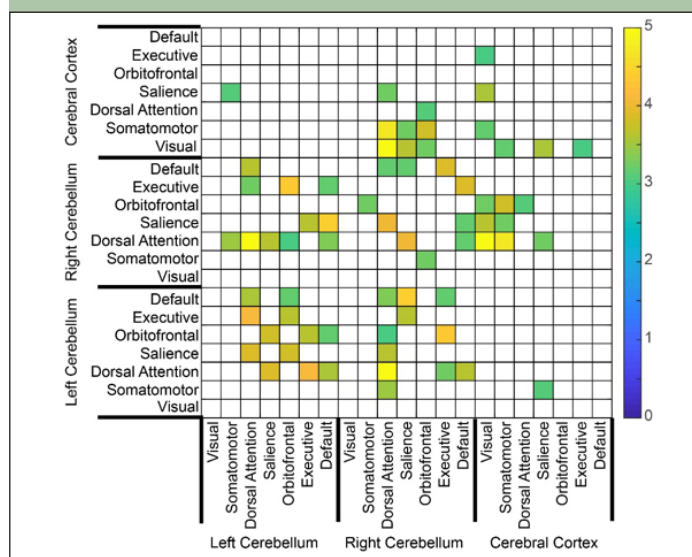
Figure 1. Response to Favorite Music. Images show significant activation across participants to preferred musical selections played forward and in reverse greater than to blocks of silence (above), and to forward greater than reversed musical selections (below). Results were cluster corrected using family-wise error, with display threshold set at $p < 0.001$



To evaluate at a finer spatial distribution changes in functional connectivity, we computed time courses for 361 regions comprised of a 333-region functional brain parcellation of the cerebral cortex (32), 14 subcortical regions derived from subject-specific FreeSurfer segmentation, and the 14 cerebellar regions from the Buckner et al. parcellation shown in Figure 2 (31). Results

for comparison of functional connectivity after vs. before the music test show in Figure 3 that for almost all brain region pairs functional connectivity after the music task was equal to or higher than before the task. While no individual connections were significant following full multiple comparison correction across all 361 x 361 region pairs given the modest sample size, the mean functional connectivity averaged across all region pairs was higher after the task compared to before ($p=0.0167$, paired t-test over 17 subjects).

Figure 2. Changes in functional connectivity after listening to preferred music. Colored squares show functional connections between 7 cortical networks and corresponding networks within the left and right cerebellum that showed greater connectivity after musical task than before, corrected by false discovery rate <0.05 across all connections. Color scale shows t-statistic from bidirectional paired t-test across 17 subjects



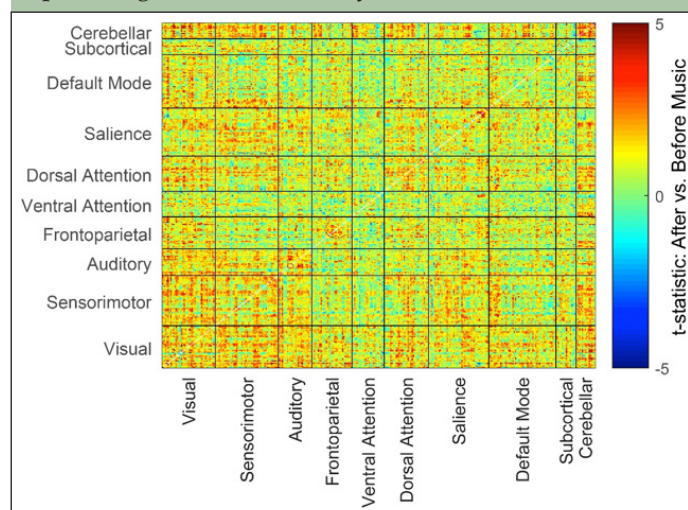
Discussion

In a cohort of patients with Alzheimer disease related dementia, we find that listening to preferred musical selections is specifically associated with activation of the supplementary motor area when compared with the same selections played in reverse such that passages were not clearly recognizable. After a period in which favorite musical selections were played, there were widespread increases in fMRI connectivity involving both corticocortical and corticocerebellar connections, particularly involving sensory and attentional networks.

These findings directly support previous research identifying the supplementary motor area as a region associated with selective activation to more familiar musical stimuli (34, 35). This region, in addition to the anterior insula that was also more active for familiar music, may play an important role in the preservation

of musical memory in Alzheimer disease related dementia given that these areas tend to be relatively spared from neurodegenerative processes in the disease (34). Recognition of famous musical passages has also been associated with preservation of brain tissue in the anterior temporal lobes in Alzheimer and semantic dementias (36).

Figure 3. Changes in functional connectivity after listening to preferred music. Results from connections between 361 x 361 gray matter regions of interest, grouped by functional network. Warm colors represent greater connectivity after the music task and cool colors represent greater connectivity before the music task



The dorsal anterior cingulate, supplementary motor area, and frontal insula comprise a brain network known to process stimulus salience across multiple sensory and cognitive domains, and form a core part of the brain's ventral attention network engaged in response to novel or unexpected stimuli (37). The specific activation of the supplementary motor area for favorite musical selections may suggest an attentional mechanism for symptomatic improvements associated with music listening whereby preferred musical selections evoke brain attentional responses, at least for a window time following the musical stimuli.

The brain's salience network is closely associated with reward circuits in the ventral striatum, also known to play a key role in both salience processing and music appreciation. Activation of dopaminergic pathways in the ventral striatum is associated both with salience and valence of sensory stimuli (38), with dopamine signaling salience of rewarding stimuli (39). Selective activation of the ventral striatum has been associated with responses to musical stimuli evoking emotional chills (40), and specific activation of the dopaminergic striatum has been demonstrated in response to favorite music (22).

Widespread decreases in functional connectivity have been observed in Alzheimer disease related dementia, with earliest involvement of the brain's default network

(41-46). In contrast, the brain's salience network is relatively preserved until late in Alzheimer disease and given the specific ability of familiar music to engage these circuits (34) may facilitate attention, reward, and motivation associated with the salience and mesolimbic networks (47).

Increased functional connectivity in our results associated with a personalized musical intervention suggests recruitment of brain networks that were highest among sensory regions and corticocerebellar circuits. Given that Alzheimer disease related dementia is typically associated with decreased functional connectivity (48), it is plausible that symptomatic relief observed after musical interventions may be related to such connectivity increases that occur in the context of apathetic and amotivational states observed in dementia. Anecdotal evidence from observation of music listening programs has highlighted precisely this type of "awakening" associated with musical interventions (49).

It remains unclear from our results the duration and generalizability of the effect on brain connectivity and attentional activation seen in our results. We studied only a single imaging session, and while participants had been trained for a period of weeks on a music-listening program, it is unknown whether such training was required to see an effect, whether such an effect persists beyond a brief period following stimulation, or whether other functional domains such as memory or mood may be enhanced by the specific changes in neural activation and connectivity in our results. Given the modest sample size in our study and known heterogeneity of symptoms in patients with early Alzheimer Disease, these results serve primarily a heuristic value in suggesting mechanisms for neurophysiological effects that can be tested in clinical trials with larger sample sizes and control of additional variables such as psychiatric comorbidities, personal musical history, environmental support, and pharmacotherapy. Further, while we do observe widespread increases in functional connectivity following music listening, our study is not powered to specifically identify which brain networks are primarily affected.

Nevertheless, we find support for an effect in Alzheimer patients for personalized music interventions that utilize favorite musical selections of individuals to promote improved attention and function consistent with the empirical benefits seen in clinical practice (15). Given the potential benefit of adjunctive therapies such as personalized music intervention, particularly given the low cost, few reported adverse side effects, and wide potential availability of these interventions in a large and growing patient group with enormous social cost and personal impact, continued evaluation of mechanisms and potential applications of personalized music programs and music therapy is warranted.

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Ethical standard: All experimental procedures were performed following informed consent for research participants in accordance with protocols approved by the University of Utah Institutional Review Board and the Code of Ethics of the World Medical Association for protection of human subjects in scientific research.

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Developed by Johns Hopkins School of Nursing, New Ways for Better Days: Tailoring Activities for Persons with Dementia and Caregivers (TAP) is an individualized, family -centric program. It provides people with dementia with activities that are tailored to their abilities and interests and trains caregivers (formal and informal) in use of activities as part of daily care routines. The program has been shown in randomized trials to improve quality of life of persons with dementia, and reduce behavioral symptoms and caregiver time providing care as well as improving engagement and caregiver sense of efficacy.

The program is delivered or supervised by occupational therapists and involves three phases: A novel assessment approach to identify preserved capabilities, physical functioning and previous and current interests of the person with dementia;

Development of “activity prescriptions” which specifies the person’s capabilities, an activity and activity schedule, specifications for setting up the activity and strategies for effectively involving the person with dementia;

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WHS Senior Companion Program has received a grant to implement New Ways for Better Days as a pilot program investigating the use of volunteers to engage in tailored activities with clients who have dementia.

The grant will fund the training and certification costs for Occupational Therapist who would be willing to provide in-kind match for the grant.

The Senior Companion Program is part of the Corporation for National and Community Services, the federal agency for volunteering, service, and civic engagement.



Weber Human Services

Senior Companion Program

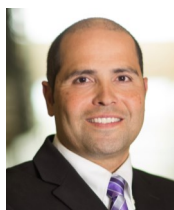
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2018 Alzheimer's Research Symposium Series

- ♦ *May 10, 6:30-8:30 PM, Provo Library at Academy Square, Dr. Keoni Kauwe, Ph.D.*
- ♦ *June 13, 6:30-8:30 PM, Logan Public Library, Dr. Elizabeth Fauth, Ph.D.*
- ♦ *June 27, 6:30-8:30 PM, Salt Lake City Library, Dr. Kevin Duff, Ph.D., ABPP (CN)*

SYMPOSIUM SPEAKERS



Dr. John "Keoni" S.K. Kauwe, Ph.D., is an internationally recognized researcher specializing in Alzheimer's disease genetics at Brigham Young University. His research focuses on innovative approaches to characterize the genetic architecture of Alzheimer's disease and he has made important contributions towards discovering more than a dozen new genetic risk factors for Alzheimer's disease. He will present at the Provo Event.



Dr. Elizabeth (Beth) Fauth, Ph.D., is an associate professor in the Family, Consumer, and Human Development at Utah State University. She teaches undergraduate classes in gerontology, and is the coordinator of the gerontology certificate program at USU. She conducts research on the integration between well-being and social support and the transition into needing assistance late in life. She also conducts research on stress and well-being in family caregivers of persons with dementia. She will be sharing interesting findings from her research. She will present at the Logan Event.



Dr. Kevin Duff, Ph.D., ABPP (CN), is an Associate Professor in the Department of Neurology at the University of Utah, and is a neuropsychologist at the Center for Alzheimer's Care, Imaging and Research (CACIR) where he conducts clinical research in neuropsychology, aging, and dementia. He will be sharing research findings that CACIR has been engaged with including PET imaging, environmental indicators, and Mild Cognitive Impairment. He will present at the Salt Lake City Event.



Ronnie Daniel is the executive director of the Alzheimer's Association, Utah Chapter. Over the past four years that he has served in this capacity, he has helped increase care and support services for all people affected by Alzheimer's disease and related dementia. The chapter has been instrumental in engaging the State of Utah to adopt a state Alzheimer's Plan and fund the plan. He also has been a strong advocate for strengthening research for Alzheimer's. He will present exciting news about research occurring nation-wide. He will present at all three events.

REGISTRATION INFORMATION:

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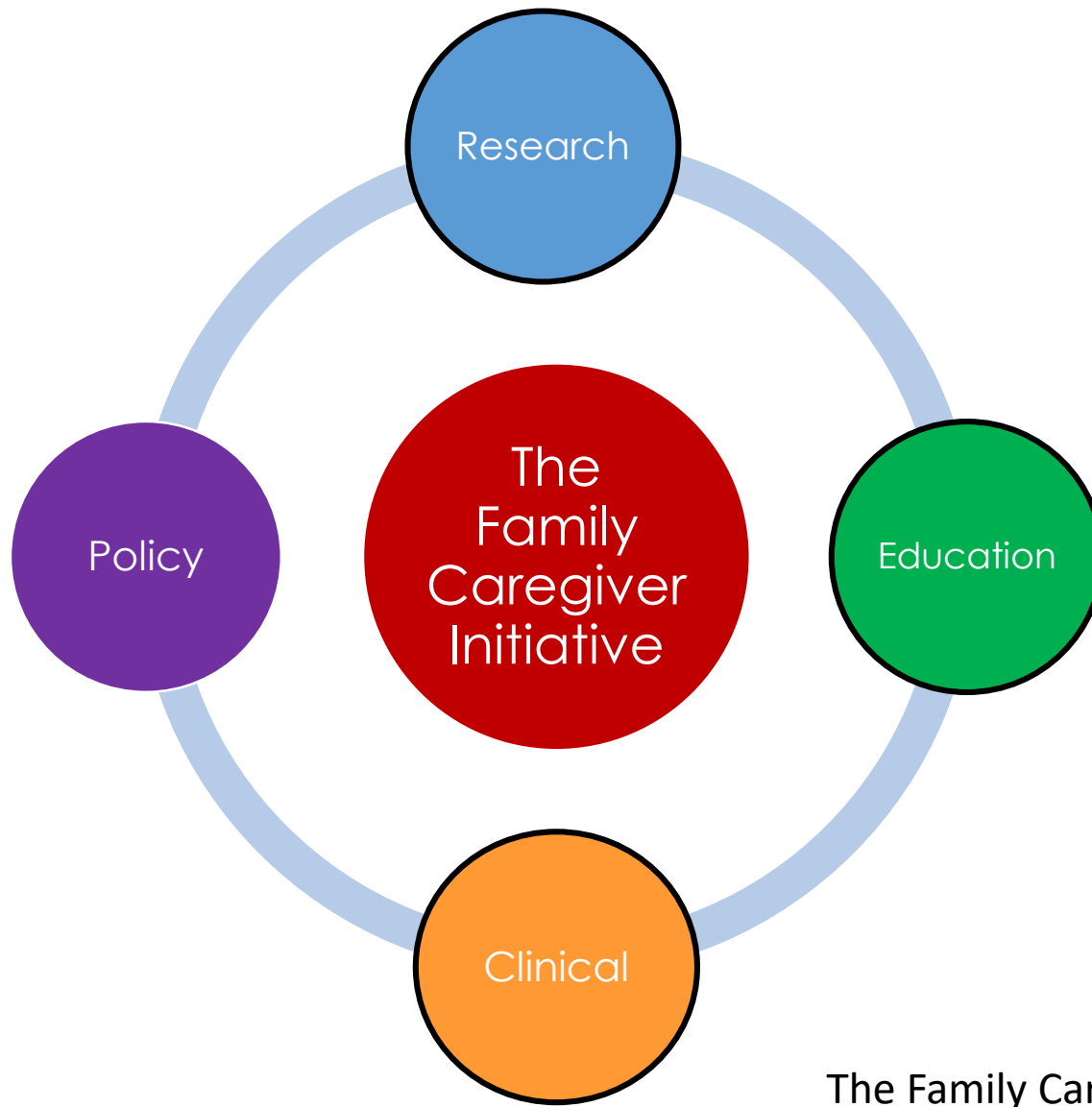
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