

The Effect of COVID Phases on EBCP Cumulative Exam with Chiropractic Students

Mark E Murdock*

Palmer College of Chiropractic Florida, Port Orange, FL, USA

*Corresponding Author: Mark E Murdock, Palmer College of Chiropractic Florida, Port Orange, FL, USA.

Received: December 19, 2020; Published: January 30, 2021

Abstract

Introduction: The purpose of this retrospective study was to determine if there was a statistical difference in the Evidence Based Clinical Practice (EBCP) grades for the cumulative exam 2 with different teaching and testing methods used during three Covid-19 phases.

Methods: The differences in the phases were as follows (teaching method, voice over powerpoint (VOP) access and testing method): 0 (in-class lecture, no VOP, in-class on paper), 1 (voice over powerpoint and on-line Q&A with professor, VOPs available, on-line exam), 2 (powerpoint review on-line, VOPs available, on-line exam). Author performed retrospective analysis of EBCP cumulative exam grades by Covid-19 phase using ANOVA and Kruskal-Wallis test.

Results: Differences were found between Covid-19 phase with respect to EBCP cumulative exam grades by ANOVA. Phase 1 and 2 were significantly ($p < .0001$) lower than Phase 0. Phase 1 and 2 were not significantly different from each other ($p = 0.805$). Due to questionability of normality of Phase 0 scores as per Shapiro-Wilk test (with Holm method) and heterogeneity of variance (Levene, $p = 0.00791$), Kruskal-Wallis test was performed and revealed significance difference ($p = 4.594e-12$). Analysis by estimation (effect size and confidence interval) revealed decreased performance by 29 (95%CI 40-17) to 26 (95%CI 35-17) points out of 200 between phase 1 or 2 respectively versus phase 0. MCID is not established regarding the, at least, 17/200 drop in grades; although, this represents an 8.5% drop at the least.

Discussion: ANOVA and Kruskal-Wallis revealed a statistically significant drop in grades when lockdown procedures were implemented. Therefore, the null hypothesis is rejected. Some difficulties performing EBCP cumulative exam online included possibility of cheating and technical glitches. Limitations were as follows: multiple variables, unknown seasonal effects, unknown GPA influences, retrospective design, stress influences and ceiling affect.

Conclusion: This study demonstrated a negative effect on EBCP cumulative exam grades ("the final") due to COVID-19 restrictions and educational modifications using difference teaching and testing methods for each phase. These conclusions must be balanced with limitations. Further studies should consider limitations of this study and provide a plan to eliminate or capture any main affects or interactions.

Keywords: Evidence Based Medicine; EBM; EBCP; Covid-19; Coronavirus; Assessment; Education; Online

Introduction

The virus Covid-19 surfaced in December 2019 and was declared a pandemic by the World Health Organization (WHO) in March of 2020 [1]. This virus had a 3% fatality rate with variation depending upon location [1] and age. Many governments created travel restric-

tions and shutdown many businesses to decrease the spread of the virus including doctoral programs [2]. These shutdowns impacted higher learning by causing pedagogical methodologies to move toward distance learning over the internet [2]. Chiropractic programs were modified [3] within weeks. These modifications included “massive open online courses (MOOCs), recorded classes, online live interaction, tutorial, short communications, conferences” [4]. Many of these models can be accessed by personal computer (PC), tablet [4] or smartphone [5].

Advantages of online and blended learning include transcending space and time, convenience, equal or slightly more effectiveness for learning and reusability [6]. Although, meta-analysis of effectiveness in learning has shown high heterogeneity [7] and thus should be treated with caution [6]. Disadvantages include high cost of preparation, maintenance costs, platform maintenance and learners’ feeling of isolation [6]. Bajpai recommended considering the learning theory being employed to develop a course with online component to fit the intended outcomes [8]. According to Carmargo, the Covid-19 pandemic “had a catalytic effect on the change in educational processes worldwide” [4].

The evidence based clinical practice (EBCP) course covers many topics as noted in table 1. These topics are of different complexity and form the bases of the course outcomes which feed into the program outcomes. Many teaching methods have been investigated in the past. Systematic reviews comparing difference methods of training where limited by low methodological quality studies and low n numbers: n = 5 [9] and n = 11 [10].

Topic Number	Topic Content
T01	Basics: Definitions, Pillars
T02	Critical Thinking: 5As, Logic, Creativity
T03	Scientific Method: Hypothesis test, Errors
T04	Ethics
T05	Reliability, Validity General
T06	Ask: Background, Foreground (PICO)
T07	Access/Acquire: Pyramid, Databases (Pubmed: MeSH, Dynamed)
T08	Appraisal: General Stats: Data Types, Distributions, Measures of Central Tendency (Mean, Median, Mode), Dispersion (SD, z, %tiles)
T09	Appraisal: Stat Selection: Data Types, Parametrics (n, homogeneity, Skew, Kurtosis)
T10	Appraisal: Significance, Confidence Intervals (CIs) Alpha level, P-value, Statistical significance
T11	Appraisal: ABCDFix: Allocation (Randomization, concealment), Blinding, Comparison (Table 1), Drop-out, Follow-up, Intention to Treat, X-tra factors.
T12	Appraisal: Formal Tools
T13	Appraisal: Correlation, Regression
T14	Appraisal: Diagnostic Reliability: Kappa, ICC, MAD
T15	Appraisal: Diagnostic Validity: Sensitivity, Specificity, Likelihood ratio, PPV, NPV
T16	Appraisal: Treatment (Surrogate End Points, Effect size, Difference in Means Tests), Metaanalysis (Forrest Plot, Heterogeneity, Funnel plot)
T17	Appraisal: Risk/Prevention: OR ARR, NNT
T18	Apply: Clinical significance, Effect size (Minimally Clinically Important Difference (MCID))
T19	Assess: OATs, Specific ADLs

Table 1: EBCP topics covered.

The primary aim of this retrospective study was to determine if there was any difference in EBCP cumulative exam grades (“the final”) between different phases of Covid-19 and related modifications to teaching and evaluation. The setting of this study was in 1st quarter of a chiropractic doctoral program that lasts 13 quarters as evidenced by comparison of the cumulative exam in week 9 - 10 of 11 weeks. The phases of Covid-19 were based upon the mandates from the State. Phase 0 is a term that the author chose for pre-Covid-19 or minimally affected by Covid-19 time-period. Phase 1 was the time frame of maximal impact from Covid-19 where only essential businesses were open. Phase 2 included minimal business shutdown (restaurants at 50% capacity, bars closed, large gatherings discouraged). In addition, social distancing, mask usage and hand washing was highly encouraged. Many businesses made these recommendations mandatory. Different phases of Covid-19 required different teaching and testing methods which are detailed in the methods and summarized in table 2.

Covid Phase	Restrictions and Guidance	Teaching Location	Voice over powerpoints (VOPs) available by Professor	Cumulative Exam Location, questions/time
0	No restrictions, pre-Covid	In Class	No	In class, 50/50
1	No contact, non-essential businesses shutdown	Online (knowledge reviews)	Yes	Online, 50/50
2	Disinfection, Social distancing, mask usage, designated partners, washing hands	Online with more powerpoint coverage in virtual classroom	Yes	On line 50/64

Table 2: Descriptions of the phases and teaching styles.

Methods

Teaching and assessment methods for phase of Covid-19

The phase 0 group was prior to Covid-19 and consisted of 1 quarter. The students experienced conventional teaching methods included lecture of 50-minute duration. The PowerPoints (Microsoft, Inc.) were available on the learning management system (LMS) called Brightspace; however, they were not recorded by audio or video. Around week 6, the students had a midterm while around week 9 or 10, the students completed an in-class cumulative written exam.

The phase 1 group was totally online (one quarter). They learned by online voice over powerpoints (VOPs) through the LMS. Virtual classrooms were set the first week and every even week through Brightspace. The online virtual classrooms emphasized the main points of the VOPs and tackled any questions. Instructions were given regarding how to access the virtual classroom and materials.

The phase 2 group (one quarter) learning was analogous to the phase 1 group with more of the powerpoints presented virtually through the LMS.

EBCP cumulative assessment methods

The exam was 50 minutes with 50 questions in phase 0 and 1 while it was 64 questions in 50 minutes during phase 2.

Statistical methods

Retrospective analysis of anonymized EBCP cumulative exam grades was performed by grouping them by Covid phase, checking assumptions and determining whether the best analysis approach would be ANOVA or Kruskal-Wallis test with an alpha of 0.05 with equal parsing. Planned comparisons between all group combinations using familywise error rates would be determined if test is significant.

This analysis would be performed using the statistics platform R (R Core Team (2019). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria).

Background literature acquisition methods included the following searches in Pubmed: Covid-19; Covid-19 online; CPR online; EBCP (filtered for free-full text). Many articles identified from literature review as noted in the reference section. The author also included sources from personal collection regarding these topics and statistics. Additional literature acquisition by Pubmed performed using the following terms: online learning, teaching and learning, and online educational assessment.

Results

Descriptive stats reveal means and standard deviations that were rather similar as indicated in table 3.

Covid Phase	Restrictions and Guidance	Teaching Location	Voice over powerpoints (VOPs) available by Professor	Cumulative Exam Location	Mean	SD	N
0	No restrictions, pre-Covid	In Class	No	In class, 50/50	163	19	70
1	No contact, non-essential businesses shutdown	Online (knowledge reviews)	Yes	On-line, 50/50	134	27	27
2	Disinfection, Social distancing, mask usage, designated partners, washing hands	Online with more powerpoint coverage in virtual classroom	Yes	On-line, 50/64	137	21	62

Table 3: Descriptions of the phases, teaching style and results.

Assumptions check revealed that phase 0 had significant non-normal distributions as per Shapiro-Wilk’s test. Although, Shapiro-Wilk’s test becomes too sensitive when N numbers are higher. Levene’s test was significant for heterogeneity of variance. Phases were independent since they were different students. Phases were also independent in the sense that they did not affect each other since no one had to retake the class. Group sizes were different compared to phase 2: 70, 27, 62.

The inferential statistic ANOVA revealed p-values less than alpha and therefore significant as per table 4. For difference of means significance tests (like ANOVA) the sampling distribution should be normal (p169) [11] in the groups (p442) [11]. As per Triola, the n numbers are above 30 and therefore the central limit theorem can be invoked for the sampling distribution and thus it can be considered normal [12]. Differences were found between Covid-19 phase with respect to EBCP cumulative exam grades by ANOVA. Phase 1 and 2 were significantly (p = <. 0001) lower than Phase 0. Phase 1 and 2 were not significantly different from each other (p = 0.805).

ANOVA	Df	Sum Sq	Mean Sq	F value	P
Phase	2	28991	14496	31.25	3.85e-12
Residuals	156	72355	464		
Kruskal-Wallis	Df			Chi-squared	P
	2			52.213	4.594e-12

Table 4: ANOVA and Kruskal-Wallis test output.

Due to questionability of normality of Phase 0 scores as per Shapiro-Wilk test (with Holm method) and heterogeneity of variance (Levene’s test, $p = 0.00791$), Kruskal-Wallis test was performed and revealed significance difference ($p = 4.594e-12$) since the groups were non-paired ($p236$) [11]. Analysis by estimation (effect size and confidence interval) revealed decreased performance by 29 (95%CI 40-17) to 26 (95%CI 35-17) points out of 200 between phase 1 or 2 respectively versus phase 0. MCID is not established regarding the, at least, 17/200 drop in grades; although, this represents an 8.5% drop at the least.

Graphical analysis illustrated difference between phase 1 and 2 versus phase 0. Therefore, analysis by estimation (effect size and confidence interval) revealed a decrease in exam grades during active Covid-19 phases not by chance compared to phase 0 without Covid-19 [13].

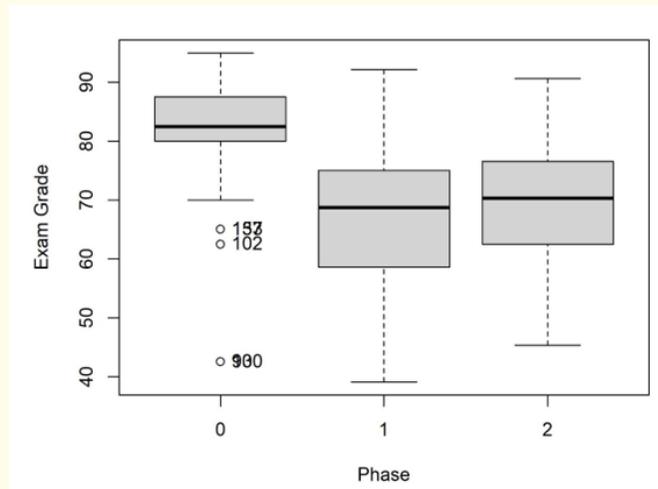


Figure 1: Exam grades by Covid-19 phase (Recalculated out of 100).

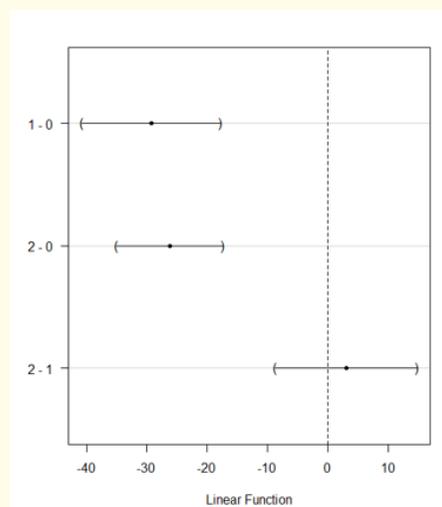


Figure 2: Exam grades by Covid-19 phase with family wise error rates at 95% CI.

Discussion

Overview

Just as practicing chiropractors have required adaptation to the challenges caused by shutdowns related to the Covid-19 Pandemic [1] pedagogical changes in some chiropractic colleges have been attempted to overcome these challenges. This discussion will review the results of this attempt to overcome these challenges, difficulties of online assessment and limitations of this study.

Interpretation of results

Covid-19 pandemic seemed to cause alterations to the teaching and testing environment that resulted in decreased grades on the EBCP cumulative exam for phase 1 and 2. This could be interpreted in many ways. Was there a seasonal affect? Was their grade depressed by the hard time they went through during that time? Or perhaps none of the factors made a significant impact. These other factors would have to be explored through prospective studies including linear regression and model building although the rapid change due to COVID-19 could not be replicated along with related stress factors.

Difficulties

Difficulties could have affected scores and the implementation of the study methods. Some difficulties the author experienced in performing EBCP exams online included concern regarding cheating and technical glitches. Cheating could be accomplished by students working together, having cheat-sheets or using "Ctrl F" to look up terms in the PowerPoints (Microsoft Inc.). Technical glitches where the students could not get into the exam through the LMS was an issue in rare instances. Other difficulties include multiple limitations in this study that cause generalizability to be affected.

Limitations of the Study

Limitations were as follows: multiple variables, unknown prior GPA influences, retrospective design, stress influences and ceiling effect. The multiple variables that were changed make it difficult to compare the groups with all predictors and interaction effects. Effects were not corrected by GPA influences. This study was performed by retrospective design and therefore was not optimal. Influence of stress was not able to be determined retrospectively. Ceiling affect caused phase 0 grades to present as a non-normal distribution. These limitations affect the ability of this information to be generalizable.

Further Study

Further studies should consider limitations of this study and provide a plan to eliminate or capture any main affects or interactions. Comparison of different EBCP exams in different contexts are of interest.

Conclusion

Covid-19 impacted many sectors of the United States economy including education. Adaptations had to be created rapidly to provide equitable educational services. These adaptations increased instructor's workload and did not benefit the student's grades. Covid-19 modifications that included online teaching, VOP availability and online testing seemed to decrease EBCP cumulative exam scores with statistical significance. Although the MCID is not established, the grades were decreased around 8.5. Many possibilities exist in interpreting this difference. Perhaps the students gave up, or the learning style was too different, or the stress was too high, or the students needed more mentoring. Limitations should be considered with the design of future research efforts.

Disclosure

No conflicts known. No sources of funding.

IRB Determinations

This study did not constitute human subjects research pursuant to 45 CFR 46 since the data is deidentified to phase and exam grade. This study was assigned a non-human subject's research assurance number, for tracking purposes only, which is N2020-12-18-M.

Bibliography

1. Johnson C. "Response of Practicing Chiropractors during the Early Phase of the COVID-19 Pandemic: A Descriptive Report". *Journal of Manipulative and Physiological Therapeutics* 43.5 (2020): 403e1-403e21.
2. Khalaf K., et al. "Introducing a comprehensive high-stake online exam to final-year dental students during the COVID-19 pandemic and evaluation of its effectiveness". *Medical Education Online* 25 (2020): 1-10.
3. Johnson C and Green B. "Harnessing the Web: How Chiropractic Education Survives and Thrives During COVID-19 Pandemic". *Chiro Educators Research Forum (CERF)* (2020).
4. Carmargo CP, et al. "Online learning and COVID-19: a meta-synthesis analysis". *Clinics* 75 (2020): e2286.
5. Kim JH and Park H. "Effects of Smartphone-Based Mobile Learning in Nursing Education: A Systematic Review and Meta-analysis". *Asian Nursing Research Journal* 13.1 (2019): 1-29.
6. Liu Q., et al. "The Effectiveness of Blended Learning in Health Professions: Systematic Review and Meta-Analysis". *Journal of Medical Internet Research* 18.1 (2016): e2.
7. Pei L and Wu H. "Does online learning work better than offline learning in undergraduate medical education? A systematic review and meta-analysis". *Medical Education Online* 24.1666538 (2019): 1-13.
8. Bajpai S., et al. "Health Professions' Digital Education: Review of Learning Theories in Randomized Controlled Trials by the Digital Health Education Collaboration". *Journal of Medical Internet Research* 21.3 (2019): 1-22.
9. Nascimento JdSG., et al. "Clinical simulation for nursing competence development in cardiopulmonary resuscitation: systematic review". *The Revista Latino-Americana de Enfermagem* 28.3391 (2020): 1-10.
10. Garcia-Suarez M., et al. "Basic Life Support Training Methods for Health Science Students: A Systematic Review". *International Journal of Environmental Research and Public Health* 16768 (2019): 1-15.
11. Fields A. "Discovering Statistics Using IBM SPSS Statistics". Sage; Los Angeles (2013).
12. Triola M. "Elementary Statistics". Pearson: Boston (2006): 280-281.
13. Cummings G. "Understanding The New Statistics: Effect Sizes, Confidence Intervals, and Meta-Analysis". Routledge; New York (2012).

Volume 12 Issue 2 February 2021

©All rights reserved by Mark E Murdock.