

Music and Rhythm for Parkinson's: Improving Physical and Mental Wellbeing

Alexander Pantelyat, MD

Assistant Professor of Neurology; Director, Johns Hopkins
Atypical Parkinsonism Center; Director, Johns Hopkins Center
for Music & Medicine



Johns Hopkins Center for Music & Medicine

- <https://www.hopkinsmedicine.org/center-for-music-and-medicine/>
- Vision
 - Music as medicine. Medicine for musicians.
- Mission
 - To bring music and medicine together by:
 1. Making music and rhythm an integral part of treating illness
 2. Improving the health of musicians worldwide

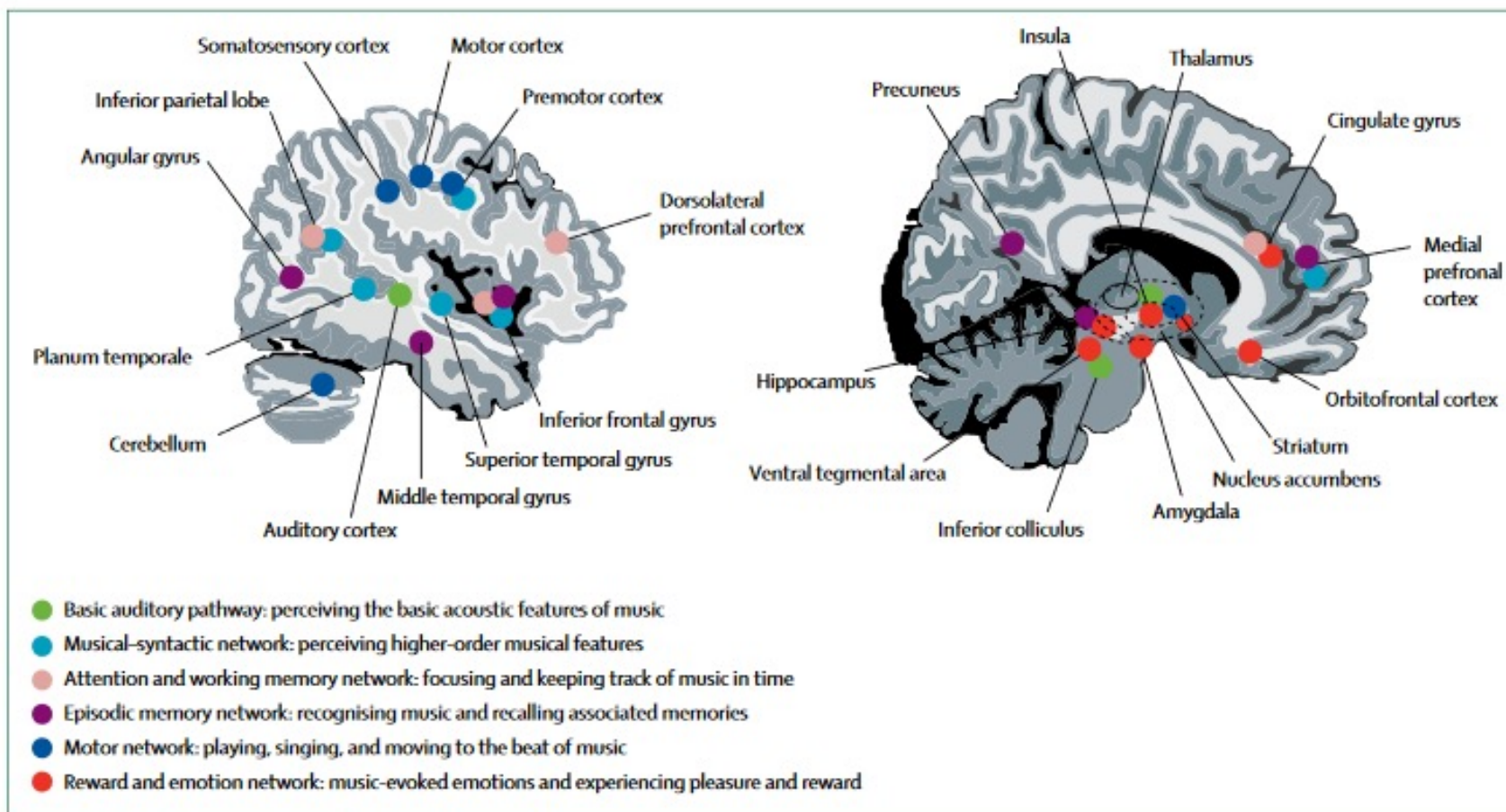
Outline

- How music affects the brain
- Types of music-based interventions
- Action steps
- Questions

‘Music do I hear? Ha, ha, keep time: how sour sweet music is when time is broke and no proportion kept.’

- Shakespeare, Richard II, Act 5 scene v

Music Processing



OPERA Hypothesis

- Benefits of music are driven by adaptive plasticity in speech-processing networks, and that this plasticity occurs when 5 conditions are met. These are:
-

1. **Overlap:** there is anatomical overlap in brain networks that process acoustic features used in both music and speech (e.g., waveform periodicity, amplitude envelope)
2. **Precision:** music places higher demands on these shared networks than does speech, in terms of the precision of processing

OPERA Hypothesis

- 3. Emotion:** the musical activities that engage this network elicit strong positive emotion
- 4. Repetition:** the musical activities that engage this network are frequently repeated
- 5. Attention:** the musical activities that engage this network are associated with focused attention

Music and Neural Plasticity

Ramon y Cajal, 1904:

*Everybody knows that the ability of a pianist [...] adaptation to the new work [...] requires many years of mental and muscular gymnastics. To understand this important phenomenon, it is necessary to accept that, **in addition to the reinforcement of pre-established organic pathways, new pathways are created by the ramification and progressive growth of terminal dendritic and axonal processes.** (p. 541)*

Ramon y Cajal S. 1999. Pasik P, Pasik F, translators. Texture of the nervous system of man and the vertebrates. New York: Springer-Verlag. Original work published in 1904.

Neurologic Music Therapy Interventions

- **“The brain that engages in music is changed by this engagement”** (Thaut M. 2005. *Rhythm, Music and the Brain*)
- Music can stimulate complex cognitive, affective, and sensorimotor processes in the brain that can then be generalized and transferred to nonmusical therapeutic applications
- Musical activity can be used to activate areas of the brain not/less affected by neurological diseases, possibly allowing to bypass faulty pathways (*need more evidence!*)

Patterned Sensory Enhancement (PSE)

- Improving posture by stretching (arms high above head): increasing stretch with higher pitch or louder volume; direction of movement parallels direction of musical line
- Patients have reported increased “freedom” of movement with PSE , increasing range of motion and ability to exercise longer

Holten S. 2013. *Neurologic Music Therapy in Parkinson's Disease*, 2nd ed. 988.

Therapeutic Instrumental Music Performance

- Goal is to optimize gross and fine motor skills by rhythmic entrainment
- Instrument is itself a target of movement
- Immediate auditory feedback is provided

Holten S. 2013. *Neurologic Music Therapy in Parkinson's Disease*, 2nd ed. 989.

Music-Assisted Relaxation

- Stress can exacerbate symptoms of Parkinson's and other conditions.
- Calming music at rhythm of 50-60 beats per minute (similar to normal resting heart rate), instrumental, at lower frequencies, and without extreme variation in volume, pitch, or rhythm.
- Patients and caregivers often report decreased stress and symptom improvement during music listening.

Source: S. Holten, 2013

Action Steps: What You Can Do Now

- March to music you enjoy (playlist)
- *Enroll in a dance class*
- Join a (virtual?) choir
- Pick up a musical instrument
- Consider seeing a music therapist!

Parkinson's

- The 2nd most common neurodegenerative disease after Alzheimer's (>1.5 million US cases by 2050)
- 4 cardinal signs of Parkinson's:
 - Tremor
 - Rigidity
 - Akinesia/bradykinesia
 - Postural instability

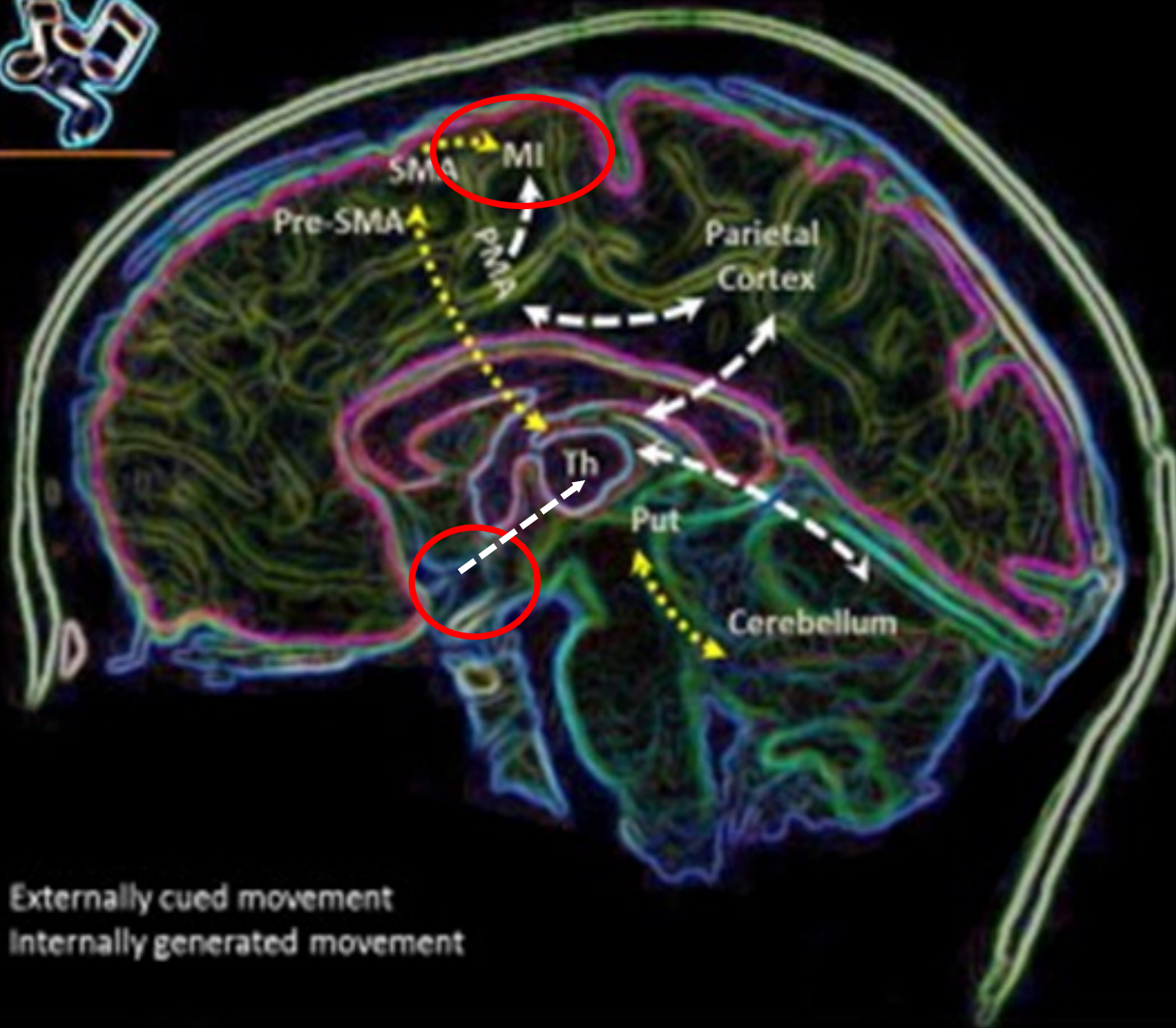


Illustration of the Parkinson's disease by Sir William Richard Gowers from A Manual of Diseases of the Nervous System in 1886 (WikiMedia Commons)

How might music/rhythm work in Parkinson's

- Therapeutic music performance or singing may be used to improve gross/fine motor skills by *rhythmic entrainment* (Thaut 1996; McIntosh 1997; Rochester 2010; Nozaradan 2012)
- Definition:
 - Patterning of body processes and movements to the rhythm of music (Gale Encyclopedia of Medicine)
 - Bypassing or facilitating faulty pathways

Entrainment. (n.d.) Gale Encyclopedia of Medicine. (2008). Retrieved from <http://medicaldictionary.thefreedictionary.com/entrainment>



Nombela et al. *Neurosci Biobehav*
Rev. 2013;37(10 Pt 2):
2564-25. 70.

Rhythmic Auditory Stimulation (RAS)

- Typically used for gait rehabilitation
- Rhythm is external timekeeper
- Cueing provided by a metronome or recorded/live music with strong rhythm
- Allows to anticipate next step
- Verbalizing a cadence (beat), counting, singing, playing music (ie... march)

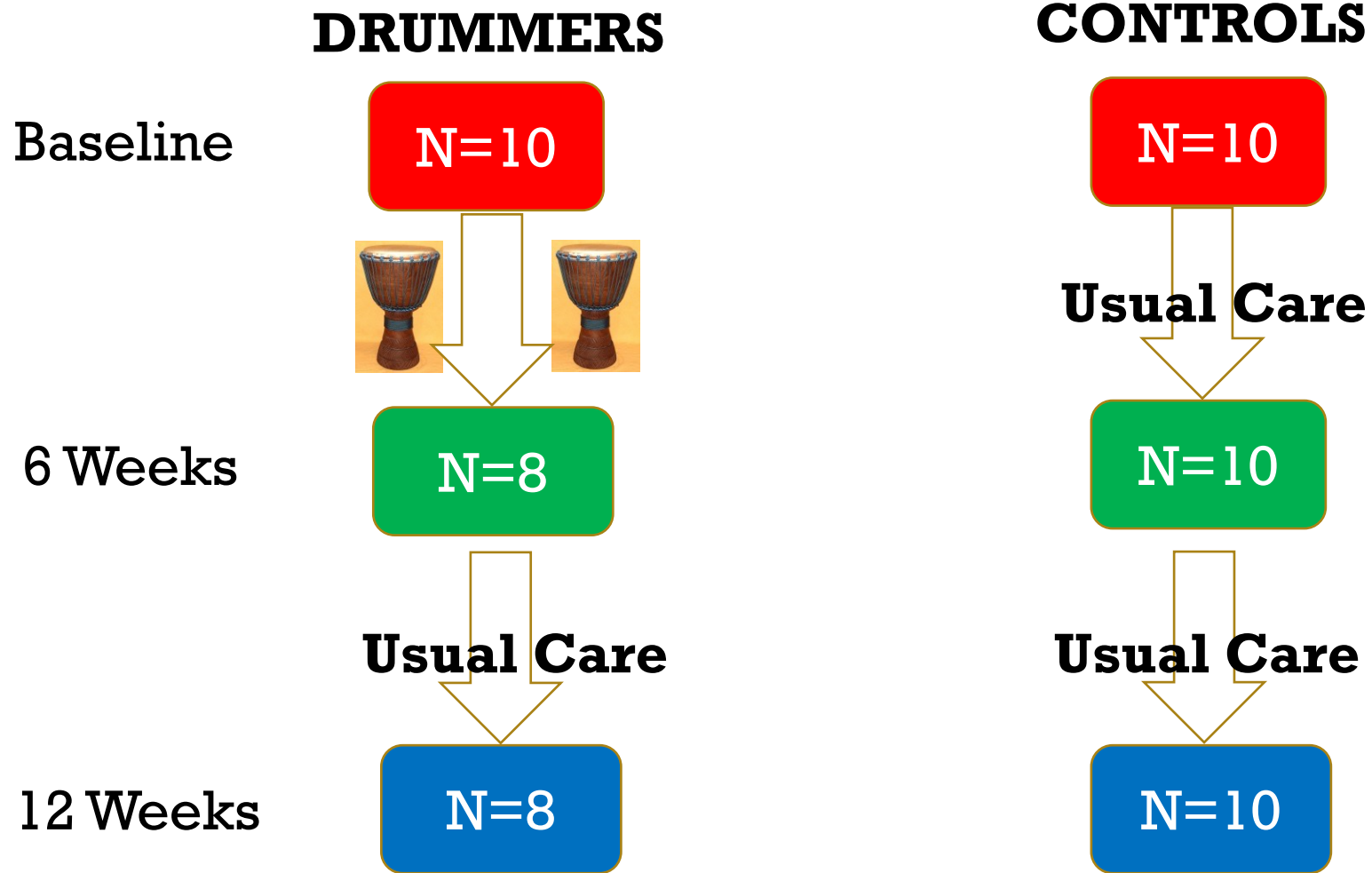
Drumming

- Drumming has long been a part of traditional healing rituals in many cultures worldwide
- A group of patients with Parkinson's at UPenn reported a significantly improved sense of well-being after a single West African drum circle class for 45 minutes

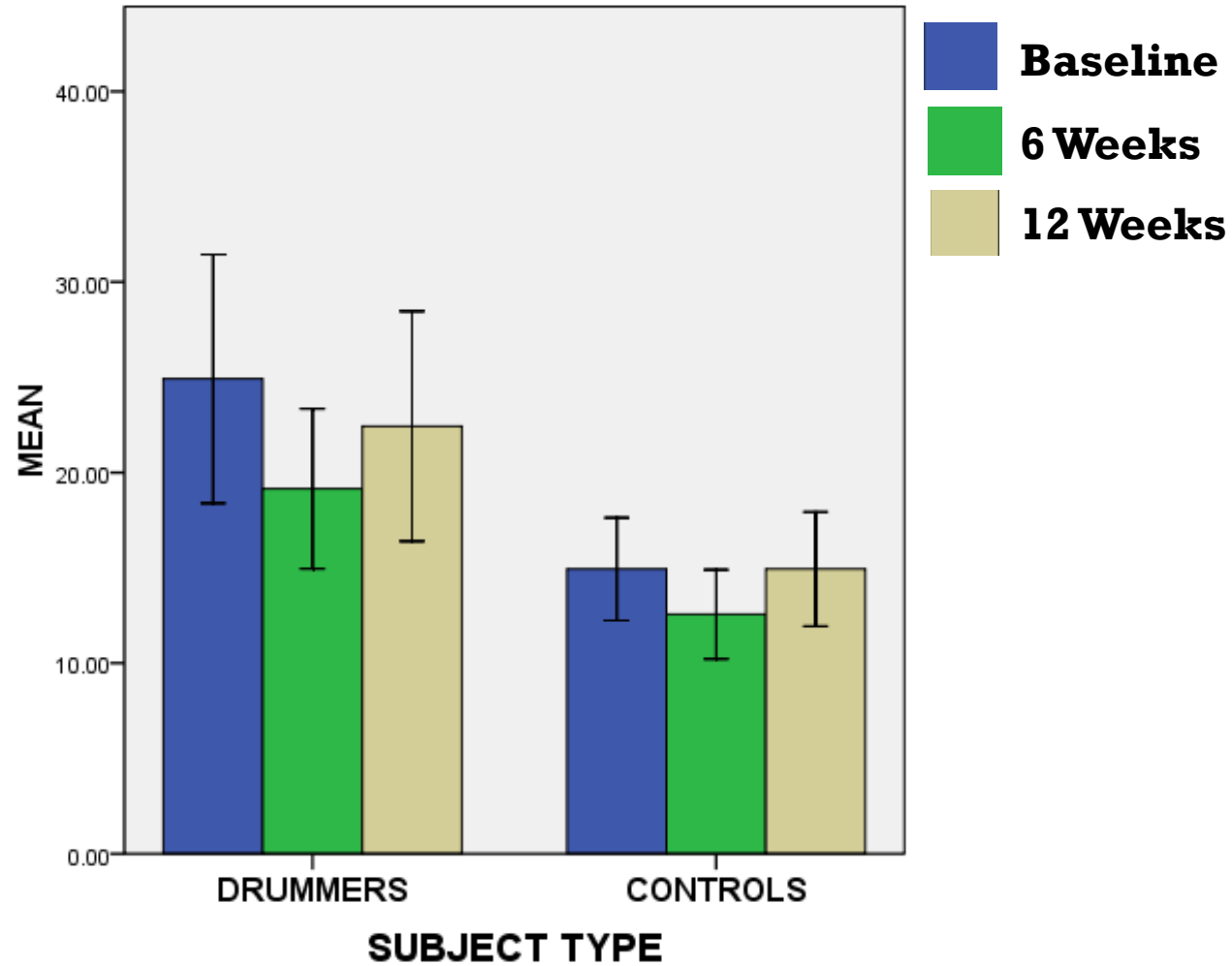
Can drumming improve well-being and motor function in Parkinson's?



Study Design—Continued



PDQ-39 Results



DRUM-PD Conclusions

- 6 weeks of twice-weekly West African drum circle classes significantly improved self-reported quality of life in patients with Parkinson's
 - Improvement waned within 6 weeks of completion of classes, suggesting that continued drumming is necessary to sustain demonstrated short-term benefits
 - iTUG performance trended toward improvement in drummers, but not controls over 12 weeks

Pantelyat et al. *Mov Disord Clin Prac.* 2015

DRUM-PD Conclusions

- Mood in drumming group worse than control group at baseline
 - Difference decreased at 6 weeks
 - Became non-significant at 12 weeks

Pantelyat et al. *Mov Disord Clin Prac.* 2015

Guitar-PD Study



Group 1

Screening



6 weeks

Guitar Class +
Usual Treatment



6 weeks

Usual Treatment



6 weeks

Usual Treatment



END

Group 2

Screening



6 weeks

Usual Treatment



6 weeks

Guitar Class +
Usual Treatment



6 weeks

Usual Treatment



END

Guitar-PD Results



- Across all participants, PDQ-39 Summary Index improved from baseline to week 12 and remained improved at week 18, *but was not statistically significant*
- BDI-II scores trended toward improvement after 6 weeks of guitar lessons and AES apathy measures trended toward improvement after 12 weeks
- MDS-UPDRS total scores significantly improved at 12 weeks and remained improved at 18 weeks

Music Therapy for Voice

- Therapeutic singing: focus on deeper breathing to counteract soft/fading volume and monotone, improving intelligibility
- With practice, may help with speech initiation
 - Demonstrated clearly in stroke patients with speech deficits
- Verbal cues of remembering how it feels to sing a phrase can often be enough to replicate phrasing in normal speech

Parkinsonics Study

- 32 participants with PD (20 male)
- Random assignment to weekly choir vs. weekly facilitated Parkinson's support group for 12 weeks
 - Tracked diary of home singing exercises
- **Crossover after 12 weeks**
- Motor, cognitive, mood, patient-reported QOL and objective voice outcomes (loudness in dB, spectral voice analysis) every 6 weeks for 30 weeks
- Blinded assessments

Parkinsonics Study Results

- 26/32 patients completed study
- Significant improvement from baseline in average loudness on Cookie theft picture description at 24 weeks
 - Improved minimal reading volumes at 24 weeks and 30 weeks
- Increased minimal loudness on Rainbow passage reading at 24 and 30 weeks
- Participants also improved on the MDS-UPDRS Motor scale between baseline and 24-week and 30-week visits, regardless of intervention order

Parkinsonics Study Results

- Weekly group singing is a feasible intervention that may improve some aspects of conversational voice volume in Parkinson's
 - Some improvements were sustained at least 6 weeks after interventions ended

Parkinsonics Study Results—2

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- Weekly group singing is a feasible intervention that may improve some aspects of conversational voice volume in Parkinson's
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ParkinSonics—What's Next?

- Program (ParkinSonics) continues weekly in the same location (currently through Zoom) under the same leadership; **open to all parkinsonian disorders**
- Funded by Hopkins PD and Movement Disorders Center
- Planning follow up assessments of voice, motor function, and quality of life

Hopkins Center for Music and Medicine: Updates/On the Horizon



- Short-term effects (in clinic) of RAS in atypical parkinsonism (in prep)
- Pilot home trial of MedRhythms MR-005 device delivering adaptive RAS in Parkinson's (recruiting)
- Zoom drumming classes started 02/2021 for individuals with Parkinson's and care partners (→Huntington disease)
- Peabody conservatory offering subsidized group guitar lessons for individuals with Parkinson's

Hopkins Center for Music and Medicine: Updates/On the Horizon



- **Music for Pain Project (School of Nursing)**
- Personally selected music for perioperative outcomes among men undergoing radical prostatectomy (Mamaril et al., under review)
- Baltimore Racial Justice Concert Series

Music and the Brain: NIH-Kennedy Center Symposium and Sound Health Partnership

- NIH/Kennedy Center Workshop on Music and the Brain: Finding Harmony
- Sound Health Initiative
- Music in Health funding opportunities (2019, 2020)
- “Music and Mind” with Renee Fleming



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Prescribing Playlists?

- In 2018, British Health Secretary Matt Hancock proposed to enable the country's doctors to prescribe therapeutic art- or hobby-based treatments for ailments including dementia (by 2023): social prescribing
- Similar (more focused) campaign launched in Montreal, Quebec in Fall 2018
- Massachusetts recently launched a pilot social prescribing program

Action Steps: Revisited

- March to music you enjoy (playlist)
- *Enroll in a dance class*
- Join a choir
- Pick up a musical instrument
- Consider seeing a music therapist!

Questions? Comments?

