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Athens Journal of Health and Medical Sciences

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The current issue is the third of the ninth volume of the *Athens Journal of Health and Medical Sciences* (AJHMS), published by the **Health & Medical Sciences Division** of ATINER.

Gregory T. Papanikos
President
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20-23 June 2022, Athens, Greece

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- Acceptance of Abstract: 4 Weeks after Submission
- Submission of Paper: **DEADLINE CLOSED**
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11th Annual International Conference on Health & Medical Sciences 1-4 May 2023, Athens, Greece

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Important Dates

- Abstract Submission: **3 October 2022**
- Acceptance of Abstract: 4 Weeks after Submission
- Submission of Paper: **3 April 2023**

Academic Member Responsible for the Conference

- **Dr. Vickie Hughes**, Director, Health & Medical Sciences Research Division, ATINER & Assistant Professor, School of Nursing, Johns Hopkins University, USA.
- **Dr. Carol Anne Chamley**, Head, Nursing Research Unit & Associate Professor, School of Health and Social Care, London South Bank University UK.
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Development and Testing of a Web Application to Improve Entry-to-Practice Pediatric Nursing Competencies: A Proof-of-Concept Study

By Ruth Chen^{*} & Haris Saud[‡]

Nurse educators can design technology-enhanced learning supports to prepare graduates to meet entry-to-practice (ETP) competencies and pass licensure examinations. The purpose of this study was to develop and test a proof-of-concept web application (Web App) to facilitate understanding of ETP competencies, and to explore the Web App's potential to improve performance on NCLEX readiness tests. We developed and evaluated the Web App in two stages. We focused on identifying important technical considerations involved in creating the Web App, developing learning content, and creating self-testing questions for learners in the Pilot phase. In the full-scale implementation phase, participants accessed the Web App content and self-testing questions and completed a study questionnaire and knowledge test; a subset of participants completed the NCLEX readiness test. Web App participants demonstrated a small-medium effect size on the knowledge test for overall score ($d=0.39$) and knowledge transfer ($d=0.44$) when compared with non-participants. There was no significant difference in performance on the NCLEX readiness test between participants and non-participants. This proof-of-concept study supported the development, implementation, and evaluation of a Web App to promote learning of ETP competencies. Future research directions include development and evaluation of technology-enhanced learning aids that align with nursing curricula and ETP competencies.

Keywords: education technology, web application, competency-based education, entry-to-practice competencies

Background

Over the past decade, there has been a global shift in nursing education with an increased focus on learners' preparedness for nursing practice and attainment of entry-to-practice nursing competencies (Arcand and Neumann 2005). In 2003, the International Council of Nurses (ICN) defined Entry-to-Practice (ETP) Competencies as key competencies a generalist nurse must achieve by the time they enter nursing practice (Black et al. 2008). In 2004, ten Canadian nursing regulatory bodies developed ETP Competencies for graduates of registered nurse education programs in order to promote consistency across different Canadian jurisdictions (Black et al. 2008). The resulting document from this Jurisdictional Competency Project summarized 119 competencies under the following five categories: (1) professional

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responsibility and accountability; (2) knowledge-based practice; (3) ethical practice; (4) service to the public; and (5) self-regulation (Black et al. 2008).

In Ontario, the provincial regulatory body for registered nurses (RNs), the College of Nurses of Ontario (CNO), used the Jurisdictional Competency Project to create 100 ETP Competencies which were subsumed under the same five competency categories (Entry-to-Practice Competencies for Registered Nurses, 2014). A guiding principle of the CNO's ETP Competencies is that baccalaureate programs will prepare new graduate RNs to "practice safely, competently, and ethically with people... across the lifespan" (CNO 2014, p. 4). As such, undergraduate nursing programs in Ontario must prepare graduates who are capable of caring for individuals of all ages.

ETP Competencies to Competency-Based Education

The rise of ETP Competencies in Canada and other parts of the world has led to curricular changes in nursing education programs. Provincial nursing regulatory bodies have used the Jurisdictional Competency Project to develop specific ETP Competencies and competency measures, recognizing the need to convey to educational institutions that a curriculum designed to meet these competencies should form the basis for accreditation of their degree program (CNO 2014).

With the ETP Competencies framework in mind, baccalaureate nursing education programs have begun to explore a competency-based education (CBE) model. CBE is an educational model that explicitly outlines the skills and abilities required in a competent practitioner (Chapman 1999). While, historically, a criterion for accreditation was for students to complete minimum required clinical hours in the practice setting, CBE proposes that achievement of ETP Competencies should serve to accredit nursing programs. This move to a competency-based approach to degree completion is not exclusive to nursing. Other health professional education programs such as medicine, occupational therapy, and physical therapy, have also developed outcome-based ETP Competencies for graduates of their respective disciplines (Verma et al. 2006). In Canada and the United States, graduates of registered nursing programs must also pass the National Council Licensure Examination for Registered Nurses (NCLEX-RN) for successful licensure and entry to practice.

Mobile, Smartphone-Based Learning Supports

To prepare nursing graduates for practice, many mobile technologies and smartphone-based learning supports have been developed over the past few decades. One such learning support is the use of mobile applications for licensure preparation, and companies such as Uworld® and Kaplan® specialize in licensing exam preparation, including the NCLEX-RN. Smartphones have a number of capabilities that can enhance learning and, specifically, support CBE in nursing and health professions education.

Digital games for medical students and residents, especially through virtual and/or augmented reality, are being used as training tools to help simulate difficult

environments and help in developing key practice competencies. For example, games can be used in surgical training to improve hand-eye coordination and reflex time (Graafland et al. 2012, Rosenberg et al. 2005). Simulation-based activities can also fulfil a variety of other educational goals, including providing repetitive practice, range in difficulty, multiple learning strategies, a controlled learning environment, individualized mastery plan, and defined outcomes (Guze 2015). Opportunities exist for smartphones to be applied in the context of nursing education to further a CBE model for undergraduate nursing.

Nursing Pediatric Clinical Experiences

Pediatric nursing is a practice area with high student interest but limited clinical placement availability. Due to the limited availability of these pediatric placements, up to 65% of students at one of our institutions do not receive a clinical placement in pediatrics. However, pediatric nursing knowledge and skills are still tested on the NCLEX-RN, which all baccalaureate-prepared nursing (BScN) graduates need to successfully complete in order to be a Registered Nurse in Canada. Anecdotal reports suggest that even though pediatric content is woven through the program's theoretical course content, students subsequently perform poorly on pediatric-related NCLEX-RN content and demonstrate consistently weak performance on the portion of the Health Education Systems Incorporated (HESI) exam pertaining to pediatric nursing practice. The HESI exam is a computer-adaptive test that mimics the NCLEX-RN testing format and has been used by BScN programs and learners to assess their preparedness for the NCLEX-RN.

These anecdotal findings suggest a need for creative and effective approaches to address students' gaps in pediatric nursing exposure, knowledge, and practice, with the goal to help students achieve ETP competencies in pediatrics and to be successful on the NCLEX-RN. In a pediatrics residency program in Abu Dhabi, drastic changes were initiated after pass rates on the Arab Medical Board examinations revealed that the pediatric residency program scored consistently below the national average; a competency-based training reform brought about significant improvements in educational and patient care outcomes (Ibrahim et al. 2015). Simulation-based learning and technology-supported learning is being used more and more frequently in health professions education programs. Therefore, we saw an opportunity to develop and test a proof-of-concept web application which would provide a technology-supported learning experience to help students achieve the required ETP competencies in pediatric nursing.

Purpose

The purpose of this study was threefold:

- 1) To create a proof-of-concept, smartphone-accessible web application (Web App) that would support student development of pediatric nursing ETP competencies.

- 2) To evaluate the Web App for effectiveness of content delivery, knowledge development, and self-testing with respect to the CNO's ETP competency domains.
- 3) To explore the Web App's potential to improve student performance on NCLEX-readiness tests such as the HESI.

Research Ethics Approval

Research Ethics Board approval for this study was obtained from both universities prior to study implementation. All participants provided written and informed consent to participate.

Methods

Development of the Web App - Technical Considerations

The first phase of this project was to design a proof-of-concept web application that would support learner development of pediatric nursing ETP competencies. The Web App design phase occurred between September 2016 and March 2017. Important technical decisions needed to be made before content could be added. We first needed to identify a platform that could host the content we intended for learners to access. We decided early in the project design phase to create a web application, as opposed to a native app, because a web application could be used with any internet-enabled computer, tablet, or smartphone device. We researched several website building and hosting services, and selected Squarespace® because of the simplicity, ease-of-use, and modern design of its website building services.

Next, the Web App domain name www.MyCAPnurse.com was selected, with the CAP acronym standing for "Competence, Assessment, Practice." Using the CNO's ETP competencies as the guiding framework, all authors curated content and developed learning modules that covered pediatric content within the five CNO ETP competency domains: Professional Responsibility and Accountability, Knowledge-Based Practice, Ethical Practice, Service to the Public, and Self-Regulation.

We reviewed the Canada Copyright Act and the University's Fair Dealing Policy to ensure that any publicly-available pediatric nursing content accessed on www.MyCAPnurse.com was appropriate for use. Pediatric content was curated and adapted to provide a broad and balanced representation of the different ETP competency domains. Publicly-available resources, as well as online learning videos, articles, and pediatric content created by the research team, were collated, evaluated for appropriateness and quality, and matched to one or more ETP competencies. All content was formatted for the platform by our site developer and research assistants.

One of the goals for the Web App was to provide opportunities for students to test their own learning of the content they reviewed on the Web App. Therefore,

we selected the 4Screens® Engageform platform which allowed us to embed quiz questions at the end of every learning module. Up to ten (10) multiple choice and/or short answer quiz questions for each learning module were developed, and all quiz questions provided learners with immediate feedback to their responses. The Web App content, including the learning modules and quiz questions, was reviewed by all members of the research team, several of whom had expertise in pediatric nursing.

Pilot Implementation

A pilot cohort (n=33) of senior-level nursing students at one of our study sites (i.e., one university) was recruited in April 2017. Pilot participants were allowed to review the Web App content and quizzes. At the end of 12 weeks, participants were asked to provide feedback on the Web App's mobile accessibility, visual appeal, and module content quality. Furthermore, participants were asked how much time was spent on the Web App. This feedback was reviewed, and the research team used the pilot participants' feedback to refine the Web App platform and content in preparation for full-scale implementation.

Web App Platform Refinement

Based on the pilot phase and subsequent feedback, significant revisions were made to www.MyCAPnurse.com. Additional content modules and quiz questions were created. In the pilot phase, we created 13 learning modules and 68 quiz questions. We added 9 more learning modules and 94 more quiz questions for the full-scale implementation phase (see Table 1).

There was a significant expansion of content with respect to the Service to the Public and Self-Regulation ETP competency domains. While much of the content in these two domains did not specifically cover pediatric nursing practice, we curated and developed learning modules to reflect a pediatric nursing practice lens. Additional quiz questions were added to existing learning modules to emulate the NCLEX-RN exam's testing format. The visual layout of www.MyCAPnurse.com was also refined to ensure that learning activities and modules were easier to find, and the Web App was easier to navigate, both on a laptop/desktop computer and on tablet/mobile devices.

Table 1. *Web App Learning Module Topics*

Pediatric Advanced Life Support (PALS) Resuscitation Congestive Heart Failure Heart Murmurs Situation, Background, Assessment, Recommendation (SBAR) Pediatric Septic Shock Clinical Practice guidelines ABCDs of Pediatric Assessment Medication Errors in Pediatrics Medication Safety in Pediatrics Safe Medication Use in the ER Status Epilepticus Clinical Practice Guidelines Pediatric Assessment Clinical Practice Guidelines
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Pediatric Procedures Clinical Practice Guidelines
Developing SMART Learning Goals
QA Program Learning Plan
Ethical Issues for Nurses
- Therapeutic Lying/Deception
- DNR Ethics
- Company Policy and Best Practice
Self-Regulation
- Public Protection
- Confidentiality
- Professional Responsibility

Full-Scale Web App Implementation

A larger sample of nursing students at both universities (n=72) was recruited in January 2018 to participate in the study and no students who participated in the pilot phase enrolled in the full-scale implementation phase. Of the 72 participants who enrolled in the study, only 46% (n=33) accessed and perused the enhanced and refined version of the Web App over the span of four months. A research assistant sent participants bi-weekly email check-ins. These messages highlighted the various features www.MyCAPnurse.com offered and were intended to promote students' use of the Web App during the study period.

Participant feedback on the user interface, ETP competencies, and self-reporting data was collected through email correspondence throughout the four-month duration. At the end of the four-month study period, all participants (including those who did not access the web application during the study period) completed a Web App questionnaire and knowledge test. The Web App questionnaire gathered users' experiences with www.MyCAPnurse.com and both qualitative and quantitative data were collected. The knowledge test consisted of 32 multiple-choice questions (MCQs) that assessed pediatric content knowledge. Half of the MCQs were questions that had been accessible to Web App users through www.MyCAPnurse.com, while the remaining half were new MCQs for all participants. We structured the knowledge test this way, with half of the questions being familiar and half of the questions not familiar, to assess for Web App participants' knowledge transfer.

A small subset of participants also completed the HESI examination. The academic performance of all participants was analyzed and compared across the two cohorts (Web App users vs non-users).

Results

Participant Evaluation of Web App and Perceptions of Knowledge Acquisition

Participants were asked to rate the Web App on a 7-point Likert scale for content and effectiveness of exposure to pediatric ETP competencies (see results in Table 2). In the qualitative feedback collected, participants indicated that the module content was relevant to nursing practice and helped them learn more about the pediatric ETP competencies required for nurses in Ontario. However, participants

wanted access to more NCLEX-RN-style practice questions. Web App participants also commented that the module content was not accessed as frequently as they desired due to a number of factors; school workload was the most frequently cited barrier.

Table 2. Mean Scores by Web App Participants for Web App Content and Various Descriptors (7-Point Likert scale*)

	Mean Score (SD)
Usefulness for learning CNO ETP competencies for pediatric nursing	4.64 (1.27)
Relevance of quiz questions to module content	5.03 (1.18)
Relevance of quiz questions to CNO ETP competencies	5.00 (1.12)
Relevance of web app to <i>Evidence-Informed Knowledge</i> of pediatric nursing**	4.79 (1.14)
Relevance of web app to <i>Collaboration with Clients</i> **	4.82 (1.29)
Relevance of web app to <i>Communication and Collaboration with Members of Health Care Team</i> **	4.85 (1.20)
Relevance of web app to <i>Professionalism</i> in nursing practice**	5.18 (1.26)

*Note: A 7-point Likert scale for the questions was used, with a score of 1 meaning “not at all useful/relevant” and a score of 7 meaning “extremely useful/relevant”.

**Note: These are Canadian Association for Schools of Nursing (CASN) Competencies.

Knowledge Test Results Summary

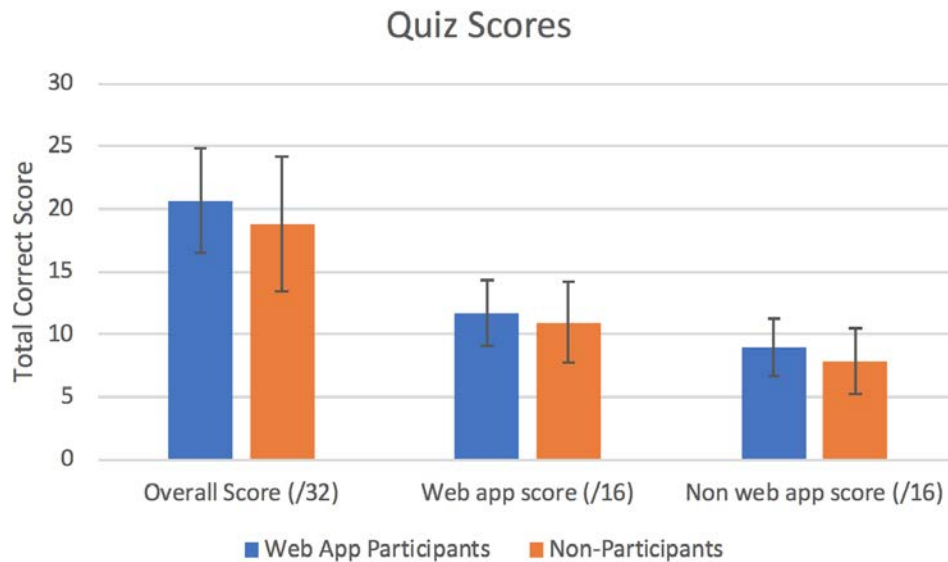
The knowledge test component of the final questionnaire consisted of 32 MCQs. To test both learning recall from the Web App and knowledge transfer, 16 questions were repeated from the Web App content and would have been familiar to participants, while an additional 16 questions were new for all respondents. Questions were paired so that test content between the old and new questions would be consistent. For example, a Web App question on normal infant heart rates would be paired with a newly developed question on the normal respiratory rate range for infants.

Our hypothesis was that Web App participants would score significantly higher on the familiar Web App questions when compared with non-Web App participants. Furthermore, we also hypothesized that, if reviewing the Web App content facilitated transfer of learning, Web App participants would score higher on the unfamiliar pediatric questions when compared with non-Web App participant scores.

SPSS Version 25 was used for the statistical analyses. Overall, Web App participants scored 20.70 (SD=4.16) questions correct out of 32, while non-participants' average score was 18.82 (SD=5.37). An independent samples Kruskal-Wallis test yielded an $H=2.18$, $p=0.14$; effect size $d=0.39$. On the familiar/recall Web App questions, participants scored 11.73 (SD=2.63) out of 16, while non-participants scored 10.95 (SD=3.24); $H=0.835$, $p=0.36$; effect size $d=0.26$. On the non-Web App questions assessing knowledge transfer, participants scored 8.97 (SD=2.31) and non-participants scored 7.87 (SD=2.62); $H=3.16$, $p=0.076$; effect size $d=0.44$. These results are presented in Figure 1. Subgroup analyses performed

based on university program site and based on whether the participant had completed a previous pediatric clinical placement did not yield any statistically significant differences in Web App test performance.

Figure 1. Results of the Knowledge Test, Showing an Overall Score (Out of 32), a Score of Repeat Web App Questions (Out of 16), and a Score of Non-Web App Questions (Out of 16)



HESI Results

A small subset of study participants elected to complete the HESI exam at the end of the study period. Because this was an optional offering, 18 students completed the HESI, 4 of whom were Web App participants. The results showed that Web App participants received a mean overall HESI score of 786.50 (SD=166.96), while non-participants scored 809.57 (SD=156.67). For reference, a HESI score of 850 or greater is considered “Acceptable”. The independent-samples Kruskal Wallis test demonstrated $H=0.229$, $p=0.63$. For the HESI pediatric scores, Web App participants scored a mean of 721.75 (SD=97.70) and non-participants scored 754.43 (SD=258.96); $H=0.00$; $p=1.0$.

Discussion

This study provided important insight into the process of developing a Web App for use in nursing education and CBE. In creating and evaluating this proof-of-concept Web App, we had to make important technical and content decisions that would lead to successful Web App development, implementation, and evaluation. Useful information gained throughout the Web App development process will be presented here.

Development Process - Choosing to Create a Web Application

The way we interact with technology, including smartphones and apps, is continually and rapidly evolving. The decision to develop a web application to deliver modules on ETP competencies was a sound choice in 2016, when myCAPnurse.com was created. A web application maximized accessibility and provided participants the freedom to access the content through their preferred medium, rather than restricting them to certain platforms or operating systems. However, a web-based application has to maintain an internet connection to use and may, paradoxically, restrict access, a shortcoming that native applications have overcome (Vaupel et al. 2018). The convenience of a native app (e.g., easier to launch) may also encourage app use more than web applications on mobile devices. Native app development requires creators to have more technical competence and must be tailored to the specific smartphone platform. Website building companies like Squarespace® guide web app development and this site became our preferred choice for the Web App we created. While creating a native app would require more computer programming knowledge and capability than a web application, it may be the more popular choice for end users, as smartphone application use evolves.

Canada Copyright Act and University's Fair Dealing Policy

To create our proof-of-concept Web App, it was important to understand the policies around content use, given that the learning module content we curated greatly relied on publicly-available pediatric nursing content. Prior to developing or importing content onto the Web App, we needed to understand and comply with the Canada Copyright Act and the University's Fair Dealing Policy in the content we added to the Web App. Another direction we could have taken was to develop most, or all, of the Web App content independently. However, given the short timeline we had for the development phase, we needed to work with existing pediatric nursing content. We also felt that curating publicly-available content could be beneficial for student learning (e.g., news articles could provide diverse perspectives on current issues.)

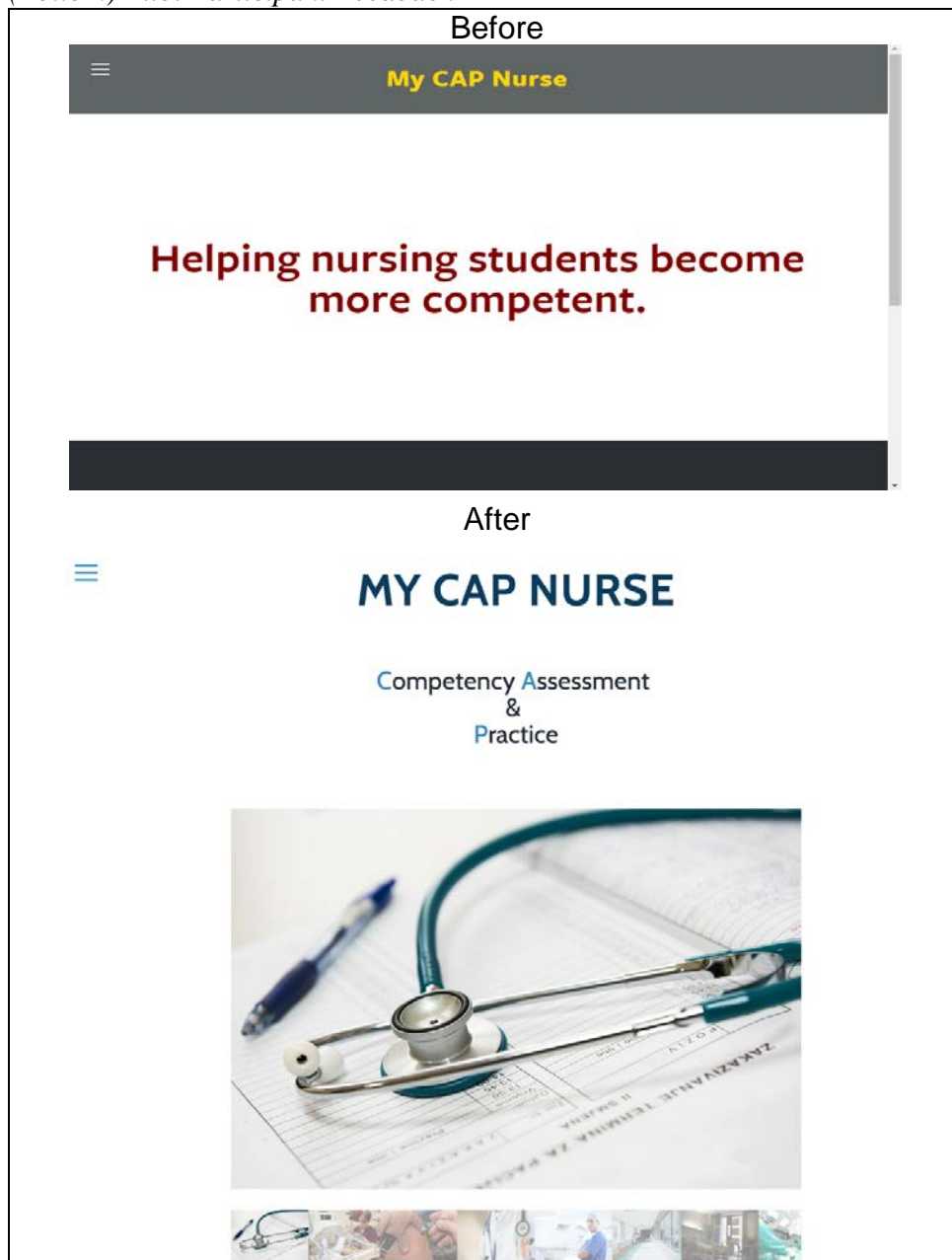
Purpose of Modules

When undertaking the design of an ETP competency-based Web App, it was important that any modules created have clear learning objectives and purpose and would tie in to the ETP competencies. To meet this goal, our team linked learning activities and modules to specific ETP competencies and each learning module highlighted the connection. Not only did this provide learners with exposure to the ETP competencies required by the provincial nursing regulatory body, it also ensured learners knew what knowledge and skills they would be expected to develop within that specific module. This is consistent with a competency-based educational approach (Pijl-Zieber et al. 2014).

User Interface (UI) Considerations

Visual appeal was a very important consideration during the Web App refinement process. In the pilot implementation, some of the participants identified the layout of the Web App as the reason they used the app less frequently. Significant visual overhauls were subsequently made to ensure that the web app was aesthetically pleasing and that the visual appeal did not take away from the overall experience (see Figure 2 for screenshots of the home page before and after pilot feedback).

Figure 2. Example of www.myCAPnurse.com Home Page Before (Top) and After (Bottom) Pilot Participant Feedback



A related UI point of consideration is the ease of use and navigation of the Web App. Qualitative feedback in the pilot implementation indicated that the initial version of the Web App was not easy to navigate. Through refinement, we added a Contents/Index page, as well as a search bar, to ensure that it was easy to find one's way around the Web App. Great care was also taken to ensure that the Web App was always simple and intuitive to use. The aim was to prevent "visual clutter", overcrowding of information, and minimizing the number of steps (or "clicks") required to access module content.

ETP Competency Development

In the pilot phase, participants responded that the Web App and activities were useful in learning the CNO ETP Competencies for pediatric nursing. One Web App participant in the full-scale implementation phase commented, "I felt that [...] the module content was very relevant to nursing practice and helped me learn more about the entry to practice competencies that are required for nursing in Ontario." However, another participant noted that the "app wasn't intuitive." Overall, participant feedback suggested that the web app was useful in providing exposure to the students and helping them learn about the ETP competencies, but still challenging to navigate.

Study Questionnaire, Knowledge Test and HESI Performance

Within the first week of posting the study announcement at both universities, we received over 120 students who signed up to participate in the study. All interested individuals were provided the link to the Web App and were encouraged to use the Web App as often as desired. A research assistant sent participants bi-weekly check-in emails, and these messages highlighted the various features of www.myCAPnurse.com. However, at the conclusion of the study, only 33 of the original Web App participants completed the final study questionnaire and pediatric Web App knowledge test questions.

There were no statistically significant differences between Web App participants and non-participants when it came to both the repeat knowledge test questions (from the Web App) and the new questions. We expected a significant difference in performance when it came to the repeat knowledge test questions, given that the Web App participants would have been exposed previously to those questions, while non-participants would not. Interestingly, both groups performed better on the repeat questions than on the new questions, although it was not statistically significant. We did, however, note a moderate effect size of 0.44 for the Web App participants who demonstrated improved performance on new, or unfamiliar, test questions when compared with non-participants. This suggests that pediatric Web App users may have had some transfer of pediatric knowledge after use of the Web App.

On the HESI, there were no significant differences in performance between the Web App participants and non-participants. While we expected Web App participants to perform better on the pediatric portion, but not necessarily on the

overall HESI, our data was underpowered to detect any statistically significant differences between groups, if indeed the Web App use supported pediatric HESI performance.

While we recruited more participants than our sample size calculations required, a significant limitation to our findings is that we were under-powered to detect the outcomes of interest for participants who used the Web App. This is especially true for the HESI, where there were only four Web App participants and 14 non-participants. For the Web App knowledge test, we had only 33 web app participants and 39 non-participants. Sample size calculations required 80 study participants, half of whom would use the Web App. A two-point difference on the Web App Test result score would yield a moderate effect size of 0.5. To achieve the same moderate effect size of 0.5 on the HESI, we focused on the HESI pediatric sub-scores as our primary outcome, instead of the overall HESI score. We required 30 total participants, 10 of whom were Web App users, to achieve the minimally acceptable score of 850 as compared with non-Web App users who we anticipated would achieve an average score 750.

Additional Considerations

Disconnect Between ETP Competencies and NCLEX Examination Preparation

A possible reason for the poor uptake of the Web App by participants could be the disconnect between the relative importance ascribed to learning about the ETP Competencies when compared to the need to prepare for the NCLEX licensure examination. The Web App focused on helping students understand ETP competencies in pediatric nursing because the study team felt that pediatric nursing content was an area of the nursing curriculum where students wanted more exposure. The focus of the Web App was on ETP competencies, and all learning modules made explicit connections to specific ETP competencies. Focusing on helping students develop ETP competencies might not necessarily translate to better outcomes on practice-based exams like the HESI, and participants may have used the Web App less because they did not see the connection to the HESI or NCLEX.

Minimal Time Spent on App

The majority of Web App participants (n=26) spent a total of 0-3 hours/week reviewing the learning content on the Web App during the study period. Two participants reported 3-6 hours/week of review, three spent 6-9 hours/week, and two devoted 10+ hours/week to web app review. The minimal time spent by most of the Web App participants would prevent them from reviewing the ETP Competencies learning modules in depth. Furthermore, because the MCQ and short answer self-testing questions were embedded at the end of every learning module, this would also explain why Web App participants performed similarly to non-participants on the repeat questions of the knowledge test.

Curriculum Integration and Motivation

If Web App content was more directly linked and integrated to the BScN program curricula or linked to evaluation measures within the course curricula at the two university sites involved in this study, students would likely have greater incentive to review the Web App frequently and regularly. Those interested in future Web App or technology-enhanced learning supports would benefit from connecting their work to nursing program curricula and to evaluation measures within the program curriculum. Our results suggest that participants are less motivated to engage in learning that is perceived to be future-oriented (e.g. understanding ETP competencies) and not directly connected to their current course of studies and/or licensure examination preparation. This could be due to the students' motivation for learning. Learners who are intrinsically motivated to learn tend to be more engaged, retain information better, and are generally happy; in contrast, those students who are extrinsically motivated by some outside force may not be as likely to seek additional opportunities to learn when they are not directly related to the extrinsic objective (Hanus and Fox 2015).

Conclusion

The manner with which students engage technology and mobile applications for learning continues to evolve and change. This proof-of-concept study supported the development, implementation, and evaluation of a Web App to promote learning of ETP competencies for pediatric nursing practice. Future research directions include continued development and testing of technology-enhanced learning aids that align with nursing program curricula, entry-to-practice competencies, and future licensure examinations. Furthermore, education researchers are ideally positioned to develop technology-supported learning aids that promote intrinsic and extrinsic motivators for use and that could evolve with technological advances in smartphone and mobile-supported learning and developments in the education research literature.

Acknowledgments

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Investigation of Nursing Students' Eating Attitudes and Affecting Factors: A Cross-Sectional Study

By Olcay Çam^{*}, Elif Deniz Kaçmaz[‡] & Cansu Guler[°]

The aim of the study was to determine the eating attitudes of university students and the factors affecting these attitudes. The descriptive study was conducted with 711 nursing students studying at a public university nursing faculty. A Personal Information Form and Eating Attitude Test (EAT) were used as data collection tools. Descriptive statistics and chi-square analysis were used in the evaluation of the data. 59.6% of students had a normal range in Body Mass Index (BMI). The mean EAT score of the students was 16.64±9.12. As a result of the chi-square analysis, there was a statistically significant difference between the groups in the EAT scores of variables such as satisfaction with weight and body image; parental attitude; satisfaction with the department; self-worth; perceived general health status; presence of a chronic disease; professional psychological support; diet and physical exercise; and attention to diet ($p<0.05$). It was determined that 8.9% of the students participating in the study are at risk of developing an eating disorder. It was determined that the students' perceived parental attitudes, being satisfied with their body image and weight, self-worth, diet and physical exercise, and paying attention to their diet all affect their eating attitudes.

Keywords: student, nurse, eating attitudes

Introduction

Eating behaviour, which is one of the most basic biological activities and necessary for the continuation of life, is an action with social, cultural and psychological dimensions (Ağaçdiken Alkan et al. 2016, Atlı Özbaş 2016). Psychologically, it is stated that eating behaviour is closely related to emotions such as stress, tension, boredom, happiness and excitement felt as a result of events (Özkan and Bilici 2018). An eating attitude, on the other hand, is the tendency of an individual to create feelings, thoughts and behaviours about eating and nutrition (Yılmaz 2017). Eating attitudes and behaviours are affected by many factors such as age, gender, genetic structure, hormones, mood, environment, cultural and religious beliefs, media and body image. Negative changes in eating attitudes can cause health problems such as eating disorders (Özkan and Bilici 2018, Kadioğlu and Ergün 2015).

Eating disorders are psychiatric disorders that include deterioration in eating attitudes and behaviours, which can lead to problems such as malnutrition and over-nutrition in an individual (Özyazıcıoğlu and Aydın 2019). In eating disorders, the individual's eating attitude and body image are impaired (Ünalın et al. 2009). According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-V), eating disorders are classified as anorexia nervosa; bulimia nervosa; binge

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eating disorder; other specified feeding and eating disorder; pica; rumination disorder; avoidant/restricted food intake disorder; and others (muscle dysmorphia, orthorexia nervosa) (American Psychiatric Association 2013). Although a specific cause for eating disorders is not known, its emergence has tried to be explained by biological factors, developmental problems, psychodynamics, cognitive and sociocultural factors that are also effective in eating attitudes and behaviours (Atlı Özbaş 2016, Ulaş et al. 2013).

Literature Review

In terms of eating disorders, it is stated that university students are among the high-risk groups due to their developmental period and possible psychosocial and economic difficulties (Çelik et al. 2016, Vardar and Erzenin 2011, Ünalın et al. 2009). Studies have shown that the probability of having an eating disorder in university students is between 6.3% and 14% (Çelik et al. 2016, Kadiođlu and Ergün 2015, Ünalın et al. 2009). In studies examining eating disorders in university students, it is stated that the rate of eating disorders is high in those who are above normal weight according to BMI, stay in a dormitory, live in a town, are not satisfied with their body weight, go on a diet, are female students and have mental health problems such as depression (Çelik et al. 2016, Kadiođlu and Ergün 2015, Ünalın et al. 2009, Oruçular and Bariskin 2015, Pengpid and Peltzer 2018).

It is stated that it is useful for health professionals to make a general assessment in order to ensure that individuals make changes in the diet they are used to (Serin and Şanlıer 2018). Undergraduate nursing students, who are in the high-risk group and who are expected to be role models in society, are expected to have healthy behaviours first (Usta et al. 2015). Considering the increase in the incidence of eating disorders day by day, it is thought that it is important to include eating attitudes and disorders in preventive mental health practices and to conduct screening studies in order to identify at-risk individuals.

It is thought that determining the eating attitudes and affecting factors of student nurses will be effective in their professional and personal development. Considering that today's undergraduate students will be role models for tomorrow's professional nurses with their positive life behaviours, it is important to take protective measures by determining the risk of eating disorders and affecting factors in the study. In this study, it was aimed to determine the eating attitudes of student nurses and the factors affecting their eating attitudes.

For this purpose, the research questions are:

1. What is the rate of eating disorders in nursing students?
2. What are the factors affecting the eating attitudes of nursing students?

Materials and Methods

Population and Sample of the Research

This cross-sectional study was conducted with students studying at a public university nursing faculty between 01.02.2020-30.06.2020. The universe of this research consists of nursing students studying at one Faculty of Nursing in the 2019-2020 academic year (N=1203). A methodological method was not used to determine the sample of the research, and it was aimed to include individuals who were at school during the institutional leave and who met the inclusion criteria of the research. Volunteering to participate in the research, being a nursing student and completing the questionnaires were criteria for inclusion in the research (n=711) (Reach rate 59%).

Data Collection Tools

The data of the study were obtained by using the Personal Information Form and the Eating Attitude Test.

Personal Information Form: The form, which was developed by the researchers and includes the sociodemographic, academic and general characteristics of the students, consists of 25 open and closed-ended questions.

Eating Attitudes Test (EAT-40): The Eating Attitudes Test was developed by Garner and Garfinkel (1979) and is used to assess the risk of eating disorders. The validity and reliability study of EAT-40 in Turkey was conducted by Savaşır and Erol (1989). The EAT consists of 40 items and the answers are evaluated in a six-step Likert form as “always-never”. In the evaluation of scale items, “sometimes” is 1 point, “rarely” is 2 points, and “never” is 3 points. For items 1, 18, 19, 23, 27 and 39, other options are evaluated as “0” points. For the other items of the scale, always is 3 points; very often is 2 points; and often is 1 point; and other options are calculated as 0 points. As a result, the scores obtained from each item of the scale are summed to obtain the total score of the scale. The cut-off value for EAT-40 is 30 points. People whose score of 30 and above are considered be at high risk of having an eating disorder. The Cronbach Alpha reliability coefficient of the scale was found to be 0.70 in the study of Savaşır and Erol (1989). The Cronbach Alpha reliability coefficient of the scale was found to be 0.725 for this study.

Data Collection

The data of the study were obtained between February and March 2020. In order to reach the whole universe, the questionnaires were distributed by the researchers between the courses and collected at the end of the break.

Ethics-Approval Statement

Ethics committee permission (Date and Number: 30.01.2020-01/07-512) from one University Scientific Research and Publication Ethics Committee to

carry out the research and institutional permission from Faculty of Nursing and verbal permissions from the participants for the application of the questionnaires.

Evaluation of Data

While evaluating the findings of the study, SPSS (Static Package for Social Sciences) for Windows 21.00 program was used for data coding and statistical analysis. In the study, Cronbach's Alpha coefficient was used to test the reliability of the EAT scale. Chi-square analysis was used to compare categorical data. Results were expressed as mean, standard deviation, min-max, number and percentage. The results were accepted as 95% confidence interval and significance value as $p < 0.05$.

Results

The mean age of the students participating in the research is 21.28 ± 1.66 (min-max: 18-32); 85.9 of the students are female; 33.3% are 1st grade; 32.3% of them have spouses/lovers. The mean body mass index (BMI) of the students is 22.01 ± 3.07 (min-max: 14.53-35.06). BMI of 59.6% was in the normal range. 42.9% of the students were satisfied with their weight and 50.6% were satisfied with their body image. 94% of the students are in the nuclear family structure and 58.2% find their parents' child-rearing attitude egalitarian and democratic. 55.3% of students live in student dormitories. 45.6% of the students stated that they had taken a nutrition lesson at least once in their education life. 81% of the students find themselves valuable (Table 1).

Table 1. *Introductory Characteristics of Students*

Features	n	%
Gender		
Woman	611	85.9
Man	100	14.1
Class		
1st Class	237	33.3
2nd Class	133	18.7
3rd Class	191	26.9
4th Class	150	21.1
Spouse-Beloved		
Yes	230	32.3
No	481	67.7
Body Mass Index		
Slim ($\leq 19.99 \text{ kg}\% \text{m}^2$)	181	25.5
Normal ($20.00-24.99 \text{ kg}\% \text{m}^2$)	424	59.6
Slightly obese ($25.00-29.99 \text{ kg}\% \text{m}^2$)	89	12.5
Obese ($>30 \text{ kg}\% \text{m}^2$)	17	2.4
Weight Satisfaction		
Yes	305	42.9
No	294	41.4
Not sure	112	15.8

Body Image Satisfaction		
Yes	360	50.6
No	214	30.1
Not sure	137	19.3
Family Members		
Nuclear family	668	94.0
Other (Fragmented,Wide)	43	6.0
Parent's Childrearing Attitude		
Repressive and Authoritarian	81	11.4
Overprotective	132	18.6
Egalitarian and Democratic	414	58.2
Rejective/Inconsistent	84	11.8
Living place		
Family	178	25.0
Student dormitory	393	55.3
Student house	120	16.9
Alone	20	2.8
Taking a Nutrition Lesson		
Yes	324	45.6
No	387	54.4
Self-Value		
Yes	576	81.0
No	26	3.7
Not sure	109	15.3

When the general life habits of the students are examined, 80.7% of them report that they do not smoke and 68.1% do not consume alcohol. 16.7% of the students report that they do diet, 34.3% do physical exercise, and 48.9% pay attention to their diet at a normal level (Table 2).

Table 2. *General Life Habits of Students*

Features	n	%
Smoking Status		
Yes	137	19.3
No	574	80.7
Alcohol Use Status		
Yes	227	31.9
No	484	68.1
Dieting Status		
Yes	119	16.7
No	592	83.3
Doing Physical Exercise Status		
Yes	244	34.3
No	467	65.7
Attention to Diet		
A lot	46	6.5
Normal	348	48.9
A little	244	34.3
None	73	10.3

The mean EAT score of the students was found to be 16.64 ± 9.12 (min-max: 0.00-59.00). In the chi-square analysis performed to compare the categorical data,

there was a statistically significant difference between the groups in terms of satisfaction with weight, satisfaction with body image, parental attitude, self-esteem variables and EAT scores ($p \leq 0.05$); There was no statistically significant difference between the groups in the EAT scores of variables such as gender, class, having a spouse/lover, body mass index, family structure, place of residence, and taking nutrition lessons ($p > 0.05$) (Table 3).

Table 3. Comparison of Students' Personal Characteristics and EAT Scores

Features	EAT scores				Statistical Analysis X^2 ; p
	<30 n	%	≥ 30 n	%	
Gender					
Woman	556	91.0	55	9.0	0.107;0.744
Man	92	92.0	8	8.0	
Class					
1st Class	207	87.3	30	12.7	6.714;0.082
2nd Class	124	93.2	9	6.8	
3rd Class	176	92.1	15	7.9	
4th Class	141	94.0	9	6.0	
Spouse-Beloved					
Yes	209	90.9	21	9.1	0.31;0.861
No	439	91.3	42	8.7	
Body Mass Index					
Slim (≤ 19.99 kg/m ²)	167	92.3	14	7.7	3.451;0.327
Normal (20.00-24.99 kg/m ²)	389	91.7	35	8.3	
Slightly obese (25.00-29.99 kg/m ²)	78	87.6	11	12.4	
Obese (> 30 kg/m ²)	14	82.4	3	17.6	
Weight Satisfaction					
Yes	287	94.1	18	5.9	12.072;0.002**
No	255	86.7	39	13.3	
Not sure	106	94.6	6	5.4	
Body Image Satisfaction					
Yes	339	94.2	21	5.8	16.379;0.000**
No	181	84.6	33	15.4	
Not sure	128	93.4	9	6.6	
Family Members					
Nuclear family	610	91.3	58	8.7	0.434;0.510
Other (Fragmented,Wide)	38	88.4	5	11.6	
Parent's Childrearing Attitude					
Repressive and Authoritarian	71	87.7	10	12.3	8.235;0.041*
Over protective	116	87.9	16	12.1	
Egalitarian and Democratic	388	93.7	26	6.3	
Rejective/Inconsistent	73	86.9	11	13.1	
Living place					
Family	162	91.0	16	9.0	3.470;0.325
Student dormitory	355	90.3	38	9.7	
Student house	114	95.0	6	5.0	
Alone	17	85.0	3	15.0	
Taking a Nutrition Lesson					
Yes	302	93.2	22	6.8	3.160;0.075
No	346	89.4	41	10.6	
Self-Value					
Yes	536	93.1	40	6.9	17.692;0.000**
No	19	73.1	7	26.9	
Not sure	93	85.3	16	14.7	

* $p < 0.05$, ** $p < 0.01$, X^2 : Chi square, EAT: Eating Attitude Test.

When the general living habits were examined, there was a statistically significant difference between the groups in terms of diet and physical exercise, attention to nutrition patterns and EAT scores ($p \leq 0.05$). It was determined that there was no statistically significant difference between the groups in the EAT scores of smoking and alcohol use variables ($p > 0.05$) (Table 4).

Table 4. Comparison of Students' General Life Habits and EAT Scores

Features	EAT scores				Statistical Analysis χ^2 ; p
	<30 n	%	≥ 30 n	%	
Smoking Status					
Yes	120	87.6	17	12.4	2.645;0.104
No	528	92.0	46	8.0	
Alcohol Use Status					
Yes	202	89.0	25	11.0	1.913;0.167
No	446	92.1	38	7.9	
Dieting Status					
Yes	87	73.1	32	26.9	57.532;0.000**
No	561	94.8	31	5.2	
Doing Physical Exercise Status					
Yes	213	87.3	31	12.7	6.798;0.009**
No	435	93.1	32	6.9	
Attention to Diet					
A lot	32	69.6	14	30.4	31.390;0.000**
Normal	327	94.0	21	6.0	
A little	225	92.2	19	7.8	
None	64	87.7	9	12.3	

* $p < 0.05$, ** $p < 0.01$, χ^2 : Chi-square, EAT: Eating Attitude Test.

Discussion

In this study, which was conducted to examine the eating attitudes of nursing students who are trained to be health professionals and the factors affecting them, the eating attitudes of the students were determined and some factors affecting their eating attitudes were determined.

It was determined that the mean YTT-40 score of the nursing students participating in the study was 16.64 ± 9.12 . In studies conducted with university students in our country, the mean score was 15.66 ± 8.50 ; 17.76 ± 12.34 (Arslantaş et al. 2017); 18.43 ± 10.56 (Duran et al. 2016). It was determined as 20.9 ± 9.3 (Ünalın et al. 2009), 27.98 ± 12.98 (Özvurmaz et al. 2018). It was determined that 8.9% of the students participating in the study were at risk of having or developing an eating disorder. Similar to the high incidence of eating disorders in university students in international studies (Uri et al. 2021, Trindale et al. 2018, Pengpig and Peltzer 2018, Hasan et al. 2018, Yu et al. 2015), it has been reported that the risk of eating disorders in university students varies between 4.2% and 84.5% in national studies (Hacıhasanoğlu Aşıl et al. 2020, Uzun et al. 2018, Usta et al. 2015, Akdevelioğlu and Yörüsün 2019, Arslantaş et al. 2017, Duran et al. 2016, Özvurmaz et al. 2018, Ulaş et al. 2013). It can be thought that this variability seen

in the results of the research is due to the sample sizes and sociocultural differences of the individuals forming the sample.

When the relationship between students' eating attitudes and their personal characteristics is examined, in our study, it was determined that factors such as gender, age, presence of spouse/lover, BMI, number of individuals in the family, family structure, place of residence, academic achievement, taking nutrition courses and transferring them to practice did not affect the EAT score averages. As a result of our research, it can be said that some of these factors, which were not found to affect students' eating attitudes, are different from the literature. In the literature, there are studies showing that the mean EAT score is affected by the gender factor originating from female students (Ağaçdiken Alkan et al. 2016, Özvurmaz et al. 2018) and the BMI factor originating from obese individuals (Usta et al. 2015, Çelik et al. 2015, Balhara et al. 2012, Pengpid and Peltzer 2018). Contrary to the literature, the lack of a relationship between BMI and eating disorders may be due to the fact that most of the individuals participating in the study were of normal weight. In addition, it is thought that this variability arises due to the sociocultural differences of the individuals who constitute the sample of the research.

From the students participating in this research, a significant relationship was found between being satisfied with weight and body image and EAT. It was noted that 41.4% of the students were not satisfied with their weight and 30.1% with their body image. Like this study's findings, a study which was worked out by Ağaçdiken Alkan et al. (2016) found that there was a significant relationship between being satisfied with their weight and body and their eating attitude, and 33.3% of the students were not satisfied with their weight. It is known that the desire for positive body image affects the eating attitudes and behaviours of individuals (Öngören 2015, Özboilat 2011).

In the literature, the results of studies on the relationship between family structure and eating disorders are inconsistent. While some studies have found a relationship between eating disorders and family structure (Sapmaz Yurtsever and Sütücü 2017), some studies have found no relationship (Ozenç et al. 2014). In the literature, it is suggested that the disrupted eating behaviours of individuals who are negatively evaluated in childhood and who have experienced an overprotective, authoritarian and punitive parenting style emerge as a way of controlling the environment. It has been found that individuals at risk of eating disorders perceive their parents' parenting negatively (Ozenç et al. 2014, Sapmaz Yurtsever and Sütücü 2017). It was determined that there was a significant relationship between students' perceived parental attitudes and EAT. Our research findings support this information.

It was determined that 81% of the students value themselves and there is a significant relationship between their self-worth and EAT. In the study of Ağaçdiken Alkan et al. (2016), while 89.7% of the students stated that they value themselves, no significant relationship was found between eating attitude and self-worth (Ağaçdiken Alkan et al. 2016). Also, in the multiple regression analysis of Çelik et al.'s (2015) study, it was concluded that low self-esteem did not predict the abnormal eating attitudes of nursing students (Çelik et al. 2015). It is thought that

low self-esteem causes a change in eating attitudes due to dissatisfaction with one's body, thus increasing the risk of developing an eating disorder (Ulaş et al. 2013). In our study, it is seen that half of the students are satisfied with their bodies, and this satisfaction is thought to be associated with a high level of self-worth.

When the relationship between students' eating attitudes and general life habits is examined, it was noted that features such as smoking, and alcohol use did not affect the EAT score averages. It was determined that there was a significant relationship between the dieting status of the students and the EAT. Similarly, in the study of Ulaş et al. (2013), it was found that the risk of possible eating disorders increased in students who were on diet. It is thought to be caused by individuals starving themselves by dieting in order to maintain weight control (Ulaş et al. 2013).

It was determined that there is a significant relationship between doing physical exercise and EAT. Similarly, in the study of Ünalın et al. (2009) and Rouzitalab et al. (2019) and it was determined that there is a positive relationship between doing physical exercise and eating disorders. It is thought that individuals who do physical exercise make changes in their diet in order to maintain or improve their physical form (Ünalın et al. 2009, Rouzitalab et al. 2019).

It was determined that there was a significant relationship between students' attention to their diet and EAT. Similar to our findings, there are studies in the literature showing that there is a significant relationship between paying attention to diet and eating attitude (Kadioğlu and Ergün 2015, Ağaçdiken Alkan et al. 2016). Studies have found that the frequency of skipping meals is high in university students (Ulaş et al. 2013, Yılmaz and Özkan 2007). Behaviours that occur in this age period affect the whole life. Considering the importance of adequate and balanced nutrition in every period of life, the importance of regular eating habits should not be overlooked.

Limitations of the Study

The results of this research are based on the self-reports of individuals. For this reason, it includes subjective evaluations as a limitation of the research. In addition, research findings cannot be generalized to the entire population as it covers only one faculty.

Conclusion

It was determined that 8.9% of the students participating in the study had an eating disorder risk. It was determined that the students' perceived parental attitudes, being satisfied with their body image and weight, self-worth, diet and physical exercise, and paying attention to their diet affect their eating attitudes.

It is thought that it is important to determine the eating attitudes of university students and to increase their awareness of eating attitudes in order to plan pre- and post-graduate education, to raise awareness of students about nutrition and to

screen risky groups, to take protective measures and to provide the necessary guidance and support. Determining the eating attitudes of student nurses, firstly establishing their own health care behaviours, and taking their place in the field as bio-psycho-socially healthy professionals after graduation is an important issue in terms of both the quality of care they will provide and individual satisfaction. Another issue that increases the importance of determining the eating attitudes of nursing students is that they set an example for the society as a role model for healthy living behaviours. It is thought that the healthy nurses of the future are in a crucial position in the increase of quality service areas and the development of our society.

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Knowledge Attitudes and Behaviors of Postgraduate Nursing Students Regarding Evidence

By Emel Tuğrul* and Süreyya Bulut[±]

This analytical-cross-sectional study aims to determine the knowledge, attitudes, and behaviors of nursing students receiving postgraduate education regarding evidence-based nursing. The study was carried out between 1 March 2021 and 31 August 2021 with 115 students who received postgraduate education in different departments of nursing. The data of the study were collected using a questionnaire and the students' knowledge, attitudes, and behaviors regarding evidence-based nursing scale. Number, percentage, standard deviation, t-Test, and ANOVA test were used in the analysis of the data. It was determined that 87.8% of the students took scientific research courses, 94.8% knew to do a literature review, and 81.7% followed scientific journals related to their field. While 60% of the students took evidence-based practices course, 53% had difficulty in reaching evidence-based practices. The students' knowledge, attitudes, and behaviors regarding evidence-based nursing scale mean score was found to be 71.93 ± 12.14 . The study had found that the knowledge, attitudes, and behaviors regarding evidence-based practices of the students who received postgraduate education in the field of nursing were at a good level. It has been determined that the students are willing to do scientific research and follow the scientific literature.

Keywords: *evidence-based practice, nursing education, postgraduate education*

Introduction

Evidence-based practice (EBP) aims to meticulously use the current and best-published evidence on the subject for patient recovery and good service planning and execution in the decision-making process for patient medical care (Babaoğlu et al. 2009, Kocaman 2003, Stetler et al. 1998, Temel and Ardahan 2011). In nursing, studies using the scientific method will carry nurses from experience-based decisions to evidence-based decision-making awareness in the future, and nursing, which produces its own knowledge, will take more responsibility for the scientific value and use of knowledge (Çopur et al. 2015, Karagözoğlu 2006, Temel and Ardahan 2011).

Due to their clinical implications, evidence-based studies are also very important in postgraduate education, where scientific studies are carried out more intensively. In the master's degree program for nursing, students are taught to research by gaining the ability to access, evaluate and interpret information. In doctorate education, it is aimed to gain the ability to conduct independent research and interpret information by considering the scientific events from a wider perspective (Karaman and Bakırcı 2010, Ruzafa et al. 2015). In this regard, the inclusion of studies on evidence-based practices in postgraduate education contributes to the development of scientific practices and following up-to-date approaches. In

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many nursing master's and doctoral programs, courses for evidence-based practices are included in the curricula (Yılmaz et al. 2019).

Özdemir and Akdemir (2009) found that 68.9% of nurses sometimes, and 12.8% always do, use evidence-based practice in their studies. Arslan and Çelen (2018) on the other hand, stated that undergraduate students' status of reading journals and participating in scientific meetings about the nursing profession was not at a good level, but their attitudes towards evidence-based nursing were high. Kalkım and Midilli (2020) found that the mean scores on knowledge of evidence-based nursing of female students who had taken a course on evidence-based practices or nursing, who had seen the topic of evidence-based practices or evidence-based nursing as part of a course, and who wished to take part in a scientific study, were statistically significantly higher.

There is a need to make adjustments in undergraduate and graduate nursing education programs to provide an opportunity for the teaching of Evidence-Based Nursing practices and the development of projects. Groups that produce knowledge need to take more responsibility for the scientific value and use of knowledge (Kocaman 2003). Within the scope of postgraduate education, students are expected to have knowledge of evidence-based practices in their fields and reflect this knowledge into their field of study. Therefore, creating strategies that improve students' knowledge, skills, and behaviors on evidence-based practices is important. In order to develop these strategies, it is necessary to know the sources of evidence that students frequently use, the difficulties they experience in accessing evidence, and to determine the knowledge, attitudes, and behaviors of students about the use of the evidence-based practice. This situation highlights the need for inclusive and reliable research and evidence-based information (Köse and Özenç 2013). No study has been found that reflects the knowledge, attitudes, and behaviors of nursing graduate students in Turkey regarding evidence-based practices. Therefore, it is considered that the results obtained from this study will fill the gap in this field.

Research Questions

1. What are the knowledge, attitudes, and behaviors of postgraduate nursing students about evidence-based nursing?
2. Is there a relationship between the socio-demographic characteristics and scientific research knowledge of the students and their knowledge, attitudes, and behaviors about evidence-based nursing?

Methods

This analytical-cross-sectional study was conducted to determine the postgraduate nursing students' knowledge, attitudes, and behaviors on evidence-based nursing. The study was carried out between 1 March 2021 and 31 August 2021. The universe of the study consisted of students enrolled in any of the master's or doctoral programs in the Department of Nursing Fundamentals, Internal Medicine

Nursing, Surgical Diseases Nursing, Obstetrics-Gynecology Nursing, Pediatric Nursing, Public Health Nursing, and Department of Mental Health and Diseases Nursing at Aydın Adnan Menderes University Health Sciences Institute in the 2020-2021 academic year. The minimum sample size to be reached in the study was calculated using the known population ($N=175$) method ($Z: 1.96, \pi: 0.50, p-\pi: 0.05, N: 175$) and determined as 110. A total of 115 students, 104 female, and 14 male, were included in the research sample, which was determined by the convenience sampling method (Karasar 2008).

Data Collection Tools

The data of the study were collected using a questionnaire consisting of 24 items designed by the researchers in line with the literature (Arslan and Çelen 2018, Kalkım and Midilli 2020, Tumala and Alshehri 2019), and the Students' Knowledge, Attitudes, and Behaviors regarding Evidence-Based Nursing Scale. Data collection tools were prepared electronically and sent to the students via e-mail. It took approximately 15 minutes to fill out the questionnaire.

Questionnaire

The questionnaire consists of 24 items regarding students' socio-demographic characteristics, evidence-based practices knowledge, and scientific research knowledge.

Students' Knowledge, Attitudes, and Behaviors Regarding Evidence-based Nursing Scale

The students' knowledge, attitudes, and behaviors regarding the evidence-based nursing scale was developed by Johnston et al. (2003) to determine the knowledge, attitudes, and behaviors of medical students about evidence-based practice. Brown et al. (2010) adapted the scale to be used for nursing students, and Muslu et al. (2015) carried out the Turkish validity and reliability study of the scale. The Cronbach's alpha-value for the "knowledge" sub-dimension of the scale was found to be 0.70; the Cronbach's alpha value for the "attitude" sub-dimension of the scale was found to be 0.60; the Cronbach's alpha value for the "future use" sub-dimension of the scale was found to be 0.80; and the Cronbach's alpha value for the "practice" sub-dimension of the scale was found to be 0.77. The Likert-type scale consists of 26 items and four sub-dimensions: "knowledge", "attitude", "future use" and "practice". A high score indicates that the student's level of knowledge is high. The *knowledge sub-dimension* of the scale (first 5 items) reflects the knowledge and understanding that they have acquired in theory and practice about evidence-based nursing. In the scoring of the sub-dimension, six options were given: Strongly Agree (6); Partially Agree (5); Agree (4); Disagree (3); Partially Disagree (2); and Strongly Disagree (1). Students were asked to choose the most suitable one among these options. The *attitude sub-dimension* of the scale (items 6-11) reflects the students' thoughts regarding the concept of evidence-based nursing. The scoring of this sub-dimension is the same as that of

the knowledge sub-dimension. The *future use sub-dimension* of the scale (items 12-20) determines the tendency of students to use this approach in their professional lives. Item 13 was scored as 6: very easy - 1: very difficult. Item 14 was scored as 6: totally - 1: not at all. Item 19 was scored as 6: very useful - 1: completely useless. Item 20 was scored as 6: I would like to - 1: I do not want very much. The *practice sub-dimension* of the scale (items 21-26) defines the clinical question/problem determination of evidence-based nursing, searching for the best evidence to solve the problem, criticizing the evidence, integrating the evidence, and using the steps to evaluate effectiveness. The sub-dimension is scored as a five-point Likert scale as never (1) and every day (5).

Inclusion Criteria

- To be registered in any of the master's or doctoral programs in Nursing at Aydın Adnan Menderes University Health Sciences Institute in the 2020-2021 academic year in which the study was conducted.
- Volunteer to participate in the study

Exclusion Criteria

- Students who left the postgraduate education program at the time of the study for any reason were not included in the study.

Data Analysis

The data of the study were analyzed using SPSS 21.0 (Statistical Package for Social Sciences for Windows). Distribution normality was examined using Shapiro-Wilk test. Number, percentage, mean, standard deviation, t-Test, and ANOVA test were used in the analysis of the data.

Ethical Approval

Approval from Aydın Adnan Menderes University Nursing Faculty Non-Interventional Research Ethics Committee (No: E-50107718-050.99-2100014214) and research permission from Aydın Adnan Menderes University Nursing Faculty was obtained to conduct the study. Also, the purpose of the study was explained to the participants, and their consent was obtained.

Results

It was determined that the mean age of the participants was 30.33 ± 6.78 , and 90.4% of them were female. It was determined that 73.9% of the participants were graduate students, and 26.1% were doctoral students. While 76.5% of the students were working as nurses in the hospital, 14.8% of them were academicians at the university. It was determined that 8.7% of the students had a different occupation. In terms of the department that students were continuing their postgraduate education, it was determined that 16.2% of the students were enrolled in Nursing

Fundamentals; 18.1% in internal medicine nursing; 18.2% in Surgical Nursing; 8.7% in Obstetrics and Gynecology Nursing; 7.8% in Child Health and Diseases Nursing; 15.7% in Public Health Nursing; and 15.3% in the Department of Mental Health and Diseases Nursing. Table 1 shows the behavior of the participants regarding scientific research.

Table 1. Students' Scientific Research Characteristics (N=115)

Characteristics	n	%
Status of taking a Scientific Research course		
Yes	101	87.8
No	14	12.2
Knowing to do a Scientific Literature review		
Yes	109	94.8
No	6	5.2
Taking part in a scientific research		
Yes	60	52.2
No	55	47.8
Following scientific journals related to the field		
Yes	94	81.7
No	21	18.3
Encouragement by the advisor to do scientific research		
Yes	109	94.8
No	6	5.2
Participating in scientific events (congress, symposium, panel, etc.)		
Yes	91	79.1
No	24	20.9
Willingness to do scientific research		
Yes	111	96.5
No	4	3.5
Feeling competent to do scientific research		
Yes	52	45.2
No	63	54.8
Have taken any course related to evidence-based practices		
Yes	69	60.0
No	46	40.0
Attending courses, seminars, symposiums on evidence-based practices		
Yes	26	22.6
No	89	77.4
Having Difficulties accessing evidence-based practices		
Yes	61	53.0
No	54	47.0

It was determined that students used more than one database for scientific literature review. It has been determined that the most used database is Dergi Park (86.1%); then PubMed (85.2%); Google Scholar (69.6%); Türkiye Klinikleri (68.7); Cochrane (51.3%); Science-direct (45.2%); EbscHo (29.6%); and ClinicalKey (28.7) databases are also actively used by the participants.

Among the participants, 82.9% of them stated that they had difficulties while reading a scientific article. It was determined that the parts that they had difficulty in understanding in a scientific article were statistics (33.9%), method (14.7%), findings and tables (13.9%), discussion (11.7%), and article writing language (8.7%).

The students' knowledge, attitudes, and behaviors regarding evidence-based nursing scale mean scores are given in Table 2. The scale total mean score was found to be 71.93 ± 12.14 . The scale sub-dimension mean scores were determined as 8.21 ± 3.58 for the knowledge sub-dimension, 25.83 ± 8.29 for the attitude sub-dimension, 17.70 ± 5.23 for the future use sub-dimension, and 20.41 ± 4.88 for the practice sub-dimension.

Table 2. Students' Knowledge, Attitudes, and Behaviors regarding Evidence-based Nursing Scale Mean Scores

Scale and scale sub-dimensions	X ± SS	Min-Maks
Scale total score	71.93±12.14	26-102
Sub-dimensions		
Knowledge	8.21±3.58	5-17
Attitude	25.83±8.29	6-39
Future use	17.70±5.23	9-33
Practice	20.41±4.88	6-30

A significant difference was found between the attitude sub-dimension mean scores and postgraduate course stage and scientific research course taking ($F=2.091$, $p<0.05$; $t=2.156$, $p<0.05$). While there was no difference found between taking an EBP course and the scale mean score, a significant difference was found between the use of EBP in course preparations and the total scale mean score and the practice sub-dimension mean score ($t=-2.079$, $p<0.05$; $t=-2.539$, $p<0.05$). However, a statistically significant difference was found between the students' purpose of using EBP and the practice sub-dimension mean scores ($F=6.717$, $p<0.05$) (Table 3).

Table 3. The Students' Knowledge, Attitudes, and Behaviors Regarding Evidence-based Nursing Scale Mean Scores, t-Test and ANOVA Results for the Postgraduate Education Stage, Taking a Scientific Research and EBP Courses, Using EBP in Lesson Preparation, and Purposes of Using EBP (N=115)

	Scale total score	Knowledge Sub-dimension	Attitude Sub-dimension	Future use Sub-dimension	Practice Sub-dimension
	X ± SS	X ± SS	X ± SS	X ± SS	X ± SS
Postgraduate education stage					
Master's course phase	69.89 ±13.34	8.93±3.91	23.45±8.55	17.70±5.79	20.31±5.15
Master's thesis phase	74.54±10.97	7.83±7.12	27.05±7.39	18.02±5.24	21.67±4.50
PhD course phase	72.12±11.08	7.12±3.44	27.25±7.88	18.00±4.78	19.75±4.23
PhD thesis phase	72.43±13.31	7.93±4.35	27.43±9.53	17.56±4.66	19.50±5.21
PhD qualification	70.66±5.16	7.00±2.44	31.16±3.92	15.66±2.80	16.83±3.18
Test	F= 0.781 p= 0.540	F= 0.968 p=0.428	F= 2.091 p=0.047*	F= 0.265 p=0.900	F= 1.643 p=0.169
Taking a scientific research course					
Yes	72.17±12.34	8.20±3.72	26.44±8.27	17.48±5.24	20.29±5.08
No	70.21±10.87	8.28±2.43	21.42±7.25	19.28±5.07	21.28±2.99
Test	t= 0.565 p=0.573	t= -0.076 p= 0.940	t= 2.156 p= 0.033*	t= -1.209 p= 0.229	t= -0.708 p= 0.480
Taking a EBP course					
Yes	71.71±12.32	8.02±3.54	25.66±8.63	17.73±5.12	20.65±4.98
No	72.28±12.00	8.50±3.67	26.08±7.83	17.65±5.44	20.06±4.75
Test	t= -0.247 p= 0.806	t= -0.688 p= 0.493	t= -0.265 p=0.791	t= 0.087 p=0.931	t= 0.630 p=0.530
Using EBP in lesson preparation					
Yes	77.04±12.03	8.24±3.58	27.63±8.17	19.46±5.24	23.98±4.76
No	71.93±11.59	8.06±3.71	25.20±9.23	17.33±5.03	19.33±4.82
Test	t= -2.079 p= 0.040*	t= 0.174 p= 0.862	t= -0.623 p= 0.541	t= -1.297 p= 0.197	t= -2.539 p= 0.012*
Purposes of using EBP					
Assignment	68.85±14.76	8.22±3.91	24.70±8.80	17.00±5.83	18.92±5.06
Scientific research	71.50±11.10	8.22±3.66	25.26±8.86	18.54±5.04	19.52±4.76
Patient care in the clinic	74.71±11.10	8.21±3.33	27.39±7.03	17.10±5.01	22.65±4.18
Test	F= 1.924 p=0.151	F=0.000 p= 1.000	F= 1.045 p=0.355	F= 1.134 p= 0.326	F= 6.717 p= 0.002*

*p<0.05, EBP: Evidence-based practice.

Discussion

This study was conducted in an analytical-cross-sectional design in order to determine the knowledge, attitudes, and behaviors of postgraduate nursing students regarding evidence-based nursing.

Our study concluded that the students had difficulties while reading a scientific article, they used more than one database for scientific literature review, and they mostly benefited from the Dergi Park database. The information obtained as a result of online scanning includes more research results than other websites. It is considered that these results are caused by the fact that the journals in which the

studies are published are more accessible online from the Dergi Park database. Kalkım and Midilli (2020) stated that undergraduate nursing students mostly use the Google Scholar database for scientific literature review and to access scientific evidence via the internet. The widespread use of scientific journals and databases has enabled students to access information more easily and quickly. The use of databases by students may differ according to the subjects and research areas they are studying. Our study and other studies show that students are familiar with and actively use literature review knowledge and databases, which are very essential in postgraduate education.

In our study, students stated that although they could access information easily and quickly, they had difficulty in understanding a scientific article while reading; in particular, they had difficulty in understanding the statistics section. Kalkım and Midilli (2020) stated that the majority of the students knew about the scientific literature review, but they had difficulty in reaching scientific evidence. While reading the studies they had found, postgraduate students should be able to understand, interpret and even reflect on their practices. It is considered that taking courses related to scientific research in which accessing the studies, understanding and interpreting them will be guiding in realizing this process.

It was determined that the majority of the participants took a scientific research course and half of them took part in a research study. Also, it was determined that the majority of the students were encouraged by their advisors to conduct research, and most of them were willing to do research. The postgraduate education process provides many opportunities for students to improve themselves in scientific research subjects. The postgraduate education process is a process that requires active participation in scientific activities as well as scientific research courses. Particularly during the thesis period, students are expected to improve themselves in research planning, execution, and reporting. In this process, participating in different scientific meetings improves the students' perspectives. The thesis advisors' guidance and opportunities for students on these issues also contribute to the improvement of students and increase their motivation.

It was determined that the knowledge, attitudes, and behaviors of the students on evidence-based nursing were at a good level, and there was no significant difference between the postgraduate education stages and the students' knowledge, attitudes, and behaviors regarding evidence-based nursing scale mean scores.

It was found that there was a difference between the mean scores of the attitude sub-dimension of the scale. Also, there was a difference between the use of EBP in course preparations and the total scale mean score and the practice sub-dimension mean score. It was determined that the knowledge, attitudes, and behaviors of the students on evidence-based nursing were at a good level on attitude and practice sub-dimension scores, while their knowledge and future use sub-dimensions scores were at a moderate level. Çelik et al. (2021) stated that undergraduate nursing students' knowledge, attitude, and future use mean scores were at a good level, practice mean score was at a moderate level, and the age and class of the students were effective in their knowledge, attitude, future use, and practice mean scores. Arslan and Çelen (2018) stated that nursing students'

attitudes towards evidence-based nursing were at a moderate level; Başdaş and Özbey (2020) stated that nursing students' attitudes towards evidence-based nursing were at a high level; and Kalkım and Midilli (2020) stated that nursing students' attitudes towards evidence-based nursing were at a good level. The results of the study are important in terms of showing that students who can reach information quickly use this interest in professional fields and attach importance to the fact that their practices are evidence-based. It is considered that this situation in undergraduate students will enable students pursuing postgraduate studies to further their education; both apply evidence-based practices and will enable the use of evidence-based practices in the studies planned by the students and their reflection in the care practices.

It was determined that there was a significant difference between the education stage of postgraduate nursing students and the attitude sub-dimension of the scale, and this was due to the master's thesis phase group. It can be stated that the fact that students do more literature review and review of publications during the master's thesis period, which is the stage in which they conduct extensive research for the first time, affects their attitudes towards evidence-based practices.

Also, it was determined that there was a significant difference between the attitude sub-dimension of the students who took scientific research courses, the attitudes of using evidence-based practices in clinical patient care, and their attitudes to future use. These results are significant in terms of showing that the students are affected by the courses they take and the purposes of using the evidence obtained.

It has been reported in the literature that there is a significant difference between the students' attitudes towards evidence-based nursing and their state of taking research courses, reading journals related to the nursing profession, participating in scientific meetings, and wishing to carry out scientific research on the profession after graduation (Arslan and Çelen 2018), and the difference between the attitudes of students towards evidence-based nursing and the scores of students who took courses on evidence-based nursing and were willing to take part in the research was significant (Kalkım and Midilli 2020). Brown et al. (2010) stated that the knowledge, attitude, and future use sub-dimension mean scores of the scale increased compared to academic years, while Özdemir and Akdemir (2009) stated that appreciating the use of evidence in clinical practice is very important in overcoming the difficulty of reaching evidence-based practice.

Although they are different sample groups, it was found that undergraduate and postgraduate nursing students have similar perspectives, study results are parallel to each other, the student awareness about the importance of the evidence-based approach in care practices has arisen, and postgraduate students have higher evidence-based nursing attitudes, especially at the thesis stage. It has been determined that the use of evidence-based nursing in practice contributes to the increase in the quality of the care provided, the improvement of patient care outcomes, the standardization of care, and the increase in nurse and patient satisfaction (Başdaş and Özbey 2020). These results show that the inclusion of evidence-based practices in clinical practice and postgraduate education has a significant effect on improving patient care and clinical practices positively.

Limitations

This research has some limitations. First, this research was conducted using the non-probability sampling method. Therefore, the results obtained represent the students included in the study and cannot be generalized. Research data were collected using a scale. Therefore, the findings are limited to the content of this scale.

Conclusion

This study had determined that the knowledge, attitudes, and behaviors of the postgraduate nursing students were at a good level. It has been determined that the students are willing to do scientific research and follow up with the scientific literature. The evaluation of the research findings in the education of nursing students who want to specialize in their field by doing postgraduate education after basic nursing education will use their research and reflection skills in the clinical environment, which includes attitude-enhancing courses and activities on evidence-based practices in order to raise students' awareness about conducting scientific research and participating in scientific activities as is important.

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The Economic Effect of the COVID-19 Lockdown in the United States: Was the Cure Worse than the Disease?

By L. Jan Reid*

COVID-19 is an ongoing global outbreak of coronavirus disease 2019, an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The World Health Organization (WHO) declared the outbreak a Public Health Emergency of International Concern on January 30, 2020; and a pandemic on March 11, 2020. Several mitigation measures have been used in attempts to limit the spread of the virus, including mandatory wearing of masks in public; bans on unnecessary travel; and the closure of non-essential businesses. This paper defines a lockdown as the closure of non-essential businesses combined with requirements that all citizens stay at home except for grocery shopping, trips to a pharmacy, and medical appointments. The effectiveness of lockdowns is controversial. Proponents tend to argue that lockdowns would have been more effective if enforcement had been increased and if lockdowns had been extended for a longer period of time. Opponents have argued that lockdowns hurt the economy, hurt children, and have had little positive effect on public health. The paper addresses the economic effect of COVID-19 lockdowns in the United States using a Benefit/Cost Analysis (BCA) framework. Two separate analyses are provided: a traditional BCA analysis, which assumes that the value of life is constant regardless of age; and a Preferred Analysis, which adjusts the number of deaths, and values the economic cost of the deaths based on the age of the deceased.

Keywords: benefit/cost analysis, COVID-19, GDP, lockdowns, unemployment

Introduction

On March 11, 2020, the World Health Organization declared COVID-19 a pandemic¹. At a media briefing, WHO director-general Dr. Tedros Adhanom Ghebreyesus stated that “This is not just a public health crisis, it is a crisis that will touch every sector” (Ducharme 2020).

The first lockdown in the United States (U.S.) occurred in the territory of Puerto Rico on March 15, 2020. By the time of that first lockdown, only 102 people had died of COVID-19 in the United States. Lockdowns were fully implemented in most U.S. states by April 7, 2020. The number of deaths rose to a total of 167,558 by August 22, 2020 (National Center for Health Statistics 2020)².

This paper performs two Benefit/Cost Analyses (Traditional and Preferred) in order to estimate whether the economic cost of the lockdowns exceeded the economic benefits. The results indicate that the economic cost of the lockdowns was up to ten times greater than the economic benefits of the lockdowns.

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¹The WHO defines a pandemic as the global spread of a new disease.

²The National Center for Health Statistics (NCHS) is a division of the Centers for Disease Control and Prevention (CDC), which is a division of the United States Department of Health and Human Services (HHS).

A Benefit/Cost Analysis is composed of two sections: a Base Case Analysis and a Sensitivity Analysis. The author's assumptions are those assumptions used in the Base Case Analysis. The Sensitivity Analysis consists of a "what if analysis". For example, a researcher might perform an economic analysis on the effect of the construction of a new highway. The Base Case Analysis might assume that the speed limit would be set at its current level of 70 miles per hour (mph) which is approximately 112 kilometers per hour (kph). The Sensitivity Analysis might assume that the speed limit would be changed to 55 mph (88 kph), resulting in fewer deaths. This does not mean that the author is assuming that the speed limit will be changed if a new highway is constructed.

Hypothesis

The paper hypothesizes that the economic cost of the lockdowns exceeded the economic benefits. The paper addresses the economic effect of COVID-19 lockdowns in the United States using a Benefit/Cost Analysis (BCA) framework. Two separate analyses are provided: a traditional BCA analysis, which assumes that the value of life is constant regardless of age; and a Preferred Analysis, which adjusts the number of lives saved, and values the economic cost of the lives saved based on the expected ages of the number of lives saved.

The goal of the lockdowns was to reduce the number of COVID-19 deaths and to ensure that Intensive Care Unit (ICU) capacity was sufficient to treat patients in critical condition. The paper finds that the lockdowns saved lives, but that the economic cost of the lockdowns was up to ten times greater than the economic benefits of the lockdowns.

Literature Review

The literature review explored the eight subjects discussed below. These subject areas were chosen because, taken together, they help explain much of the successes and failures of the economic lockdowns during the period of the study. The eight subjects are:

1. Coronaviruses
2. COVID-19 Cases and Deaths
3. Health-Care Spending
4. Macroeconomic Effects
5. Stimulus Programs
6. Benefit/Cost Analyses
7. Value of Life
8. Decline in Student Deaths

Coronaviruses

Coronaviruses are a class of ribonucleic acid (RNA) viruses that cause diseases in mammals and birds. In humans and birds, they cause respiratory-tract infections that can range from mild to lethal. Mild coronavirus illnesses in humans include some cases of the common cold (which is also caused by rhinoviruses). More lethal illnesses include Influenza, Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS), and COVID-19 (CDC 2019).

According to the Centers for Disease Control and Prevention (CDC), influenza, commonly called “the flu,” is an infectious disease caused by influenza viruses. Influenza may progress to pneumonia, which can be caused by the primary viral infection or by a secondary bacterial infection. Other complications of influenza infection include acute respiratory distress syndrome, meningitis, encephalitis, and worsening of pre-existing health problems such as asthma and cardiovascular disease. In healthy individuals, influenza is rarely fatal, but it can be deadly in high-risk groups (CDC 2019).

Influenza deaths most commonly occur in high-risk groups, including young children, the elderly, and people with chronic health conditions. Since the late 1800s, worldwide outbreaks (pandemics) of novel influenza strains have occurred every 10-40 years. Five flu pandemics have occurred since 1900: the Spanish flu in 1918–1920, which was the most severe flu pandemic; the Asian flu in 1957; the Hong Kong flu in 1968; the Russian flu in 1977; and the 2009 swine flu pandemic. (CDC 2019) Worldwide mortalities were 20-50 million from the Spanish flu; 1.1 million from the Asian flu; 700,000 from the Russian flu; and 284,000 from the swine flu.

There have been over 4.9 million deaths worldwide from COVID-19 since October, 2019.

Cases and Deaths

The CDC has explained that “While seasonal influenza (flu) viruses are detected year-round in the United States, flu viruses are most common during the fall and winter. The exact timing and duration of flu seasons can vary, but influenza activity often begins to increase in October. Most of the time, flu activity peaks between December and February, although activity can last as late as May” (CDC 2018).

For the period 2010-2011 through 2019-2020, annual estimates of death from influenza in the United States have ranged from a low of 12,000 in 2011-2012 to a high of 61,000 in 2017-2018. In the last full influenza season (2018-2019) before the pandemic, 34,157 people died of influenza. (CDC 2021a) For the period January 4, 2020 through May 1, 2021, 493,985 people died of pneumonia; 276,282 people died of COVID-19 and pneumonia; and 9,273 people died of influenza (CDC 2021b). Thus, deaths from influenza declined by 24,884 ($34,157 - 9,273 = 24,884$), or 4.40% of the total number of official COVID-19 deaths.

The change in official influenza deaths indicates that at least 24,884 influenza deaths may have been misclassified as COVID-19. Therefore, I have reduced the number of lives saved by 4.40% in the Sensitivity Analysis to the Preferred Analysis (see Table 7).

At the date of this writing, COVID-19 cases from 2020-2021 have exhibited the same seasonal pattern as the historic data of influenza in the United States. On March 7, 2021, the COVID Tracking Project (2021) found that the seven-day average of COVID-19 cases peaked on January 13, 2021 at 244,551 cases. The number of cases declined to 54,762 on March 7, 2021. (COVID Tracking Project 2021) This suggests that COVID-19 is a seasonal virus.

In an interview with NPR, Chris Murray of IHME said: “When you look at the huge [COVID-19] epidemics that unfolded in Argentina ... in Chile ... in Southern Brazil, South Africa, and ... the Northern hemisphere, . . . — ... in the statistical analysis, we see a very strong correlation with seasonality” (Aizenman 2020).

The CDC has reported that weekly provisional death counts for patients with COVID-19 rose from zero on January 4, 2020 to a high of 24,942 on January 9, 2021, and then fell to a low of 1,729 on May 1, 2021. The CDC has noted that: “COVID-19 death counts shown here may differ from other published sources, as data currently are lagged by an average of 1–2 weeks” (CDC 2021b).

Science, Public Health Policy and the Law published a paper which found that “Data from the CDC shows that only 6% of 161,392 COVID fatalities had no mention of any comorbidity. For deaths with conditions or causes in addition to COVID-19, on average, there were 2.6 additional conditions or causes per death” (Ealy et al. 2020).

On March 24, 2020, the CDC changed the guidelines for how cause of death from COVID-19 is recorded and reported. The new reporting guidelines substantially increased the number of deaths from COVID-19 (Ealy et al. 2020, p. 2).

Accurate reporting of deaths from COVID-19 is dependent upon test reliability. Lee (2020) examined the reliability of the PCR (polymerase chain reaction) test for detecting COVID-19 infection. (A PCR test is performed to detect genetic material from a specific organism, such as a virus or a bacterium.) Dr. Lee evaluated 20 test results from the Connecticut State Department of Health using a nested PCR amplification method. Dr. Lee found that the standard PCR test produced a false positive of 30% and a false negative of 20%.

Although Lee’s study does not contain enough observations to definitively find that PCR test kits produce biased results, it does suggest that the number of COVID-19 cases (and therefore deaths) might have been overestimated by 10%. As mentioned previously, influenza deaths declined by 24,946 (over 4% of official COVID-19 deaths). The decline in influenza deaths adds credibility to Lee’s finding that COVID-19 deaths might have been over counted by 10%.

As of April 14, 2021, a total of 563,440 individuals have died from COVID-19 in the United States (Yahoo News 2021). The CDC has reported that 4,270,407 people have died from all causes during the same period. (CDC 2021b) Thus, over 13% of U.S. deaths during that period were caused by COVID-19.

The Associated Press (2020) has reported that (Marchione 2021):

Life expectancy in the United States dropped a staggering one year during the first half of 2020 as the coronavirus pandemic caused its first wave of deaths, health officials are reporting.

Minorities suffered the biggest impact, with Black Americans losing nearly three years and Hispanics, nearly two years, according to preliminary estimates [on February 11, 2021] from the Centers for Disease Control and Prevention.

Forecasts of COVID-19 Deaths

On June 15, 2020, Reuters reported that “A new forecast projects 201,129 deaths due to COVID-19 in the United States through the beginning of October mainly due to reopening measures under way, the Institute for Health Metrics and Evaluation (IHME) at the University of Washington said on Monday” (Reuters 2020).

In September 2020, the University of Washington’s Institute for Health Metrics and Evaluation (IHME), headed by Chris Murray, forecast that 410,000 people would die of COVID-19 by January 1, 2021. Ashish Jha, dean of Brown University’s School of Public Health, said that IHME’s forecast is highly implausible — particularly when it comes to the projected 410,000 death toll in the U.S. by Jan. 1. “I think that’s completely unrealistic. I see no basis for that,” says Jha. (Aizenman 2020) The CDC reported that 389,371 people had died with COVID-19 by January 1, 2021 (CDC 2021b).

The September 2020 IHME forecast was much more optimistic than their forecast released in March 2021. In the March forecast, the IHME predicted that 598,521 Americans would die of COVID-19 by July 1, 2021. IHME also forecast that 655,566 people would die if the mobility of the U.S. population returns to 2019 levels (McIntyre 2021).

On April 21, 2021, the CDC reported the COVID-19 death forecasts of 36 modelers for the period April 19 to May 15, 2021. The average estimate of the models was that total deaths would rise to 595,522 by May 15, 2021 (CDC 2021c).

Table 1 compares the four mortality forecasts discussed above to the actual number of deaths in the time period predicted by the studies. The forecasts constitute a trend analysis in which the biggest driver of forecasted deaths is the number of deaths at the time the forecast was released.

Table 1. COVID-19 Mortality Forecasts

Source	Forecast Date	Ending Time Period	Mortality Forecast	Actual Deaths	Forecast Error (%)
IHME	June 2020	October 1, 2020	201,129	210,190	4.51%
CDC	June 2020	July 11, 2020	145,000	137,049	5.80%
IHME	September 2020	January 1, 2021	410,000	389,371	5.30%
CDC	April 2021	May 15, 2021	595,522	570,003*	4.29%*

As of May 8, 2021.

Lockdowns

On March 15, 2020, Puerto Rico governor Wanda Vázquez Garced signed an executive order ordering all citizens to stay at home starting at 9:00 p.m., with exceptions in limited circumstances between 5:00 a.m. and 9:00 p.m. Governmental operations and non-essential businesses were to be closed until March 30, 2020.

On March 16, 2020, U.S. President Trump recommended that residents avoid discretionary travel, shopping trips, and social visits (Kelleher 2020).

On March 19, 2020, California governor Gavin Newsom issued a statewide lockdown order. By April 7, 2020, 43 of the 50 U.S. states had issued lockdown orders. The lockdown orders (“stay-at-home orders”) affected approximately 320 million people, about 96% of all U.S. residents.

On March 17, 2020, the first lockdown order from within a state was imposed simultaneously by health authorities in the San Francisco Bay Area (Alameda, Contra Costa, Marin, San Mateo, and Santa Clara counties and the cities of San Francisco and Berkeley), affecting nearly 6.7 million people (Ravani 2020). Other cities and counties across the state followed suit over the next two days, until Gavin Newsom, the governor of California, issued the first statewide order, effective on March 19, 2020 (Wired 2020).

Health Care Spending

Business Economics reported that “The HSEI [Health Sector Economic Indicators] spending brief data provide an initial look at health care spending during the COVID-19 pandemic. They show that the year-over-year change in national health spending began to decline in March of 2020, fell to more than 20% below the previous year’s level in April, and then began to recover. By August 2020, health spending had regained essentially all its losses compared with August 2019” (Rhyan et al. 2020).

While health care spending was falling, the price of health care was rising. The St. Louis Federal Reserve Board (FRED) has reported that the health care price index rose by 3.4% from August, 2019 to August, 2020 (FRED 2021a).

The paper did not include health care spending losses in its cost calculations because these losses are subsumed in the loss of nominal Gross Domestic Product (GDP).

Macroeconomic Effects

The official unemployment rate (U-3) as reported by the Bureau of Labor Statistics (BLS) rose from 3.5% in February, 2020 to a high of 14.8% in April, 2020 and then fell to 6.1% in April, 2021 (FRED 2021b). Cohen has found that 1.1 million workers had been misclassified by the BLS. Cohen adjusted the official unemployment rate and found that accounting for the misclassification “yields an adjusted unemployment rate of 9.1% in August [2020], which is meaningfully lower than 11.0% reading in July [2020] and a peak of 19.5% in April [2020]” (Cohen 2020).

Moutray found that “And, while the unemployment rate peaked at 14.7% in April [2020], the reality was even starker, with the “real” unemployment rate—which adds in those “marginally attached to the labor force and those employed part time for economic reasons”—at 22.8% that month” (Moutray 2020).

Stimulus Program

The United States Congress passed three separate stimulus bills: the CARES Act, the Consolidated Appropriations Act 2021, and the American Rescue Plan Act. Additionally, California Governor Gavin Newsom signed the Golden State Stimulus bill. These four bills are described below.

The CARES Act

The CARES Act was a \$2.2 trillion economic stimulus bill signed into law by President Donald Trump on March 27, 2020. The bill included \$300 billion in one-time cash payments to individuals and dependent children, \$260 billion in increased unemployment benefits, \$350 billion (later increased to \$669 billion) in funding for the Paycheck Protection Program that provided forgivable loans to small businesses for payroll expenses, \$500 billion in loans for corporations, and \$339.8 billion to state and local governments (Snell 2020).

Some of the benefits (such as federal unemployment and the eviction moratorium) of the CARES Act expired in July 2020. As a result, the number of Americans living in poverty increased dramatically. On October 15, 2020, the *New York Times* reported that “The number of poor people has grown by 8 million since May, according to researchers at Columbia University, after falling by 4 million at the pandemic’s start as a result of a \$2 trillion emergency package known as the Cares Act” (DeParle 2020).

Yahoo News reported that “Without the additional \$600 per week under the CARES Act — which expired at the end of July — local consumer spending will drop by an estimated 44%, according to a new paper from the National Bureau of Economic Research that examined how the cut in benefits will affect spending in 18 counties in Illinois” (Tsekova 2020).

The Consolidated Appropriations Act 2021

The Consolidated Appropriations Act 2021 (CAA) was a \$2.3 trillion spending bill that combines \$900 billion in stimulus relief with a \$1.4 trillion omnibus spending bill for the 2021 federal fiscal year. The bill was signed into law by President Trump on December 27, 2020, thereby preventing a government shutdown (Taylor 2020).

According to the Congressional Budget Office (CBO), the CAA provided \$325 billion for small businesses; \$15 billion for economically endangered live venues, movie theaters, and museums; \$166 billion for stimulus checks to individuals; \$120 billion for an extension of federal unemployment benefits; \$82 billion for public schools and universities; \$69 billion for vaccines, testing, and health providers; \$25 billion to state and local governments for rental assistance programs; \$13 billion to increase the monthly Supplemental Nutrition Assistance Program (SNAP/food stamp) benefit by 15%; \$13 billion in direct payments to the farming and ranching industries; \$60 million for small meat and poultry processors; \$10 billion for child care, \$10 billion for the U.S. Postal Service; and an extension of the CDC’s eviction moratorium (CBO 2020a, CBO 2020b).

The American Rescue Plan Act of 2021

The American Rescue Plan Act of 2021 (ARPA) was a \$1.9 trillion economic stimulus bill signed into law by President Biden on March 11, 2021. ARPA provided extended federal unemployment benefits, \$1,400 direct payments to individuals, emergency paid leave for over 100 million American, a tax credit to employers who offer paid sick leave and paid family leave benefits, extended food stamp benefits, expanded the child tax credit, expanded the earned income tax credit, made forgiven student loan debt tax-free, grants to small businesses, \$350 billion to state, local, and tribal governments, \$130 billion for K-12 schools, \$40 billion for public colleges and universities, \$48.8 billion for housing assistance, \$164.3 billion for healthcare programs and services, \$86 billion to pension funds that are close to insolvency, \$55.5 billion for transportation, \$10.4 billion for agricultural programs and services, and \$1.85 billion for cybersecurity funding (Zhou and Stewart 2021).

ARPA also subsidized 100% of premiums for Consolidated Omnibus Budget Reconciliation Act (COBRA)³ recipients from April 1, 2021 to September 30, 2021, removed the income limit on premium subsidies for the ACA, increased subsidies to low-income individuals, protected Affordable Care Act (ACA) subsidy recipients from clawbacks due to income fluctuations in 2020, required private insurance companies to cover COVID-19 vaccines and treatment, allowed states to give 12 months of postpartum coverage for new mothers, and provided new incentives for states to expand Medicaid coverage (Keith 2021).

Golden State Stimulus Bill

The Valley Post has reported that “Governor Gavin Newsom signed the \$9.6 billion “Golden State Stimulus” bill into law Tuesday, [February 23, 2021] which includes a \$600 check for low-income Californians” (Miller 2021). The bill provides a \$1,200 direct payment to up to 5.7 million tax return filers, and a \$600 payment to individuals who receive an earned income tax credit.

Benefit/Cost Analyses

Benefit/Cost Analysis, also known as Cost/Benefit Analysis, is commonly used in the development of public policy, such as the choice of whether to build a new highway or to impose environmental restrictions in a transportation corridor.

Value of Life

In public policy, the most important assumption in a Benefit/Cost Analysis is the value of life chosen by the analyst. In the case of COVID-19 lockdowns, a high value of life will tend to increase aggregate benefits and show that lockdowns were a good policy. A lower value of life will do the opposite.

³For individuals who experience a job loss or other qualifying event, COBRA provides the option to continue their current health insurance coverage for a limited amount of time. Employers outside the federal government with more than 20 employees are required to offer COBRA coverage to those who qualify.

Sumner et al. (2020) have pointed out that “Most of the publicized cost-benefit analyses of COVID-19 lockdowns have used coarse measures like lives as units rather than life-years, which misleads politicians and the public. COVID-19 deaths disproportionately impact the oldest members of the population, whereas the economic impacts of lockdowns disproportionately harm the youngest of the working population, who have far greater life expectancies at the time of impact” (Sumner et al. 2020).

Sumner et al. (2020) conducted a study commissioned by Revolver News and found that COVID-19 lockdowns are ten times more deadly than the actual COVID-19 virus in terms of years of life lost by American citizens. This paper uses a modified form of the analytical method used by Sumner et al. (2020). An earlier study commissioned by Just Facts found that the lockdowns caused a loss of seven times more years of life than were saved by the lockdowns (Miller 2020).

Forbes Magazine has published an article by Chris Conover of The Apothecary Group. Conover provides a listing of the Value of Life (VOL) used by different researchers. The fixed-rate VOL ranges from \$5 million by Aldy and Viscucchi to \$10 million by Alex Nowrasteh of the Cato Institute (Conover 2020). I use the average value of these studies (\$7.8 million) in my Traditional Analysis below.

Benefit/Cost Analyses

Anna Scherbina of the American Enterprise Institute estimated “a lockdown would be indeed optimal and, depending on the assumptions, it should last between two and four weeks and will generate a net benefit of up to \$1.2 trillion.” Scherbina employs a Quality-of-Life Year (QALY) method and assumes a value of \$150,000/QALY. She estimates that a maximum of 406,000 lives would be saved. Thus, she implicitly assumes an average of 39.6 QALYs/person (Scherbina 2021).

Broughel and Kotrous found that the benefits of COVID suppression policies would be from \$605.9 billion to \$841.1 billion and the costs would range from \$214.2 billion to \$331.5 billion. (Broughel Kotrous 2021, p. 156) Broughel and Kotrous’ study is for the period March 1 - August 1, 2020. 160,766 people died of COVID-19 during the time period of their study, which is about 30% of total COVID-19 deaths for the period January 1, 2020 to May 8, 2021. They assume 1.04 million lives saved and \$351.5 billion in benefits, which is an average value of life of \$337,980.77/person. Their work implies a Benefit/Cost (B/C) ratio of from 2.52 to 2.83, which indicates that lockdown policies had significant net benefits.

Dr. Ari Joffe used a Wellbeing Years (WELLBY) analysis and found that the costs of lockdowns were 5.2 times greater than the benefits of lockdowns in the United States. On average, Joffe assumes a VOL of \$500,000 per life (Joffe 2020, Table 8).

Hanson (2020) estimates that 3% of COVID-19 cases result in a loss of income for three weeks for those with severe cases. On October 12, 2020, Dr. David Cutler and Dr. Lawrence Summers published their estimate of the effects of lockdowns. They estimated that lockdowns would result in mental health impairment costs of \$1.581 trillion (Cutler and Summers 2020, Table).

Allen (2021) an economics professor at Simon Fraser University in Canada, states:

The term “lockdown” is used to generically refer to state actions that imposed various forms of non-pharmaceutical interventions. That is, the term will be used to include mandatory state-enforced closing of non-essential business, education, recreation, and spiritual facilities; mask and social distancing orders; stay-in-place orders; and restrictions on private social gatherings.

I adopt Dr. Allen’s definition of the term “lockdown”. Dr. Allen reviewed over 80 different academic studies and related COVID-19 data sites. He found that “All estimates of costs and benefits depend on various assumptions of parameters and structural model forms, and many of the studies examined (especially the early ones) relied on assumptions that were false, and which tended to over-estimate the benefits and under-estimate the costs of lockdown” (Allen 2021).

Allen issued a report and provided an alternative Cost/Benefit methodology. (Allen 2021, Section III) I adopt some of his suggestions in my Preferred Analysis given below.

School Shootings

The vast majority of schools were closed in 2020 due to COVID-19. This resulted in a decline in the number of student deaths in school shootings. In 2019, eight students were killed and 43 were injured in 25 shooting incidents that occurred on school grounds or during school-sponsored events, according to Education Week’s school shooting tracker (Education Week 2020). The paper includes the decline in student deaths as a Benefit in both the Traditional and the Preferred Analyses.

Methodology

The paper calculates a B/C ratio using the following steps for the Traditional Model:

Econometrically estimate the time lag between infection and death.
Sum the benefits of the lockdowns and the cost of the lockdowns.
Divide the lockdown benefits by the lockdown costs and calculate a B/C ratio.
If the B/C ratio is greater than 1, then the lockdown was an optimal public policy.

The paper calculates a Benefit/Cost ratio using the following additional steps for the Preferred Model:

1. Calculates an economic value of life (EVOL) for each age group.
2. Sums the individual EVOLs and includes these values as benefits in lives saved; and costs in lives lost due to suicides and to the unavailability of medical treatment for other illnesses such as heart attacks, cancer, and strokes.
3. Estimates the costs of losses in GDP due to the lockdowns.
4. Performs a sensitivity analysis incorporating the findings of Lee (2020) and Cutler and Simons (2020) and reports the modified B/C ratio.

I discuss each of these steps below.

Time Lag Regression

In order to estimate a B/C ratio, more information is required. It is necessary to estimate the time lag between COVID-19 infection and death from COVID-19. For example, COVID-19 deaths rose from 58 in the last week before the lockdown (week ending March 14, 2020) to 24,942 in the week ending on January 9, 2021. Some individuals who died after the lockdown began had COVID-19 before the lockdown. If the study did not account for the time lag between infections and deaths, one might intuitively reason that the lockdowns caused additional deaths from COVID-19. The paper estimates that the maximum lag between infection and death is two weeks and uses a two-week time lag in estimating the number of lives saved by the lockdowns.

The following methodology was used to estimate the time period between infection and death. Weekly data was collected from the CDC on COVID-19 infections and deaths for the period January 19, 2020 through May 1, 2021.

A regression equation was performed on infections and deaths, and coefficients were estimated using a first order Auto Regressive Moving Average (ARMA) regression model for the variables mentioned above.

The regression equation⁴ is $D = \alpha + \beta_1C + \beta_2C(-1) + \beta_3C(-2) + \beta_4C(-3) + \beta_5A + \beta_6M$

where:

A is an AR(1) term.

C is the number of infections at time t

C(-1), C(-2), and C(-3) are the number of cases at time t-1, t-2, and t-3, respectively.

D is the number of deaths in a given week.

M is an MA(1) term.

α is the constant term.

$\beta_1, -\beta_6$ are the estimated coefficients.

The regression output is given below.

⁴The AR(1) and MA(1) terms are used to adjust for serially correlated residuals.

Dependent Variable: DEATHS				
Method: ARMA Maximum Likelihood (OPG - BHHH)				
Date: 05/04/21 Time: 04:22				
Sample: 4 66				
Included observations: 63				
Convergence achieved after 22 iterations				
Coefficient covariance computed using outer product of gradients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-367.3282	5839.264	-0.062907	0.9501
CASES	0.005191	0.001617	3.209260	0.0022
CASES(-1)	0.004927	0.001942	2.536575	0.0141
CASES(-2)	0.004052	0.002650	1.529123	0.1320
CASES(-3)	0.002345	0.001756	1.335314	0.1873
AR(1)	0.927199	0.053703	17.26520	0.0000
MA(1)	0.792760	0.120098	6.600917	0.0000
SIGMASQ	718352.2	79940.09	8.986132	0.0000
R-squared	0.984676	Mean dependent var		8878.540
Adjusted R-squared	0.982725	S.D. dependent var		6901.649
S.E. of regression	907.1052	Akaike info criterion		16.64094
Sum squared resid	45256190	Schwarz criterion		16.91309
Log likelihood	-516.1897	Hannan-Quinn criter.		16.74798
F-statistic	504.8674	Durbin-Watson stat		1.244990
Prob(F-statistic)	0.000000			

The model results show that only the number of cases in the current week and the number of cases in a previous week had a significant effect on the number of COVID-19 deaths. Because the paper uses weekly data, an infection could have occurred at any time during a previous week. Thus, a maximum lag of two weeks is used in calculating a B/C ratio.

Number of Lives Saved

It is not possible to accurately estimate the number of lives saved by the lockdowns because we do not know how people would have reacted to ever-increasing COVID-19 cases and deaths. People could have decreased deaths by locking themselves down, or they could have increased deaths by moving from one state to another in an attempt to escape the virus. Allen (2021) has pointed out that “Goolsbee and Syverson (2020), using cellular phone location records, find that voluntary ‘self-lockdown’ explains most of the enormous change in behavior in the spring, and that they do not find evidence of large temporal or spatial shifting in response to shelter-in-place policies (p. 12)”.

Nevertheless, lives saved is too important a factor to be ignored in the analysis. As explained below, the paper uses the estimate for lives saved calculated by

Yakusheva et al. (2020). Yakusheva et al. (2020) estimated that the 2020 COVID-19-mitigating public health measures “will save between 913,762 and 2,046,322 lives in the US; however, the economic downturn from shelter-in-place measures and other restrictions on economic activity could create an indirect collateral loss of 84,000 to 514,800 lives over the following years” (Yakusheva et al. 2020).

There is a two-week lag between cases and deaths, and lockdowns were not fully implemented until April 7, 2021. Thus, the mortality savings associated with the lockdown orders would not have become evident until the week ending April 18, 2020. The growth in COVID-19 mortality rates is given in Table 2.

Table 2. COVID-19 Mortality Growth Rates by Week

Week Ending	COVID-19 Deaths	Weekly Mortality Growth Rate
February 22, 2020	5	N/A
February 29, 2020	9	80%
March 7, 2020	37	311.11%
March 14, 2020	57	54.05%
March 21, 2020	577	912.28%
March 28, 2020	3,186	452.17%
April 4, 2020	10,096	216.89%
April 11, 2020	16,270	61.15%
April 18, 2020	17,136	5.32%
Average	5,264	261.62%

As shown in Table 2, the weekly mortality rate had declined from 912.28% in the week ending March 21, 2020 to 5.32% in the week ending April 18, 2020. It is reasonable to assume that the death rate would have continued to decline in the following weeks.

The Traditional Analysis adopts the high estimate of lives saved (2,046,322) and the high estimate of “indirect collateral losses” (514,800) in the “following years” as estimated by Yakusheva et al. (2020). Their estimate is reasonable given the weekly mortality growth rates calculated above.

If we assume that the weekly mortality growth rate would decline to 3.4% for the weeks after April 18, 2020, a total of 2,544,634 persons would have died of COVID-19 during this time period. This would constitute a mortality reduction of 2,032,659 over the time period given above, or 13,643 less than the estimate of Yakusheva et al. (2020).

Nominal GDP Losses

The paper calculates the effect on GDP by subtracting the expected change in nominal GDP from the actual change in nominal GDP for the period 2020 Q2 to 2021 Q1. The first quarter of 2020 is omitted from the calculation because it occurred prior to the first lockdown. The expected change in GDP is the annual growth rate of GDP for the first three years (2017-2019) that President Trump was in office multiplied by the 2019 Q4 GDP. For example, if the growth rate was 6% and 2019 GDP was \$20 trillion, then expected GDP is $1.06(20) = \$21.2$ trillion.

GDP rose from \$19.03258 trillion in 2016 to \$21.74739 trillion in 2019, an annual growth rate of 4.54%. Thus, expected GDP for the period 2020 Q2 through 2021 Q1 is $1.0454(21.74739) = \$22.734726$ trillion. The nominal GDP in 2021 Q1 was \$22.048894 trillion, for a loss of slightly over \$685 billion (\$685,831,687,600).

Traffic Fatalities

Traffic fatalities rose from 36,096 in 2019 to 42,060 in 2020. The National Safety Council has explained that “[this] marks an 8% increase over 2019 in a year where people drove significantly less frequently because of the pandemic. The preliminary estimated rate of death on the roads last year spiked 24% over the previous 12-month period, despite miles driven dropping 13%” (National Safety Council 2021).

For the Traditional Analysis, the paper calculates the increase in traffic fatalities as a cost of 5,964 lives multiplied by \$7.8 million per life for a total cost of \$46.5192 billion. For the Preferred Analysis, the paper multiplies the increase in traffic fatalities by \$12.55 million for a total cost of \$74.85 billion.

Stimulus Programs

A total of \$6.4 trillion was spent on stimulus programs by federal and state governments⁵. Of this amount, \$122.4 billion was spent on non-lockdown related programs. Thus, the cost of the lockdown-related portion of the stimulus programs was \$6,177.6 billion.

Value of Life

Traditional Analysis

For the Traditional Analysis, the total VOL is the number of lives saved multiplied by each person’s value of life. Thus, the lives saved benefit in the Traditional Analysis is \$7.8 million multiplied by 2,046,322 = \$15,961,311,600 (approximately \$16 trillion).

Preferred Analysis

The Preferred Analysis uses an Economic Value of Life (EVOL). CDC data was available for the following age groups: under 1 year, 1-4 years, 5-14 years, 15-24 years, 18-29 years, 25-29 years, 30-34 years, 35-39 years, 40-44 years, 45-49 years, 50-54 years, 55-64 years, 65-74 years, 75-84 years, and 85 years and over. Because life expectancy is dependent on the age of the person, the paper uses a different life expectancy for each age group.

EVOL was calculated using an average of the age of each group. For example, the group of 30-34-year-olds was calculated using an age of 32. The formula for calculation of the EVOL is $EVOL = (\text{Life Expectancy} - \text{Age})(\text{Economic Value})$. Economic Value is calculated as the sum of GDP/Per Capita for each year of

⁵California is the only state that used its own funds to provide an economic stimulus to its residents.

expected life. Expected GDP and GDP Per Capita are updated for each year of expected life.

Let us suppose that a 75-year-old died of COVID-19 whose life expectancy was 85 years. That person's EVOL would be calculated by the formula $(\text{GDP Per Capita})_t + (\text{Expected GDP Per Capita})_{t+1} + (\text{Expected GDP Per Capita})_{t+2} + \dots + (\text{Expected GDP Per Capita})_{t+10}$. The EVOL for different age groups is given in Table 5.

Traditional Analysis

The Traditional Analysis yields a B/C ratio of 1.28. As shown in Table 3, there were approximately \$16 trillion in benefits and \$12.5 trillion in costs. Sensitivity Analyses (see Table 4) are used to show the effect on the B/C ratio if different assumptions are used. The B/C ratios in the Sensitivity Analysis range from 0.57 to 1.64. The paper notes that three out of four sensitivities yield a B/C ratio of less than 1.00.

Table 3. Benefit/Cost Analysis Using a VOL of \$7.8 Million/Person

Item	Benefit (\$ billion)	Cost (\$ billion)
Lives Saved (assumes 2,046,322 lives)	15,961.3	
GDP Loss		685.8
Cost of Federal Stimulus Programs		6,177.6
Cost of California Stimulus Program		9.6
Mental Health Impairment Costs		1,581
Increase in Traffic Fatalities		46.5
Lives lost from economic restrictions		4,015.4
Decline in student shootings	.0624	
Total	15,961.4	12,515.9

Table 4. Sensitivity Analyses Using Different Assumptions

Item	Total Benefits (\$ billion)	Total Costs (\$ billion)	Benefit/Cost Ratio
Sensitivity 1: Assumes the low estimate of lives saved	7,127.3	12,515.9	0.57
Sensitivity 2: Assumes the mean estimate of lives saved (1,023,618).	7,984.2	12,515.9	0.64
Sensitivity 3: Assumes a value of life of \$5 million/person and the high-cost estimate for lives saved.	10,231.6	12,515.9	0.82
Sensitivity 4: Assumes a value of life of \$10 million/person and the high-cost estimate for lives saved.	20,463.2	12,515.9	1.64
Average Sensitivity	11,451.6	12,515.9	0.92

Preferred Analysis

The Preferred Analysis yields a B/C ratio of 0.22. As shown in Table 3, there were approximately \$2.7 trillion in benefits and \$12.5 trillion in costs. Sensitivity Analyses (see Table 7) are used to show the effect on the B/C ratio if different assumptions are used. The B/C ratios in the Sensitivity Analysis range from 0.10 to 0.19. The results indicate that the cost of the lockdowns was up to ten times higher than the benefits of the lockdowns.

The Preferred Analysis uses an Economic Value of Life based on the estimated ages of the deceased. The Preferred Analysis uses the following assumptions.

1. Annual GDP per capita will increase at a rate of 3.01% per annum, which is the average annual increase in GDP per capita for the period 2011 Q1 to 2021 Q1.
2. The percent of lives saved in each age group will be identical to the percent of COVID-19 deaths in each age group.
3. The remaining life expectancy for each age group will be identical to the 2018 life expectancy as published by the National Vital Statistic Reports of the CDC (Arias and Xu 2020).
4. The average age of students killed in 2019 was from 5-14 years at an EVOL of \$15,969,563.09/student.
5. An EVOL of \$12.55 million/fatality was used to value the increase in traffic fatalities.

The economic value of life for each age group is given in Table 5.

Table 5. *The Economic Value of Life Assuming 1,955,465 Lives Saved*

Age Group	EVOL/ Person (\$)	Lives Saved	Age Group EVOL (\$ million)
Under 1 year	24,507,719	233	5,710.30
1-4 years	19,498,632	122	2,378.83
5-14 years	15,959,563	345	5,506.05
15-17 years	12,552,921	282	3,539.92
18-24 years	10,901,237	2,702	29,455.14
25-29 years	8,763,573	4,697	41,162.50
30-34 years	7,250,894	8,527	61,828.38
35-39 years	6,192,284	12,939	80,121.96
40-44 years	5,033,954	21,265	107,047.05
45-49 years	4,035,254	36,864	148,755.62
50-54 years	3,336,338	58,828	196,270.14
55-64 years	2,431,779	241,981	588.44
65-74 years	1,450,787	432,902	628.05
75-84 years	853,578	540,569	461.42
85 years and over	592,537	593,209	351.50
Total (\$ billion)			2,711.19

As shown in Table 5, EVOL decreases as a person ages. The reason is that older people have fewer expected years of life remaining than do younger people. The Preferred BCA estimates a total value of lives saved in Table 6.

Table 6. *Benefit/Cost Analysis Using a Total Value of Lives Saved of \$2,711 billion*

Item	Benefit (\$ billion)	Cost (\$ billion)
Lives Saved	2,711.19	
GDP Loss		685.8
Cost of Federal Stimulus Programs		6,177.6
Cost of California Stimulus Program		9.6
Mental Health Impairment Costs		1,581
Increase in Traffic Fatalities		74.9
Lives lost from economic restrictions		4,015.4
Decline in student shooting fatalities	0.12	
Total	2,711.3	12,544.3

Table 7. *Sensitivity Analyses Using Different Assumptions*

Item	Total Benefits (\$ billion)	Total Costs (\$ billion)	Benefit/Cost Ratio
Sensitivity 1: Assumes the low estimate of lives saved decreased by 4.44%.	1,220.9	12,544.3	0.10
Sensitivity 2: Assumes the mean estimate of lives saved.	1,966.1	12,544.3	0.16
Sensitivity 3: Reduces the number of lives saved by 10% due to testing errors.	2,440.1	12,544.3	0.19
Average Sensitivity	1,542.4	12,544.3	0.15

Conclusion

The paper analyzed the economic effect of the COVID-19-related lockdowns in the United States from March 15, 2020 to May 8, 2021. The author relied heavily on official CDC estimates of COVID-19 deaths. Additionally, the author reviewed news stories, academic literature, and independent reports for the period January 4, 2020 to May 8, 2021 and makes conclusions concerning the success or failure of the lockdown policies. The paper concludes that:

1. The cost of the lockdowns was up to ten times greater than the benefits of the lockdowns.
2. The economic value of life per person ranges from \$592 thousand to \$24.5 million, depending on the age of the individual.
3. The lockdowns have saved between 913,762 and 2,046,322 lives in the U.S.; however, the economic downturn from shelter-in-place measures and

other restrictions on economic activity could create an indirect collateral loss of 84,000 to 514,800 lives in the future.

4. The lockdowns caused a loss of nominal GDP of over \$685 billion.
5. The average mortality rate for COVID-19 is approximately 1.75%. There is a maximum lag of two weeks between COVID-19 infection and death.
6. Government officials and public opinion leaders underestimated the extent of the virus' spread and how long it would take to get the virus under control.
7. COVID-19 is a seasonal virus.

The paper hypothesized that the economic costs of the lockdowns exceeded their economic benefits. This hypothesis is tested empirically by analyzing the effect of the lockdowns using a Benefit/Cost framework. The paper found that the economic cost of the lockdowns exceeded the economic benefits.

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