CRANIAL NERVE TESTING FOR OPTOMETRISTS

by

Rachel A Copley
Brigid C Roney

This paper is submitted in partial fulfillment of the requirements for the degree of

Doctor of Optometry

Ferris State University
Michigan College of Optometry

May, 2019

CRANIAL NERVE TESTING FOR OPTOMETRISTS

by

Rachel A Copley
Brigid C Roney

Has been approved

7 May, 2019

APPROVED:

Faculty Advisor:

ACCEPTED:

Faculty Course Supervisor

Ferris State University
Doctor of Optometry Senior Paper
Library Approval and Release

CRANIAL NERVE TESTING FOR OPTOMETRISTS

We, Rachel A Copley and Brigid C Roney, hereby release this Paper as described above to Ferris State University with the understanding that it will be accessible to the general public. This release is required under the provisions of the Federal Privacy Act.

Rachel A Copley and Brigid Roney
Doctoral Candidate(s)

5/7/19
Date

ABSTRACT

Background: This research study examines if education and exposure to cranial nerve testing improves practitioner comfort and confidence in performing and interpreting such testing. The study is geared toward the primary care optometry setting, where practitioners may not be as familiar with cranial nerve testing and interpretation due to perceived infrequency of need in this modality. *Methods:* A survey was administered questioning participants' ability and comfort in performing and interpreting cranial nerve testing prior to and then after watching cranial nerve instructional videos. A total of 48 participants identifying as optometrists, optometry students, or optometry faculty were surveyed. *Results:* Statistical analysis using a Mann Whitney U-test showed no statistically significant difference in subject confidence in performing or interpreting cranial nerve testing by viewing the instructional videos. *Conclusions:* Providing educational materials for cranial nerve testing does not improve practitioner comfort and confidence in performing and interpreting testing. Despite this, providing educational materials may increase the number of times practitioners perform cranial nerve testing during patient examination when such testing is indicated.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1

INTRODUCTION

Cranial nerve testing is taught by most schools of optometry and included in the optometric scope of practice. Cranial nerves II, III, IV, and VI, are routinely evaluated in a primary care optometric evaluation. While there is little data indicating how often primary care optometrists incorporate evaluation of the remaining cranial nerves, one can postulate that potential underutilization may stem from a lack of practitioner confidence in performing and interpreting cranial nerve testing. Depending on practice modality and patient demographics, optometrists may practice days or weeks before having a patient encounter that warrants the need for cranial nerve testing. Despite this, it is crucial to recall the role cranial nerves play in potential systemic and neurological pathologies. The varying intracranial courses and distinct functions of each cranial nerve makes them very useful in detecting potential locations of lesions within the nervous system, sometimes long before a patient becomes severely ill (Bombard, 2013). Additionally, the close proximity of cranial nerve nuclei in the brainstem may aid in diagnosis; a large lesion affecting multiple cranial nerve nuclei may present with multiple symptoms and therefore help localize a lesion (Gutierrez, 2017). Considering this, a basic understanding of cranial nerve testing and interpretation is certainly warranted in the optometrist's office.

As primary care providers, accessibility is in the optometrist's favor. A study by US News notes that 97% of the population lives within five miles of an optometrist's

office. This puts optometrists at the forefront of diagnosing and treating various pathologies (Howley, 2018). Furthermore, according to the Association of American Medical Colleges, the United States is estimated to lose as many as 100,000 primary care doctors by 2025. This will have a particularly devastating effect in rural areas where primary care doctors are already in short supply. Highlighting this discrepancy of care, a recent survey revealed that 41% of men in Nevada do not even have a primary care doctor. This is much higher than the national average of 28% (Finnegan, 2017). Considering these statistics and projections, it is necessary that optometrists play a role to fill this void in primary care by utilizing the skills allowed in their scope of practice to detect pathologies and initiate appropriate referrals.

Each year, more than 795,000 people in the United States suffer from a stroke (Benjamin, et al, 2017). Many healthcare providers may be familiar with the acute signs of a stroke, such as difficulty speaking, difficulty walking, upper limb paralysis, and unilateral facial weakness. Acute loss of vision may also occur with a stroke, which is often what brings a patient into the optometrist's office. Solid understanding of how to perform and interpret cranial nerve testing will allow the optometrist to detect other signs and symptoms indicative of a stroke and will facilitate prompt and appropriate referrals to manage the patient. This process has the potential to be life-saving for a patient considering the underlying systemic disease that causes a stroke.

Multiple sclerosis is yet another condition optometrists have the potential to be at the forefront of diagnosing. According to the national Multiple Sclerosis Society, an estimated one million individuals in the United States suffer from multiple sclerosis (MS Prevalence, 2019). For 20% of multiple sclerosis patients, optic neuritis is the initial sign

of their disease. Moreover, 50% of established multiple sclerosis patients will experience at least one episode of optic neuritis during their lives (Kale, 2016).These patients are typically young females who present with acute, unilateral, and painful vision loss. By performing a cranial nerve examination, optometrists may be able to more easily distinguish multiple sclerosis from other neurological disorders. Careful examination and data collection in such cases allows the optometrist to make an educated referral, streamlining the patient's care toward the most appropriate specialist.

Another disease, neurosyphilis, has the potential to masquerade as various other neurological diseases. In the early stages, neurosyphilis commonly appears in the basilar meninges; this meningeal inflammation has the potential to spread to neighboring cranial nerves and can result in various cranial nerve palsies. Ocular manifestations of neurosyphilis may include virtually any structures in the eye. Some of those include nongranulomatous anterior uveitis, Argyll-Robertson Pupil, and optic neuritis (Wender, 2008).

CHAPTER 2

METHODS

Instructional videos demonstrating how to test for cranial nerves I, V, VII, and VIII - XII were created. At the end of each video, a brief summary with possible interpretations for testing was included. Videos were uploaded to a YouTube channel and made freely available to any members of the public. A survey using a Likert scale was created to question individuals on their views on the necessity of cranial nerve testing in a primary care optometry setting, as well as comfort performing and interpreting said testing prior to and after watching instructional videos. An example item from this survey is "Prior to watching the instructional videos, I felt comfortable and competent performing cranial nerve testing" where 1 = "Strongly disagree", 2 = "Disagree", 3 = "Neutral", 4 = " Agree", and 5 = "Strongly agree" (see Appendix B). Participants were sought out using social media and e-mail. Individuals taking the survey included optometry students, optometry faculty members, and optometrists.

Statistical analysis was conducted using a Mann-Whitney U Test. In this study the independent variable was the instructional videos and the dependent variable was comfort and competence in performing and interpreting cranial nerve testing. The null hypothesis (H_o) was that there was no statistically significant difference in subject confidence in performing or interpreting cranial nerve testing by viewing the instructional videos.

CHAPTER 3

RESULTS

The research survey had 48 participants total. Of these 48 subjects, 52.1% of participants identified as female, 43.7% as male, and 4.2% preferred not to state (Table 1). To further delve into the demographics of the subject population, the majority of participants were licensed optometrists not associated with academia (64.6%) while others identified as optometry students, optometry faculty, or other (25%, 6.25%, 4.15%) (Table 1).

Prior to viewing the instructional videos the majority of participants "rarely" performed cranial nerve testing when indicated (45.8%) and many subjects admitted that they "never" utilized cranial nerve testing in their practice (27.1%) (Table 2). However, after viewing the instructional videos the majority of participants anticipated that they would "sometimes" perform cranial nerve testing in the future (31.35%) (Table 2). Overall there was a shift in participants' perception of performing cranial nerve testing from underutilization to increased incorporation in the optometric setting (Table 2).

There was a shift in reported participant confidence and competence in performing and interpreting cranial nerve testing toward improved confidence and competence (Tables 3-4). However, the Mann-Whitney U test revealed that the introduction of cranial nerve videos produced failed to produce a statistically significant change in participants' reported confidence and competence in both performing (U =

10.5) and interpreting (U = 10) cranial nerve testing. Thus, the study is unable to reject H_o in favor of H_1 (alpha = 0.05) (Tables 5-7).

CHAPTER 4

DISCUSSION

Cranial nerve testing, while included in optometrist's scope of practice, is largely underutilized. This was demonstrated when 72.9% of participants for this study stated they either "rarely" or "never" performed cranial nerve testing in practice. While the instructional videos provided in this study did not produce a statistically significant improvement in practitioner confidence in performing and interpreting such testing, there was still a shift toward improved confidence when instructional materials were provided. Additionally, there was a shift toward increased practitioner utilization of cranial nerve testing following watching the instructional videos with the most participants (30.25%) saying they would perform cranial nerve testing "sometimes". Despite the current underutilization of cranial nerve testing in the optometric realm, it remains an important part of optometric examination when indicated. The potential for nervous system lesion localization and both time appropriate and practitioner appropriate referrals provide sound reasoning for the role of these simple and quick examination elements.

This study did have some limitations. First, the sample size was small (48 participants); this potentially affected outcomes depending on the members of the population who were polled. Second, because the study mainly targeted practicing optometrists, it may have been more beneficial to include only licensed optometrists. By not including optometry students, before and after video analysis may be affected. A future study could poll and analyze the difference among healthcare providers (primary

care physicians, neurologists, registered nurses, etc.) when given a similar survey and instructional videos.

REFERENCES

Benjamin, E. J., Blaha, M. J., Chiuve, S. E., Cushman, M., Das, S. R., Deo, R., . . . Muntner, P. (2017). Heart Disease and Stroke Statistics—2017 Update: A Report From the American Heart Association. *Circulation,135*(10). doi:10.1161/cir.0000000000000485

Bombard, T., NREMT-P, MD. (2013, November 22). Neurotrauma Review Series-Part 1: Why Evaluate the Cranial Nerves? Retrieved January 27, 2019, from https://www.emsworld.com/article/11245200/neurotrauma-review-series-part-1-why-evaluate-cranial-nerves

Finnegan, J. (2017, January 12). Many Americans don't have a primary care doctor. Retrieved January 27, 2019, from https://www.fiercehealthcare.com/practices/many-americans-don-t-have-a-primary-care-doctor

Gutierrez, M. (2009, September 2). Save a Life; Neuro-Optometry Primer: The Brain. *Review of Optometry.* Retrieved from: https://www.reviewofoptometry.com/CMSDocuments/2009/9/Neuro-Optom-Supp_RO-09.02.09.pdf

Howley, E. K. (2018, December 3). What's the Difference Between Ophthalmologists, Optometrists and Opticians? Retrieved January 27, 2019, from https://health.usnews.com/health-care/patient-advice/articles/2018-12-03/whats-the-difference-between-ophthalmologists-optometrists-and-opticians

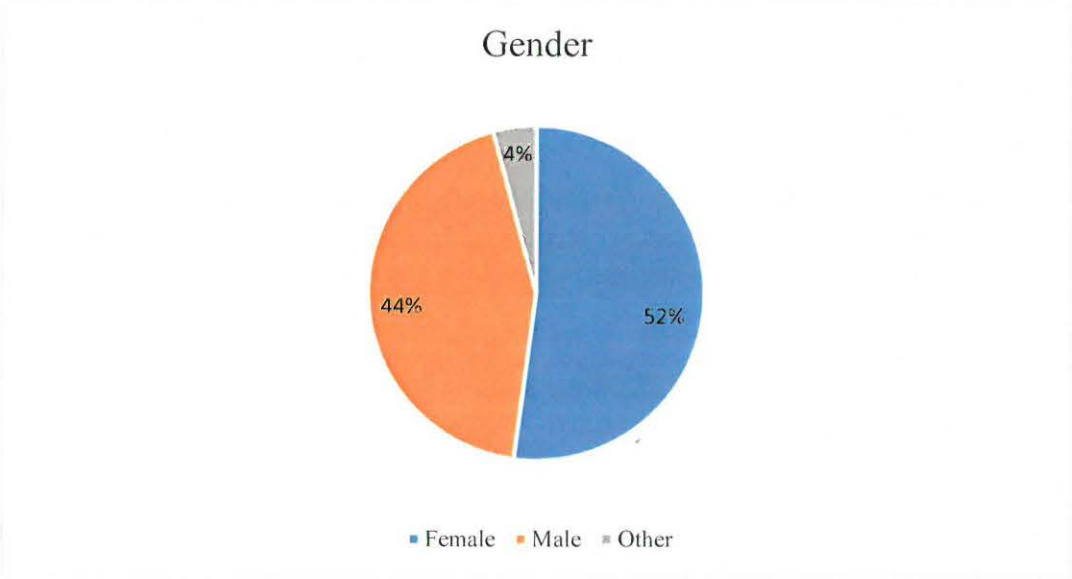
Kale, N. (2016). Optic neuritis as an early sign of multiple sclerosis. *Eye and Brain,Volume 8*, 195-202. doi:10.2147/eb.s54131

LaMorte, W. W. (2017, May 4). Mann Whitney U Test (Wilcoxon Rank Sum Test). Retrieved January 27, 2019, from http://sphweb.bumc.bu.edu/otlt/mph-modules/bs/bs704_nonparametric/BS704_Nonparametric4.html

MS Prevalence. (n.d.). Retrieved January 27, 2019, from https://www.nationalmssociety.org/About-the-Society/MS-Prevalence

Wender, J. D. (2008, November 20). How to Recognize Ocular Syphilis. Retrieved January 27, 2019, from https://www.reviewofophthalmology.com/article/how-to-recognize-ocular-syphilis

Table 1. Participant Profile



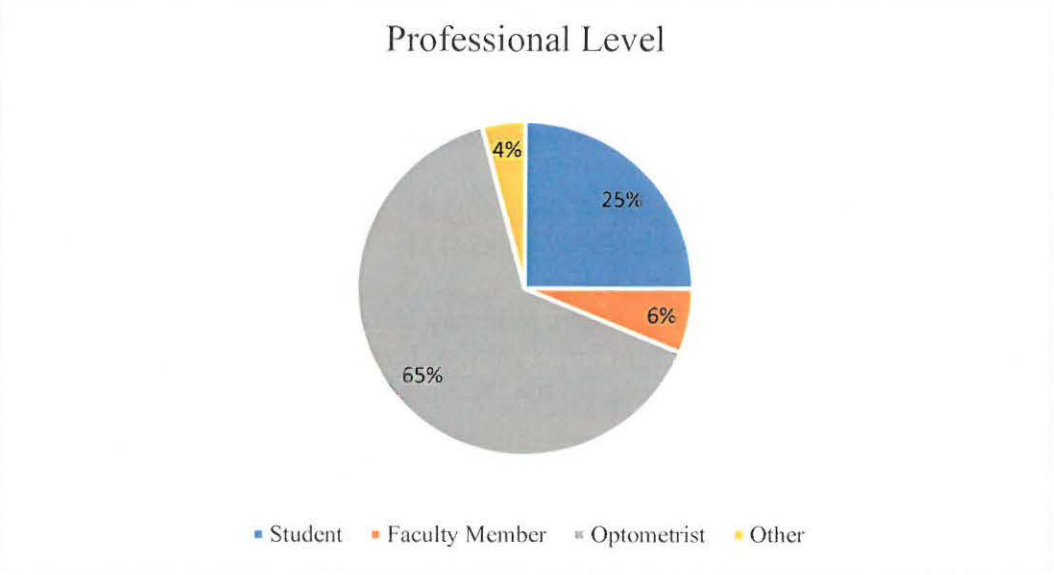
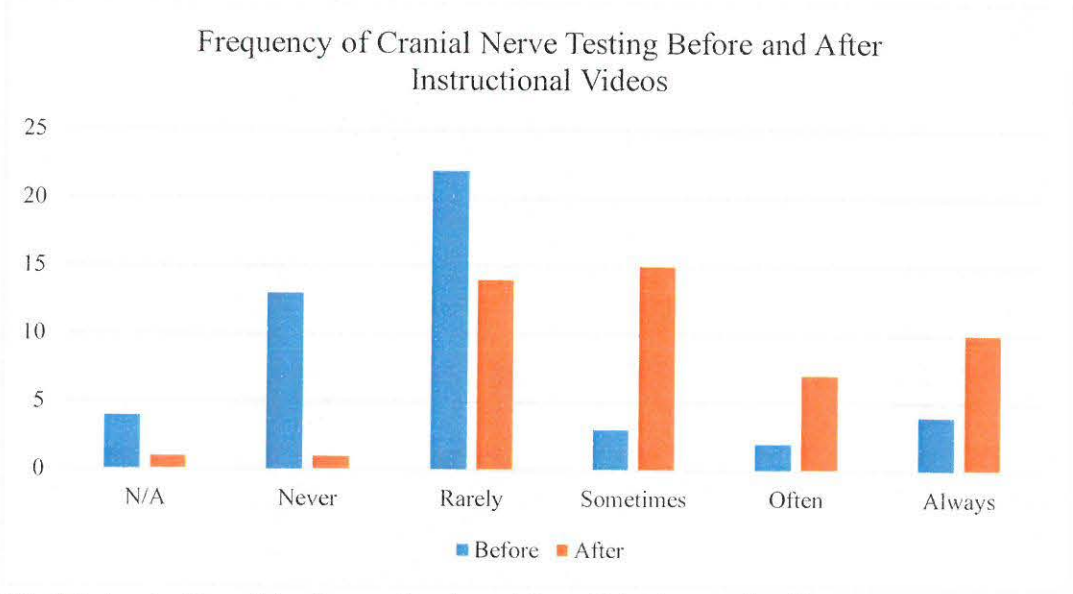
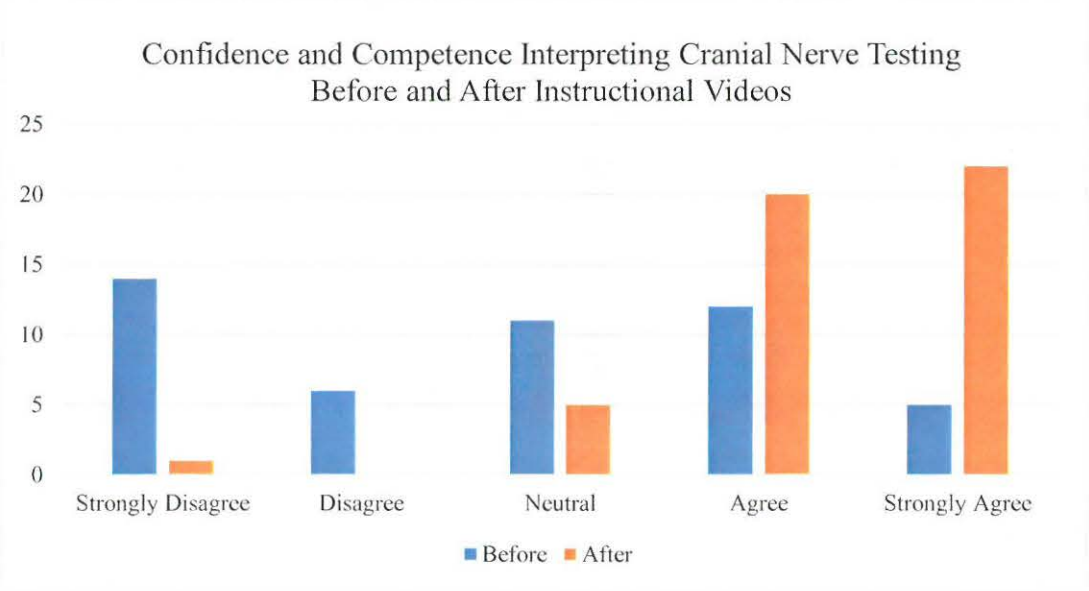


Table 2. Practitioners performing testing before and after videos



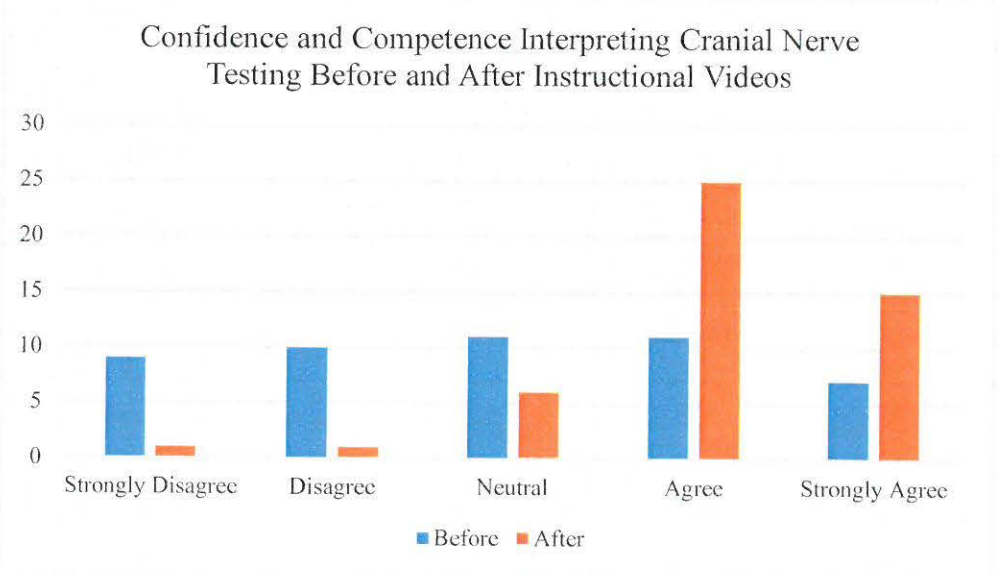
(Pertaining to item 3 in Appendix A and item 7 in Appendix C)

Table 3. Practitioner confidence and competence interpreting cranial nerve testing before and after videos



(Pertaining to item 1 in Appendix B and item 1 in Appendix C)

Table 4. Confidence and competence interpreting cranial nerve testing before and after videos



(Pertaining to item 2 in Appendix B and item 2 in Appendix C)

Table 5 Mann Whitney U Test: Confidence and competence performing cranial nerve testing before and after instructional videos

			Total Sample (Ordered)		**Ranks**	
Likert Scale	Before Video	After Video	Before Total	After Total	Before Rank	After Rank
1	9	1		1		1.5
2	10	1		1		1.5
3	11	6		2		3
4	11	25	3		4	
5	7	15	4		5	
			5		6	
			6		7.5	
			6		7.5	
				7		9
				8		10
					R1 = 29.5	R2 = 25.5
					U1 = 10.5	U2 = 14.5

(alpha = 0.05)

Table 6. Mann Whitney U Test: Confidence and competence interpreting cranial nerve testing before and after instructional videos

			Total Sample (Ordered)		**Ranks**	
Likert Scale	Before Video	After Video	Before Total	After Total	Before Rank	After Rank
1	9	1		1		1.5
2	10	1		1		1.5
3	11	6		2		3
4	11	25	3		4	
5	7	15	4		5	
			5		6	
			6		7.5	
			6		7.5	
				7		9
				8		10
					R1 = 30	R2 = 25
					U1 = 10	U2 = 15

(alpha = 0.05)

Table 7. Critical values of the Mann Whitney U Test

n_2	α	n_1																	
		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3	.05	0	0	1	2	2	3	4	4	5	5	6	7	7	8	9	9	10	11
	.01	--	0	0	0	0	0	1	1	1	2	2	2	3	3	4	4	4	5
4	.05	0	1	2	3	4	5	6	7	8	9	10	11	12	14	15	16	17	18
	.01	--	--	0	1	1	2	3	3	4	5	5	6	7	7	8	9	9	10
5	.05	1	2	4	5	6	8	9	11	12	13	15	16	18	19	20	22	23	25
	.01	--	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
6	.05	2	3	5	7	8	10	12	14	16	17	19	21	23	25	26	28	30	32
	.01	--	1	2	3	4	6	7	8	9	11	12	13	15	16	18	19	20	22
7	.05	2	4	6	8	11	13	15	17	19	21	24	26	28	30	33	35	37	39
	.01	0	1	3	4	6	7	9	11	12	14	16	17	19	21	23	24	26	28
8	.05	3	5	8	10	13	15	18	20	23	26	28	31	33	36	39	41	44	47
	.01	0	2	4	6	7	9	11	13	15	17	20	22	24	26	28	30	32	34
9	.05	4	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54
	.01	1	3	5	7	9	11	14	16	18	21	23	26	28	31	33	36	38	40
10	.05	4	7	11	14	17	20	24	27	31	34	37	41	44	48	51	55	58	62
	.01	1	3	6	8	11	13	16	19	22	24	27	30	33	36	38	41	44	47
11	.05	5	8	12	16	19	23	27	31	34	38	42	46	50	54	57	61	65	69
	.01	1	4	7	9	12	15	18	22	25	28	31	34	37	41	44	47	50	53
12	.05	5	9	13	17	21	26	30	34	38	42	47	51	55	60	64	68	72	77
	.01	2	5	8	11	14	17	21	24	28	31	35	38	42	46	49	53	56	60
13	.05	6	10	15	19	24	28	33	37	42	47	51	56	61	65	70	75	80	84
	.01	2	5	9	12	16	20	23	27	31	35	39	43	47	51	55	59	63	67
14	.05	7	11	16	21	26	31	36	41	46	51	56	61	66	71	77	82	87	92
	.01	2	6	10	13	17	22	26	30	34	38	43	47	51	56	60	65	69	73
15	.05	7	12	18	23	28	33	39	44	50	55	61	66	72	77	83	88	94	100
	.01	3	7	11	15	19	24	28	33	37	42	47	51	56	61	66	70	75	80
16	.05	8	14	19	25	30	36	42	48	54	60	65	71	77	83	89	95	101	107
	.01	3	7	12	16	21	26	31	36	41	46	51	56	61	66	71	76	82	87
17	.05	9	15	20	26	33	39	45	51	57	64	70	77	83	89	96	102	109	115
	.01	4	8	13	18	23	28	33	38	44	49	55	60	66	71	77	82	88	93
18	.05	9	16	22	28	35	41	48	55	61	68	75	82	88	95	102	109	116	123
	.01	4	9	14	19	24	30	36	41	47	53	59	65	70	76	82	88	94	100
19	.05	10	17	23	30	37	44	51	58	65	72	80	87	94	101	109	116	123	130
	.01	4	9	15	20	26	32	38	44	50	56	63	69	75	82	88	94	101	107
20	.05	11	18	25	32	39	47	54	62	69	77	84	92	100	107	115	123	130	138
	.01	5	10	16	22	28	34	40	47	53	60	67	73	80	87	93	100	107	114

(LaMorte, 2017).

APPENDIX A. PRELIMINARY QUESTIONS

Cranial Nerve Testing Instructional Videos Survey

Thank you for participating in our survey for our senior project! After viewing the instructional videos, please answer the following items

1. Are you an optometry student, optometrist, or optometry faculty member?
    a. Optometry Student
    b. Optometrist
    c. Optometry Faculty Member
    d. Other
2. Are you female, male, or prefer not to state?
    a. Female
    b. Male
    c. Prefer no to state
3. On average, how often do you perform cranial nerve testing on your patients?
    a. Never
    b. Rarely – less than 30% of patients when indicated
    c. Sometimes – between 30% and 50% of patients when indicated
    d. Often – between 50% and 75% of patients when indicated
    e. Always – greater than 90% of patients when indicated

APPENDIX B: PRE-VIDEOS SURVEY INSTRUMENT

Pre-Video Questions

The following questions pertain to your feelings PRIOR to watching the instructional videos. Please rank your response using the following scale:

1 = Strongly disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly agree

1. Prior to watching the instructional videos, I felt comfortable and competent performing cranial nerve testing.
2. Prior to watching the instructional videos, I felt comfortable and competent interpreting results from cranial nerve testing.
3. Prior to watching the instructional videos, I felt that cranial nerve testing was unnecessary in a primary care optometry setting.

APPENDIX C. POST-VIDEOS SURVEY INSTRUMENT

Post-Video Questions

The following questions pertain to your feelings AFTER watching the instructional videos. Please rank your response using the following scale:

1 = Strongly disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly agree

1. After watching the instructional videos, I feel comfortable and competent performing cranial nerve testing.
2. After watching the instructional videos, I feel comfortable and competent interpreting results from cranial nerve testing.
3. After watching the instructional videos, I feel comfortable and competent communicating the results from cranial nerve testing to my patients.
4. After watching the instructional videos, I feel that I can make an educated referral for further testing depending on the cranial nerve testing results.
5. After watching the instructional videos, I plan to incorporate cranial nerve testing into my primary care exam when indicated.
6. After watching the instructional videos, I feel that cranial nerve testing is necessary in a primary care optometry setting.
7. After watching the instructional videos, how often do you expect to perform cranial nerve testing on your patients?

   Amended Likert scale: never, rarely, sometimes, often, always

   a. Never
   b. Rarely – less than 30% of patients when indicated
   c. Sometimes – between 30% and 50% of patients when indicated
   d. Often – between 50% and 75% of patients when indicated
   e. Always – greater than 90% of patients when indicated
8. If you would like to provide additional comments, please comment below