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Comparing Postpartum Educational Modalities and Their Effect on Information Retention

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Abstract

Many educational formats exist and it is important to determine which formats are most effective for information retention. Numerous factors impact the effects of patient education including personal and demographic backgrounds, making it unlikely that one modality is universally superior to others. It remains important, though, to determine which standardized education methods are most effective for baseline analysis. This study utilized four common educational modalities (verbal, written, video, and interactive) and compared their efficacy to one another in regards to patient information retention. Four groups totaling 302 participants received their respective education and then were quizzed. All data, including quiz scores and answers to demographic/personal questions, was compiled into a Microsoft Excel® database. Via this platform and through Kruskal-Wallis testing, the data were analyzed and conclusions were drawn. This study found that no educational modality alone proved to have a significant effect on information retention. What proved to have the most significant effect was household income, highest level of education, and the time of day in which the intervention was received. More specifically, those with lower household income and level of education performed worse on quizzes, and those who had a higher household income and level of education performed best. In regard to time of the day, those who received education and the quiz in the morning tended to perform better compared to those who received the intervention in the afternoon.

Keywords: Postpartum; Educational Modalities; Information Retention; Socioeconomic

Introduction

Many educational methods exist, people learn in different ways, and a shift in information retention may be occurring due to the increased use of technology and other factors. Current modalities used to educate patients are potentially becoming outdated. More definitive data on information retention is needed to guide best education practices across patient populations. This study aims to assess four common forms of education to compare their relative effectiveness and provide insight into optimized patient learning strategies. Verbal, written, video, and interactive education modalities were compared to determine effectiveness in relaying standardized information.

Patient education, in any regard, has been repeatedly demonstrated to benefit patients' knowledge base and informed decision making. A study conducted by Patel et al. showed the effectiveness of a "planned teaching program" in regard to postpartum breast related disorders [1]. Those that participated in the planned teaching had increased knowledge compared to those who did not participate. Wiener et al. conducted a study in Laos, Vietnam to review the effectiveness of a brief face-to-face interactive educational module in terms of information retention and patient outcomes [2]. As expected, those with higher maternal education scored higher on post-education tests and achieved similar scores when tested at a later date. Osaki et al. utilized a Maternal and Child Health Handbook in Indonesia to promote home care after pregnancy and to promote care regarding the mothers' new child [3]. The use of the handbook was found to greatly improve outcomes. Lastly, Dol et al. evidenced that current educational modalities (verbal, written information, and counseling) all improve patient outcomes, but that further studies are needed to determine which methods are most effective [4]. Not only is education preferred to benefit patients' knowledge base and informed decision making, but education also increases patient satisfaction as evidenced by Howarth et al. These researchers compared women in a skills preparation group, birth stories booklet group, and a "treatment as usual" group. Those in the skills group and booklet group reported higher satisfaction compared to those in the "treatment as usual" group [5].

Educating patients is an excellent way of promoting health literacy, but certain modalities work better than others and studies have shown mixed results. Gazmararian et al. advocates for "simpler, in-person education and/or alternative modalities to access information." [6] A study conducted in Somalia found that Somali women with limited English proficiency learned best from "comic-book" style education [7]. Bustamante et al. found that individuals with lower socioeconomic status in Ecuador benefited from education directly from their healthcare providers compared to education from social media [8]. Lori et al. found that breastfeeding and lactational amenorrhea education were most effective in a group setting, compared to one-on-one teaching [9]. A 2012 study found that medical students' ability to demonstrate the use of a pMDI improved with video education [10]. However, additional studies have provided mixed results and offer differing opinions. Linden et al. found that web-based support plus standard education was not superior to standard education alone with diabetic patients for management of their diabetes [11]. A 2018 study found that only 14 out of 22 patients recalled their verbally delivered health education directly after the educational session [12]. Furthermore, Sroiwatana et al. concluded that, in their study, video education showed no efficacy over routine breastfeeding education alone, although this study had a very small sample size [13].

There are many factors to consider when educating patients. It is not surprising that aforementioned studies differ in conclusions considering there are many factors related to education, and learning methodologies and outcomes. It is impractical to assume one modality is superior to another for every patient. Effectiveness likely depends upon culture, ethnicity, socioeconomic status, health condition, age, etc. Limitations of the above include small sample sizes, outdated studies, and inconsistent conclusions. This study aims to address the aforementioned limitations and make contributions to the overall lack of knowledge about standardized education within the postpartum patient population. Furthermore, this study focuses on analyzing differences amongst common educational modalities; an approach that is underrepresented in the current literature. Other related studies have focused on healthcare providers' satisfaction and information retention rather than that of the patients' such as a study conducted by Watkins et al. that compares breastfeeding education interventions [14]. It seems that much of the focus in prior studies lies in increasing provider knowledge and awareness rather than increasing health literacy within patient populations.

Typical education formats include verbal presentation (such as lectures or discussions), written materials, videos, and interactive modalities. The objective of this study is to compare these educational modalities and their effect on information retention in postpartum women. Due to the decreasing prevalence of distributed information via paper and electronic devices in this era, it is believed that those who receive video education will obtain the highest quiz scores, meaning higher retention of educational information. Furthermore, it is hypothesized that educational background and socioeconomic status will likely positively correlate with quiz scores.

A patient-oriented study that directly compares common educational modalities is needed. Data from this study may be beneficial to the clinical and research communities regarding optimal patient education, specifically for postpartum women, but could apply to other patient populations as well.

Methods

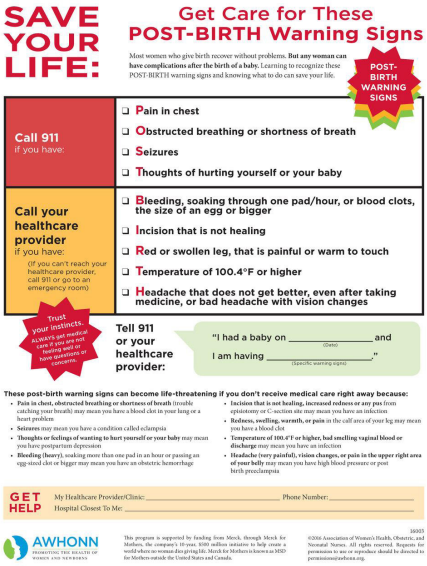
Participants

A convenience sample of 302 postpartum mothers were selected from the postpartum floor of Summa Akron City Hospital in Akron, Ohio. The participants were selected on a voluntary basis with regards to the inclusion criteria detailed below. The participants, totaling 302, were randomly assigned into four intervention groups at the time of study enrollment. Participants were then educated after delivery but before discharge and before receiving any other educational intervention. Groups were not assigned specifically regarding sociodemographic, obstetric, or clinical data in order to maintain true random assignment. Subjects were immediately quizzed after receiving education. The inclusion criteria for eligible participants in this study was defined as follows: English as primary language, 18-50 years old, and recruited from the postpartum floor after delivery, before discharge, and before receiving "Post Birth Warning Signs" education. The "Post Birth Warning Signs" education program is described at the end of the Materials and Assessments section.

Materials and Assessments

This study was conducted during the spring and summer of 2020. Information gathered from the participants included time of the day quizzes and education were given, the type of education they received, the number of times they have received postpartum education in the past, age, annual household income, employment status, racial background, highest level of education, history of postpartum complications, having received prenatal care, and type of delivery, whether vaginal or cesarean section. Subjects were randomly assigned and provided one of the four types of education and then answered questions testing their retention via a ten-question quiz immediately thereafter. The four types of education involved were verbal, written, video, and interactive formats with identical content regarding postpartum warning signs between all four modalities. Quizzes were scored and then participants were provided with correct answers/explanations to ensure quality education and safety. The full encounter, including review of the consent form, the education session, and completion and review of the quiz was designed to last no more than 35 minutes. Each subject participated in only one education session. Healthcare providers at Summa Health in Akron utilize AWHONN's "Postpartum Discharge Education Checklist" (Figure 2) and AWHONN's "Post-Birth Warning Signs" handout (Figure 1) as part of their standard of care. The educational materials in this study utilized both of these documents and therefore meet the standard of care at Summa Health.

All four types of education contained identical content verbatim. Other than the verbal education, which had no visual manifestations, the remaining three formats had the same visuals as well. Otherwise, the modalities only differed with regard to delivery format. A consent form was distributed to participants prior to the education session. Education materials were determined by the Flesch-Kincaid Grade Level to have a readability of 9.5. The Postpartum Quiz and Answer Key were determined by the Flesch-Kincaid Grade Level to have a readability of 8.1.



SAVE YOUR LIFE:

Get Care for These POST-BIRTH Warning Signs

Most women who give birth recover without problems. **But any woman can have complications after the birth of a baby.** Learning to recognize these POST-BIRTH warning signs and knowing what to do can save your life.

POST-BIRTH WARNING SIGNS

Call 911 if you have:

- ❑ **P**ain in chest
- ❑ **O**bstructed breathing or shortness of breath
- ❑ **S**eizures
- ❑ **T**houghts of hurting yourself or your baby

Call your healthcare provider if you have:
(If you can't reach your healthcare provider, call 911 or go to an emergency room)

- ❑ **B**leeding, soaking through one pad/hour, or blood clots, the size of an egg or bigger
- ❑ **I**ncision that is not healing
- ❑ **R**ed or swollen leg, that is painful or warm to touch
- ❑ **T**emperature of 100.4°F or higher
- ❑ **H**eadache that does not get better, even after taking medicine, or bad headache with vision changes

Trust your instincts. ALWAYS get medical care if you are not feeling well or have questions or concerns.

Tell 911 or your healthcare provider: "I had a baby on _____ (Date) and I am having _____ (Specific warning signs)."

These post-birth warning signs can become life-threatening if you don't receive medical care right away because:

- **Pain in chest, obstructed breathing or shortness of breath** (trouble catching your breath) may mean you have a blood clot in your lung or a heart problem
- **Seizures** may mean you have a condition called eclampsia
- **Thoughts or feelings of wanting to hurt yourself or your baby** may mean you have postpartum depression
- **Bleeding (heavy)**, soaking more than one pad in an hour or passing an egg-sized clot or bigger may mean you have an obstetric hemorrhage
- **Incision that is not healing, increased redness or any pus** from episiotomy or C-section site may mean you have an infection
- **Redness, swelling, warmth, or pain** in the calf area of your leg may mean you have a blood clot
- **Temperature of 100.4°F or higher, bad smelling vaginal blood or discharge** may mean you have an infection
- **Headache (very painful), vision changes, or pain in the upper right area of your belly** may mean you have high blood pressure or post birth preeclampsia

GET HELP — My Healthcare Provider/Clinic: _____ Phone Number: _____ Hospital Closest To Me: _____

AWHONN — PROMOTING THE HEALTH OF WOMEN AND NEWBORNS

This program is supported by funding from Merck, through Merck for Mothers, the company's 10-year, $100 million initiative to help create a world where no woman dies giving life. Merck for Mothers is known as MSD for Mothers outside the United States and Canada.

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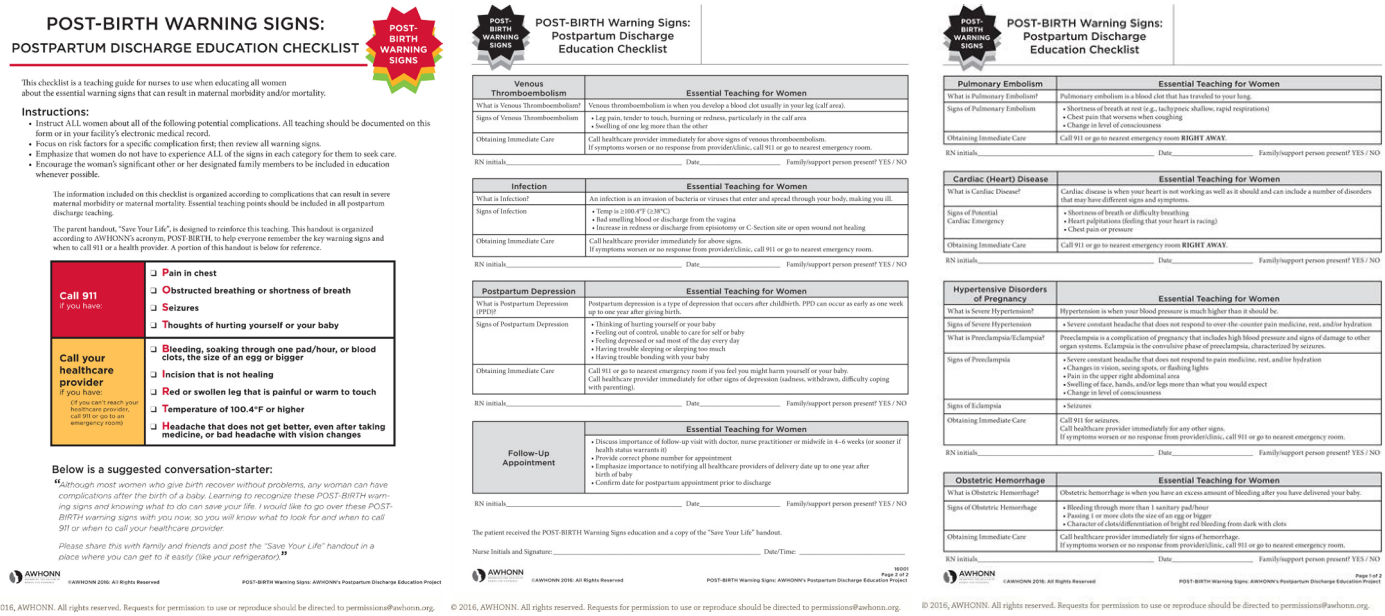
Figure 1: Save Your Life patient handout



POST-BIRTH WARNING SIGNS: POSTPARTUM DISCHARGE EDUCATION CHECKLIST

This checklist is a teaching guide for nurses to use when educating all women about the essential warning signs that can result in maternal morbidity and/or mortality.

Instructions:

- Instruct ALL women about all of the following potential complications. All teaching should be documented on this form or in your facility's electronic medical record.
- Focus on risk factors for a specific complication first; then review all warning signs.
- Emphasize that women do not have to experience ALL of the signs in each category for them to seek care.
- Encourage the woman's significant other or her designated family members to be included in education whenever possible.

The information included on this checklist is organized according to complications that can result in severe maternal morbidity or maternal mortality. Essential teaching points should be included in all postpartum discharge teaching.

The parent handout, "Save Your Life", is designed to reinforce this teaching. This handout is organized according to AWHONN's acronym, POST-BIRTH, to help everyone remember the key warning signs and when to call 911 or a health provider. A portion of this handout is below for reference.

Call 911 if you have:

- ❑ **P**ain in chest
- ❑ **O**bstructed breathing or shortness of breath
- ❑ **S**eizures
- ❑ **T**houghts of hurting yourself or your baby

Call your healthcare provider if you have:
(If you can't reach your healthcare provider, call 911 or go to an emergency room)

- ❑ **B**leeding, soaking through one pad/hour, or blood clots, the size of an egg or bigger
- ❑ **I**ncision that is not healing
- ❑ **R**ed or swollen leg that is painful or warm to touch
- ❑ **T**emperature of 100.4°F or higher
- ❑ **H**eadache that does not get better, even after taking medicine, or bad headache with vision changes

Below is a suggested conversation-starter:

"*Although most women who give birth recover without problems, any woman can have complications after the birth of a baby. Learning to recognize these POST-BIRTH warning signs and knowing what to do can save your life. I would like to go over these POST-BIRTH warning signs with you now, so you will know what to look for and when to call 911 or when to call your healthcare provider.*

Please share this with family and friends and post the "Save Your Life" handout in a place where you can get to it easily (like your refrigerator)."

AWHONN — ©AWHONN 2016: All Rights Reserved — POST-BIRTH Warning Signs: AWHONN's Postpartum Discharge Education Project

POST-BIRTH Warning Signs: Postpartum Discharge Education Checklist

Venous Thromboembolism	Essential Teaching for Women
What is Venous Thromboembolism?	Venous thromboembolism is when you develop a blood clot usually in your leg (calf area).
Signs of Venous Thromboembolism	• Leg pain, tender to touch, burning or redness, particularly in the calf area • Swelling of one leg more than the other
Obtaining Immediate Care	Call healthcare provider immediately for above signs of venous thromboembolism. If symptoms worsen or no response from provider/clinic, call 911 or go to nearest emergency room.

RN initials_____ Date_____ Family/support person present? YES / NO

Infection	Essential Teaching for Women
What is Infection?	An infection is an invasion of bacteria or viruses that enter and spread through your body, making you ill.
Signs of Infection	• Temp is ≥100.4°F (≥38°C) • Bad smelling blood or discharge from the vagina • Increase in redness or discharge from episiotomy or C-Section site or open wound not healing
Obtaining Immediate Care	Call healthcare provider immediately for above signs. If symptoms worsen or no response from provider/clinic, call 911 or go to nearest emergency room.

RN initials_____ Date_____ Family/support person present? YES / NO

Postpartum Depression	Essential Teaching for Women
What is Postpartum Depression (PPD)?	Postpartum depression is a type of depression that occurs after childbirth. PPD can occur as early as one week up to one year after giving birth.
Signs of Postpartum Depression	• Thinking of hurting yourself or your baby • Feeling out of control, unable to care for self or baby • Feeling depressed or sad most of the day every day • Having trouble sleeping or sleeping too much • Having trouble bonding with your baby
Obtaining Immediate Care	Call 911 or go to nearest emergency room if you feel you might harm yourself or your baby. Call healthcare provider immediately for other signs of depression (sadness, withdrawn, difficulty coping with parenting).

RN initials_____ Date_____ Family/support person present? YES / NO

Follow-Up Appointment	Essential Teaching for Women
	• Discuss importance of follow-up visit with doctor, nurse practitioner or midwife in 4–6 weeks (or sooner if health status warrants it) • Provide correct phone number for appointment • Emphasize importance to notifying all healthcare providers of delivery date up to one year after birth of baby • Confirm date for postpartum appointment prior to discharge

RN initials_____ Date_____ Family/support person present? YES / NO

The patient received the POST-BIRTH Warning Signs education and a copy of the "Save Your Life" handout.

Nurse Initials and Signature: _____ Date/Time: _____

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POST-BIRTH Warning Signs: Postpartum Discharge Education Checklist

Pulmonary Embolism	Essential Teaching for Women
What is Pulmonary Embolism?	Pulmonary embolism is a blood clot that has traveled to your lung.
Signs of Pulmonary Embolism	• Shortness of breath at rest (e.g., tachypneic shallow, rapid respirations) • Chest pain that worsens when coughing • Change in level of consciousness
Obtaining Immediate Care	Call 911 or go to nearest emergency room **RIGHT AWAY.**

RN initials_____ Date_____ Family/support person present? YES / NO

Cardiac (Heart) Disease	Essential Teaching for Women
What is Cardiac Disease?	Cardiac disease is when your heart is not working as well as it should and can include a number of disorders that may have different signs and symptoms.
Signs of Potential Cardiac Emergency	• Shortness of breath or difficulty breathing • Heart palpitations (feeling that your heart is racing) • Chest pain or pressure
Obtaining Immediate Care	Call 911 or go to nearest emergency room **RIGHT AWAY.**

RN initials_____ Date_____ Family/support person present? YES / NO

Hypertensive Disorders of Pregnancy	Essential Teaching for Women
What is Severe Hypertension?	Hypertension is when your blood pressure is much higher than it should be.
Signs of Severe Hypertension	• Severe constant headache that does not respond to over-the-counter pain medicine, rest, and/or hydration
What is Preeclampsia/Eclampsia?	Preeclampsia is a complication of pregnancy that includes high blood pressure and signs of damage to other organ systems. Eclampsia is the convulsive phase of preeclampsia, characterized by seizures.
Signs of Preeclampsia	• Severe constant headache that does not respond to pain medicine, rest, and/or hydration • Changes in vision, seeing spots, or flashing lights • Pain in the upper right abdominal area • Swelling of face, hands, and/or legs more than what you would expect • Change in level of consciousness
Signs of Eclampsia	• Seizures
Obtaining Immediate Care	Call 911 for seizures. Call healthcare provider immediately for any other signs. If symptoms worsen or no response from provider/clinic, call 911 or go to nearest emergency room.

RN initials_____ Date_____ Family/support person present? YES / NO

Obstetric Hemorrhage	Essential Teaching for Women
What is Obstetric Hemorrhage?	Obstetric hemorrhage is when you have an excess amount of bleeding after you have delivered your baby.
Signs of Obstetric Hemorrhage	• Bleeding through more than 1 sanitary pad/hour • Passing 1 or more clots the size of an egg or bigger • Character of clots/differentiation of bright red bleeding from dark with clots
Obtaining Immediate Care	Call healthcare provider immediately for signs of hemorrhage. If symptoms worsen or no response from provider/clinic, call 911 or go to nearest emergency room.

RN initials_____ Date_____ Family/support person present? YES / NO

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Figure 2: Postpartum Discharge Education Checklist for the Provider (page 1-3)

"Post-Birth Warning Signs": an educational program created by the Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN) that many hospitals across the nation, including Summa Akron City Hospital, have adopted as part of their education protocol. The educational formats used within this study were based solely off of these educational materials with minor supplemental additions from publications of the Mayo Clinic and the Children's Hospital of Philadelphia.

The format of the education materials began with a small introduction regarding postpartum warning signs. Next, each topic specific to postpartum complications was discussed separately. These included pulmonary embolism, cardiac disease, hypertension/preeclampsia/eclampsia, postpartum hemorrhage, venous thromboembolism, infection, and postpartum depression. Lastly, the participants were provided with closing remarks and the project's list of references. Written education was then printed out for participants to read on their own, without any verbal education to accompany it. Verbal education was delivered solely by the PI. Video education was recorded via Microsoft Powerpoint® with a voiceover feature. Interactive education was developed

through Microsoft Powerpoint® with hyperlinks. These hyperlinks required that participants interact with the educational materials by navigating to the intended slide and information. The PI of the project was available at all times, from obtaining consent to reviewing the quiz, and for questions and clarifications that participants had throughout the process. This study was approved by the Institutional Review Board at Summa Health System.

Data Collection

New mothers were surveyed on the postpartum floor at Akron Summa Hospital via a paper-based quantitative quiz. Patients were surveyed in their respective hospital rooms. Subjects were provided with one of the four modalities of education and answered questions testing their retention of such information via a ten-question quiz immediately thereafter.

Mothers were approached after delivery, before discharge, and before receiving a standard hospital "Post-Birth Warning Signs" education. They were randomly placed in one of four intervention groups (verbal, written, video, and interactive education) and received their group's educational format pertaining to postpartum warning signs. They were permitted to ask questions clarifying the basic understanding of the material and their understanding of the questions' intention during the quiz. Participants in the verbal education group received education from the PI, who presented the information to the participants from a script. Those in the written education group received a booklet to read by themselves. Participants in the interactive and video education groups utilized a computer to access their educational content.

Directly after receiving education, demographic information was collected and participants answered a ten-question quiz. The demographic questionnaire included items pertaining to race, socioeconomics, education, employment, delivery method (cesarean section or vaginal), time of day the participant received the education and took the quiz, history of postpartum complications, and history of prenatal care for their most recent pregnancy. The PI reviewed the quiz with all participants afterwards to ensure that the participants understood the correct answers. The PI was available to the patients for questions and clarifications at all times during this process. The entire educational process was conducted in a quiet environment within participants' respective hospital rooms.

Analysis

Analysis for this study consisted of calculating quiz scores (dependent variable) per education modality (independent variable) with further analysis taking into account background information of the participants (covariates). The effects of independent variables and covariates were compared via mean quiz scores. Data filtering and basic math functions on Microsoft Excel© were utilized to assess trends of independent variables and covariates. Kruskal-Wallis tests were run to understand statistical significance of the data and to calculate median, mean rank, and Z-values for groups. Clinical significance was defined as data with authentic quantitative effects that fall outside of conventional statistical significance (P-value < 0.05), but that may still be beneficial to the field of study. Such determination was made at the discretion of the study's authors.

Results

This pilot study found mild differences between mean quiz scores amongst educational modalities alone ranging from 8.25 to 8.54 (Table 1). In contrast, quiz scores varied most consistently in terms of income, highest education level, race, and the time of day in which education was received. Asian and white participants scored the highest and their mean quiz scores were 8.50 and 8.52, respectively (Table 2). Black participants scored the lowest with a mean score of 7.84. When analyzing scores per educational modality, only white and black participants were included due to sample size restrictions. White participants scored consistently higher than black participants except for quiz scores related to the written educational modality (Table 1).

	Oral	Written	Interactive	Video
Average Score	8.54 (N=76)	8.29 (N=76)	8.37 (N=75)	8.25 (N=75)
White	8.70 (N=54)	8.17 (N=54)	8.67 (N=43)	8.57 (N=53)
Black	7.57 (N=14)	8.60 (N=15)	7.50 (N=20)	7.80 (N=15)

Table 1: Mean Quiz Scores with Respect to Educational Modality and Race

	Overall	**White**		**Black**	
< $10,000	7.33 (N=42)	7.47 (N=17	8.46%	7.10 (N=20)	31.25%
$10,000 - 29,999	8.24 (N=59)	8.29 (N=24)	11.94%	8.30 (N=27)	42.19%
$30,000 - 59,999	8.32 (N=44)	8.10 (N=39)	19.40%	8.00 (N=8)	12.50%
$60,000 - 99,999	8.59 (N=61)	8.63 (N=46)	22.89%	8.25 (N=8)	12.50%
$100,000 +	8.94 (N=78)	8.95 (N=75)	37.31%	N/A (N=0)	1.56%

(*N/A for insufficient sample size of less than 5; other races not considered due to low sample size)
Table 2: Mean Quiz Scores with Respect to Household Income and Race, and Percentage of Participants by Race with Respect to Income Levels

Level of household income trends positively with higher achieved quiz scores (Table 2 and Figure 3). Those that earn less than $10,000 scored lowest (mean of 7.33) and those earning $200,000 or more scored the highest (mean of 9.29). On average, there is a general upward trend in quiz scores correlating to higher household income which is also true when looking at quiz scores achieved within each individual educational modality. When comparing black and white participants, black participants tended to score slightly lower than white participants per income bracket (Table 2). It should be noted that the majority of black participants had lower income levels while the majority of white participants had higher income levels (Table 2).

	Oral	Written	Interactive	Video
< $10,000	8.14 (N=7)	7.27 (N=15)	6.89 (N=9)	7.27 (N=11)
$10,000 - 29,999	8.20 (N=15)	8.75 (N=16)	7.87 (N=15)	8.08 (N=13)
$30,000 - 59,999	8.40 (N=20)	7.89 (N=9)	8.22 (N=18)	8.00 (N=12)
$60,000 - 99,999	8.85 (N=13)	8.25 (N=20)	8.42 (N=12)	8.94 (N=16)
$100,000 +	8.80 (N=20)	9.07 (N=15)	9.05 (N=21)	8.86 (N=22)

Table 3: Educational Modality with Respect to Household Income and its Effect on Quiz Scores

Level of education alone positively correlated to higher achieved quiz scores (Table 4 and Figure 6). Those with some high school education but no diploma scored lowest (mean of 7.38) and each successive educational level scored better on the quiz than the educational level below them, those with a doctoral degree scoring highest (mean of 9.00). This corresponds to the similar trend seen within household income, which is expected. Another trend emerged in terms of race where white participants tended to score slightly better than black participants despite sharing equal educational levels. The highest level of education achieved for any black participant was a master's degree (2 participants) followed by bachelor's degree (2 participants), and there were no black participants with a doctorate degree. Table 4 shows a participant representation of the highest educational level by race. As much as 75% of black participants did not advance their education past high school/GED compared to only 30% of their white peers. 51.23% of white participants reported a bachelor's degree or higher as compared to only 6.24% of black participants. Table 5 shows a very similar trend to that of Table 3, where quiz scores generally correlated positively with higher levels of education. However, it is not clear whether any one educational modality is superior to the others as differences remained mild between them. Table 6 and Figure 5 reveal a better performance on quizzes earlier in the day compared to later with the exception of the interactive modality.

	Overall	White		Black	
Some High School	7.38 (N=21)	7.38 (N=8)	3.94%	7.43 (N=7)	10.94%
High School / GED	8.06 (N=107)	8.00 (N=53)	26.11%	7.78 (N=41)	64.06%
Trade School	8.52 (N=23)	8.60 (N=15)	7.34%	8.57 (N=6)	9.37%
Associate's Degree	8.27 (N=30)	8.26 (N=23)	11.33%	8.17 (N=6)	9.37%
Bachelor's Degree	8.87 (N=71)	8.92 (N=64)	31.53%	N/A	3.12%
Master's Degree	8.89 (N=35)	9.00 (N=32)	15.76%	N/A	3.12%
Doctoral Degree	9.00 (N=10)	8.75 (N=8)	3.94%	N/A	0%

Education (*N/A for insufficient sample size of less than 5 or sample size more than 5 in two categories or less).
Table 4: Mean Quiz Scores With Respect To Highest Education Level and Race, and Percentage of Participants by Race with Respect to Highest

	Oral	Written	Interactive	Video
High School / GED	8.39 (N=28)	8.00 (N=21)	7.77 (N=31)	8.11 (N=27)
Trade School and Associate's Degree	8.60 (N=10)	8.19 (N=21)	8.92 (N=12)	7.90 (N=10)
Bachelor's Degree	9.06 (N=17)	8.71 (N=21)	8.71 (N=17)	9.06 (N=16)
Master's and Doctoral Degrees	8.67 (N=13)	9.00 (N=7)	9.50 (N=6)	8.88 (N=17)

(*Trade School and Associate's Degree and Master's and Doctoral Degrees were merged together due to their low sample size but similar scores within groupings).
Table 5: Mean Quiz Scores with Respect to Highest Level of Education

	Overall	Oral	Written	Interactive	Video
Morning	8.66 (N=170)	9.00 (N=50)	9.00 (N=37)	8.00 (N=48)	9.00 (N=33)
Afternoon	8.11 (N=88)	8.00 (N=13)	8.00 (N=29)	9.00 (N=9)	8.50 (N=36)
Evening	7.69 (N=16)	8.00 (N=9)	N/A	N/A	N/A

(*N/A for insufficient sample size of less than 5).
Table 6: Mean Quiz Scores with Respect To Time of the Day

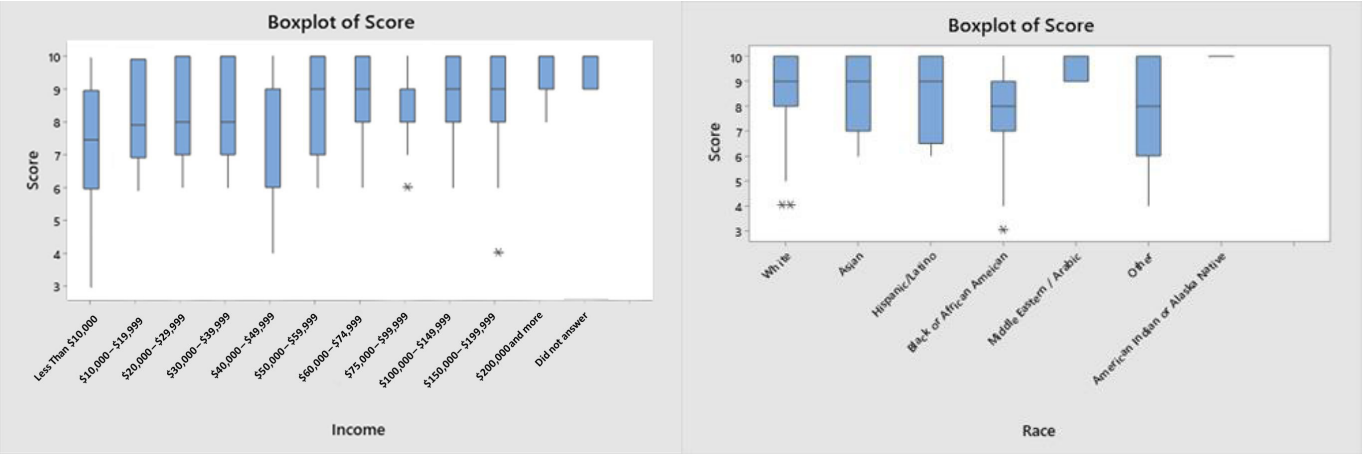

Figure 3 and 4: Boxplot of Household Income vs. Mean Quiz Score; Boxplot of Race vs. Mean Quiz Score

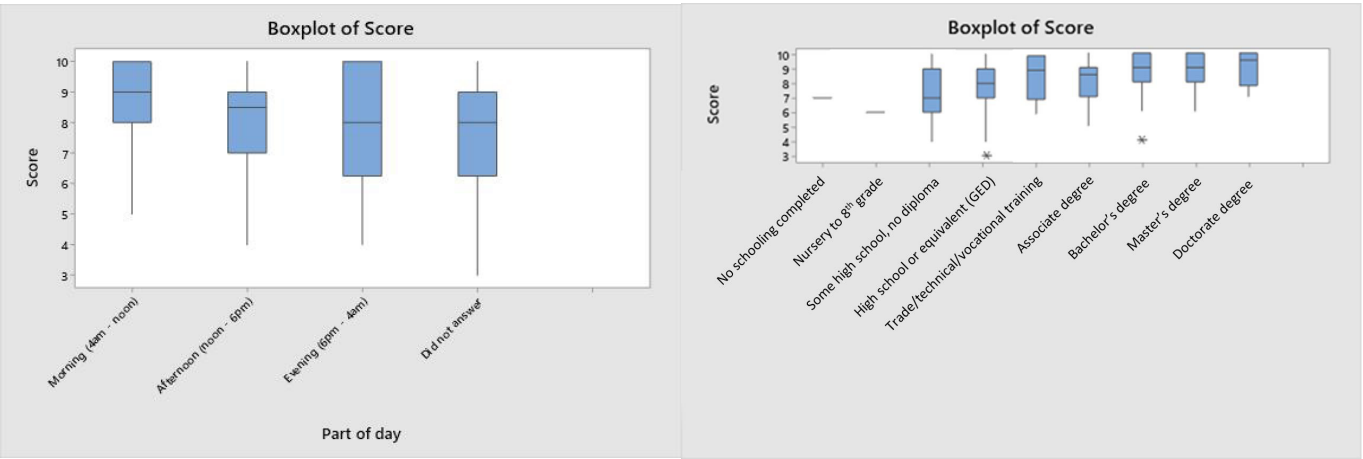

Figure 5 and 6: Boxplot of Time of the Day Quiz Was Taken vs. Mean Quiz Score; Boxplot of Highest Education Achieved vs. Mean Quiz Score

Oral

Kruskal-Wallis Test: Score versus Income

Descriptive Statistics

Income	N	Median	Mean Rank	Z-Value
$10,000 - $29,999	15	8	33.3	-0.93
$100,000 or more	20	9	41.8	0.90
$30,000 - $59,999	20	9	38.1	0.02
$60,000 - $99,999	13	9	41.4	0.62
Less than $10,000	7	8	30.7	-0.93
Overall	75		38.0	

Test

Null hypothesis H_0: All medians are equal
Alternative hypothesis H_1: At least one median is different

Method	DF	H-Value	P-Value
Not adjusted for ties	4	2.38	0.667
Adjusted for ties	4	2.56	0.635

Kruskal-Wallis Test: Score versus Race

Descriptive Statistics

Race	N	Median	Mean Rank	Z-Value
Asian	4	10	49.8	1.11
Black or African Ameican	14	8	22.8	-2.89
Middle Eastern / Arabic	1	10	61.5	1.09
Other	3	10	43.3	0.43
White	53	9	40.4	1.47
Overall	75		38.0	

Test

Null hypothesis H_0: All medians are equal
Alternative hypothesis H_1: At least one median is different

Method	DF	H-Value	P-Value
Not adjusted for ties	4	9.93	0.042
Adjusted for ties	4	10.68	0.030

The chi-square approximation may not be accurate when some sample sizes are less than 5.

Kruskal-Wallis Test: Score versus Education Level

Descriptive Statistics

Education Level	N	Median	Mean Rank	Z-Value
Associate degree	5	9	40.7	0.29
Bachelor's degree	17	9	44.9	1.48
Doctoral degree	3	10	45.8	0.64
High school graduate, diploma o	28	9	36.5	-0.47
Master's degree	12	9	38.2	0.03
No schooling completed	1	7	14.5	-1.09
Some high school, no diploma	5	7	23.1	-1.58
Trade/technical/vocational trai	4	8	34.3	-0.35
Overall	75		38.0	

Test

Null hypothesis H_0: All medians are equal
Alternative hypothesis H_1: At least one median is different

Method	DF	H-Value	P-Value
Not adjusted for ties	7	5.92	0.549
Adjusted for ties	7	6.36	0.498

The chi-square approximation may not be accurate when some sample sizes are less than 5.

Kruskal-Wallis Test: Score versus Time Of Day Quiz Was Taken

Descriptive Statistics

Time Of Day Quiz Was Taken	N	Median	Mean Rank	Z-Value
Afternoon (noon - 6pm)	13	8	30.8	-1.31
Did not answer	3	7	27.7	-0.84
Evening (6pm - 4am)	9	8	33.2	-0.71
Morning (4am - noon)	50	9	41.4	1.89
Overall	75		38.0	

Test

Null hypothesis H_0: All medians are equal
Alternative hypothesis H_1: At least one median is different

Method	DF	H-Value	P-Value
Not adjusted for ties	3	3.72	0.293
Adjusted for ties	3	4.00	0.261

The chi-square approximation may not be accurate when some sample sizes are less than 5.

Written

Kruskal-Wallis Test: Score versus Income

Descriptive Statistics

Income	N	Median	Mean Rank	Z-Value
$10,000 - $29,999	16	9	44.9	1.44
$100,000 or more	15	9	50.3	2.44
$30,000 - $59,999	9	9	34.7	-0.49
$60,000 - $99,999	20	8	34.4	-0.86
Less than $10,000	15	7	25.1	-2.56
Overall	75		38.0	

Test

Null hypothesis H_0: All medians are equal
Alternative hypothesis H_1: At least one median is different

Method	DF	H-Value	P-Value
Not adjusted for ties	4	12.36	0.015
Adjusted for ties	4	13.05	0.011

Kruskal-Wallis Test: Score versus Race

Descriptive Statistics

Race	N	Median	Mean Rank	Z-Value
Asian	2	9.5	57.5	1.28
Black or African Ameican	15	9.0	42.9	0.97
Hispanic/Latino	4	8.5	39.8	0.17
Other	1	8.0	28.0	-0.46
White	53	8.0	35.9	-1.27
Overall	75		38.0	

Test

Null hypothesis H_0: All medians are equal
Alternative hypothesis H_1: At least one median is different

Method	DF	H-Value	P-Value
Not adjusted for ties	4	3.06	0.548
Adjusted for ties	4	3.23	0.520

The chi-square approximation may not be accurate when some sample sizes are less than 5.

Kruskal-Wallis Test: Score versus Education Level

Descriptive Statistics

Education Level	N	Median	Mean Rank	Z-Value
Associate degree	10	8.0	28.0	-1.56
Bachelor's degree	21	9.0	43.5	1.36
Doctoral degree	3	9.0	54.2	1.31
High school graduate, diploma o	21	8.0	33.7	-1.06
Master's degree	4	8.5	42.8	0.45
Some high school, no diploma	5	7.0	20.4	-1.87
Trade/technical/vocational trai	11	9.0	46.6	1.42
Overall	75		38.0	

Test

Null hypothesis H_0: All medians are equal
Alternative hypothesis H_1: At least one median is different

Method	DF	H-Value	P-Value
Not adjusted for ties	6	11.06	0.087
Adjusted for ties	6	11.67	0.070

The chi-square approximation may not be accurate when some sample sizes are less than 5.

Kruskal-Wallis Test: Score versus Time Of Day Quiz Was Taken

Descriptive Statistics

Time Of Day Quiz Was Taken	N	Median	Mean Rank	Z-Value
Afternoon (noon - 6pm)	29	8	32.4	-1.75
Did not answer	5	7	20.4	-1.87
Evening (6pm - 4am)	4	9	44.8	0.64
Morning (4am - noon)	37	9	44.0	2.35
Overall	75		38.0	

Test

Null hypothesis H_0: All medians are equal
Alternative hypothesis H_1: At least one median is different

Method	DF	H-Value	P-Value
Not adjusted for ties	3	8.33	0.040
Adjusted for ties	3	8.80	0.032

The chi-square approximation may not be accurate when some sample sizes are less than 5.

*(P values < 0.05 were considered to be statistically significant)

Figure 7: Kruskal-Wallis Analysis of Statistically and Clinically Significant Demographics Data for Oral and Written Educational Modalities

Oral educational modality proved to be statistically significant for categories of age and race. Age had median test scores ranging from 8.0 to 10.0, Z-values from -1.60 to 2.66, and mean rank from 22.9 to 45.5. All three were highest for age group 29 to 35. The lowest mean rank belonged to age group 18 to 21 with identical Z-values and mean ranks for age group 22 to 28. The second highest median, Z-value, and mean rank was for age group 36 to 42. Sample sizes less than 5 were excluded: older than 42. For race, median test scores ranged from 8.0 to 9.0, Z-values from -2.89 to 1.47, and mean rank from 22.8 to 40.4, all of which were highest for white participants. Sample sizes less than 5 were excluded: Asian, Middle Eastern, and other. Income and highest level of education categories were deemed not statistically significant with P-values greater than 0.05.

Written educational modality proved to be statistically significant for categories of income and time of the day the intervention was received. The lowest income level had the lowest median (7), mean rank (25.1), and Z-value (-2.56). The next lowest median (8), mean rank (34.4), and Z-value (-0.86) belonged to the income range of $60,000-$99,999. The remaining income levels had a median score of 9 with mean ranks and Z-values comparatively lowest for $30,000-$59,999, the middle for $10,000-$29,999, and highest for $100,000 or more. Time of day median test scores ranged from 8.0 to 9.0, Z-values ranged from -1.75 to 2.35, and mean rank from 32.4 to 44.0. These scores only compared morning vs. afternoon, and all were highest for the morning. Sample sizes less than 5 were excluded: evening.

Interactive

Kruskal-Wallis Test: Score versus Income

Descriptive Statistics

Income	N	Median	Mean Rank	Z-Value
$10,000 - $29,999	15	8.0	31.9	-1.21
$100,000 or more	21	9.0	50.5	3.10
$30,000 - $59,999	18	8.0	35.8	-0.50
$60,000 - $99,999	12	8.5	39.6	0.27
Less than $10,000	9	7.0	21.3	-2.45
Overall	75		38.0	

Test

Null hypothesis H_0: All medians are equal
Alternative hypothesis H_1: At least one median is different

Method	DF	H-Value	P-Value
Not adjusted for ties	4	13.60	0.009
Adjusted for ties	4	14.39	0.006

Kruskal-Wallis Test: Score versus Race

Descriptive Statistics

Race	N	Median	Mean Rank	Z-Value
Asian	9	7.0	29.1	-1.31
Black or African Ameican	20	7.5	27.4	-2.53
Middle Eastern / Arabic	2	9.0	49.5	0.76
Other	1	9.0	49.5	0.53
White	43	9.0	44.0	2.76
Overall	75		38.0	

Test

Null hypothesis H_0: All medians are equal
Alternative hypothesis H_1: At least one median is different

Method	DF	H-Value	P-Value
Not adjusted for ties	4	10.31	0.036
Adjusted for ties	4	10.91	0.028

The chi-square approximation may not be accurate when some sample sizes are less than 5.

Kruskal-Wallis Test: Score versus Education Level

Descriptive Statistics

Education Level	N	Median	Mean Rank	Z-Value
Associate degree	9	9.0	51.4	1.97
Bachelor's degree	17	9.0	44.2	1.34
High school graduate, diploma o	31	8.0	31.0	-2.35
Master's degree	6	9.5	59.0	2.46
No schooling completed	1	7.0	15.0	-1.06
Nursery school to 8th grade	2	6.0	5.0	-2.17
Some high school, no diploma	6	7.5	30.5	-0.88
Trade/technical/vocational trai	3	9.0	38.0	0.00
Overall	75		38.0	

Test

Null hypothesis H_0: All medians are equal
Alternative hypothesis H_1: At least one median is different

Method	DF	H-Value	P-Value
Not adjusted for ties	7	20.03	0.006
Adjusted for ties	7	21.20	0.003

The chi-square approximation may not be accurate when some sample sizes are less than 5.

Kruskal-Wallis Test: Score versus Time Of Day Quiz Was Taken

Descriptive Statistics

Time Of Day Quiz Was Taken	N	Median	Mean Rank	Z-Value
Afternoon (noon - 6pm)	9	9	48.2	1.49
Did not answer	15	9	34.9	-0.61
Evening (6pm - 4am)	3	4	11.0	-2.19
Morning (4am - noon)	48	8	38.7	0.39
Overall	75		38.0	

Test

Null hypothesis H_0: All medians are equal
Alternative hypothesis H_1: At least one median is different

Method	DF	H-Value	P-Value
Not adjusted for ties	3	6.91	0.075
Adjusted for ties	3	7.32	0.062

The chi-square approximation may not be accurate when some sample sizes are less than 5.

Video

Kruskal-Wallis Test: Score versus Income

Descriptive Statistics

Income	N	Median	Mean Rank	Z-Value
$10,000 - $29,999	13	8.0	29.7	-1.44
$100,000 or more	22	9.0	44.9	1.92
$30,000 - $59,999	12	7.5	30.3	-1.26
$60,000 - $99,999	16	9.0	44.4	1.45
Less than $10,000	11	9.0	29.7	-1.30
Overall	74		37.5	

Test

Null hypothesis H_0: All medians are equal
Alternative hypothesis H_1: At least one median is different

Method	DF	H-Value	P-Value
Not adjusted for ties	4	8.73	0.068
Adjusted for ties	4	9.24	0.055

Kruskal-Wallis Test: Score versus Race

Descriptive Statistics

Race	N	Median	Mean Rank	Z-Value
American Indian or Alaska Nativ	1	10	64.0	1.24
Asian	3	9	50.0	1.03
Black or African Ameican	15	8	31.8	-1.14
Hispanic/Latino	1	9	43.0	0.26
Other	2	5	4.5	-2.20
White	52	9	39.1	0.96
Overall	74		37.5	

Test

Null hypothesis H_0: All medians are equal
Alternative hypothesis H_1: At least one median is different

Method	DF	H-Value	P-Value
Not adjusted for ties	5	8.62	0.125
Adjusted for ties	5	9.13	0.104

The chi-square approximation may not be accurate when some sample sizes are less than 5.

Kruskal-Wallis Test: Score versus Education Level

Descriptive Statistics

Education Level	N	Median	Mean Rank	Z-Value
Associate degree	6	8	25.1	-1.48
Bachelor's degree	16	9	48.7	2.34
Doctoral degree	4	9	42.1	0.44
High school graduate, diploma o	27	8	34.2	-0.99
Master's degree	13	9	44.4	1.27
No schooling completed	1	7	14.0	-1.10
Some high school, no diploma	3	6	11.8	-2.11
Trade/technical/vocational trai	4	8	31.8	-0.55
Overall	74		37.5	

Test

Null hypothesis H_0: All medians are equal
Alternative hypothesis H_1: At least one median is different

Method	DF	H-Value	P-Value
Not adjusted for ties	7	14.20	0.048
Adjusted for ties	7	15.04	0.036

The chi-square approximation may not be accurate when some sample sizes are less than 5.

Kruskal-Wallis Test: Score versus Time Of Day Quiz Was Taken

Descriptive Statistics

Time Of Day Quiz Was Taken	N	Median	Mean Rank	Z-Value
Afternoon (noon - 6pm)	36	8.5	33.9	-1.41
Did not answer	5	8.0	32.2	-0.57
Morning (4am - noon)	33	9.0	42.3	1.71
Overall	74		37.5	

Test

Null hypothesis H_0: All medians are equal
Alternative hypothesis H_1: At least one median is different

Method	DF	H-Value	P-Value
Not adjusted for ties	2	2.94	0.230
Adjusted for ties	2	3.11	0.211

(P values < 0.05 were considered to be statistically significant)

Figure 8: Kruskal-Wallis Analysis of Statistically and Clinically Significant Demographics Data for Interactive and Video Educational Modalities

Interactive educational modality proved to be statistically significant for categories of income, race, and educational level. Income median test scores ranged from 7.0 to 9.0, Z-values from -2.45 to 3.10, and mean rank from 21.3 to 50.5, with lowest scores attributed to lowest income and each subsequent income bracket scoring higher than the last. Race median quiz scores ranged from 7.0 to 9.0, Z-values from -2.53 to 2.76 and mean rank from 27.4 to 49.5 with white participants scoring highest for all three. Of note, Asian participants had a lower median score than black participants, although black participants had lower Z-values and a lower mean rank. Sample sizes less than 5 were excluded: Middle Eastern and other. Education level median quiz scores ranged from 7.5 to 9.5, Z-values ranged from -2.35 to 2.46, and mean rank from 30.5 to 51.4. Sample sizes less than 5 were excluded: no schooling completed, nursery school to 8th grade, trade/technical/vocational training, and doctoral degree.

Video educational modality proved to be statistically significant for categories of education level only. Median test scores ranged from 8.0 to 9.0, Z-values from -1.48 to 2.34, and mean rank from 25.1 to 48.7. Median scores were lowest for associate degree and high school graduate/GED with Z-value and mean rank lowest for associate degree. Master's and bachelor's degrees had the highest median scores with bachelor's degrees having the highest Z-value and mean rank. Sample sizes less than 5 were excluded: no schooling completed, nursery school to 8th grade, some high school but no diploma, and trade/technical/vocational training.

Discussion

A notable amount of data was not statistically significant with P-values greater than 0.05. That being said, it is believed that clinical significance can still be derived from the results of this study. It is believed that the small sample size utilized for this study played a factor in the interpretation of Kruskal-Wallis tests. Participant background categories of previous postpartum education, type

of delivery, prenatal care, age, and employment status did not seem statistically or clinically significant. The main findings of this study pertain to socioeconomic status: those who are less fortunate in terms of household income and highest level of education show worse performance on assessments after receiving education.

Based upon these findings, subsequent studies should include: (1) A much larger sample size so that more covariates can be captured and the statistical power of data can be optimized. (2) Extra education to participants with demographic backgrounds scoring below the average quiz score and measuring this interventional outcome, perhaps by utilizing the teach back method (this would determine whether demographic obstacles can be overcome and adjusted for). (3) An assessment of mothers' ability to recognize postpartum complications and their severity, knowing when to seek medical help, and if this corresponds to increased response and prevention of more serious or advanced postpartum complications. It is believed that by effectively educating new mothers, rates of serious complications could be decreased via prompt recognition of early signs of severe complications. It would be beneficial to focus on prospective research to establish a correlation between postpartum education and its effectiveness on recognition and response by mothers to postpartum complications. (4) An assessment of whether previous postpartum education leads to improved quiz scores. Lastly, (5) utilization of multiple educational modalities simultaneously. This study assessed the effectiveness of each individual educational modality alone on information retention and did not utilize a combination of multiple educational modalities at once, for example video education plus interactive education; and did not involve any novel educational techniques. Such a study would be very insightful.

Limitations: Some noteworthy limitations of this study include a limited sample size, the study did not account for "some college education" in gathering demographic data on highest educational level, the intervention aspect of the study began during the beginning months of the COVID-19 pandemic in the United States which could have had unforeseen effects. Quiz directions did not explicitly state that each question had only one correct answer and some participants selected multiple answers per question or none at all (these answers were considered incorrect). Information was also self-reported and although the PI was available for clarification, participants could have mistakenly or purposefully misrepresented their demographic background. Educational materials used in this study, with permission of Summa Health, were centered around those originally developed by the Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN). While they were directly based off of those materials, this study's materials were not verified nor endorsed by AWHONN for their use as an educational tool. Also, while it was helpful for conducting the study to have the PI in the room to provide directions to participants, the fact that the participants were able to ask for clarifications during their educational process could have unjustly benefited those seeking clarifications in contrast to those who did not.

Conclusions

Educational modality alone did not significantly affect information retention with mean quiz scores across the four groups. This indicates that no educational modality by itself is superior to the others. Factors that were associated with better quiz scores were higher levels of education, higher levels of household income, being of white or Asian race, and receiving the intervention in the morning. The most significant disparity was seen with the highest level of education and household income. Each successive educational level correlated to a better quiz score than the educational level below it. On average, there was also a general upward trend in quiz scores related to higher annual household income. These results are to be expected as household income generally correlates to a higher level of education. A larger proportion of the black participants in this study represented lower household income and lower educational groups compared to their white peers. This could explain why their average scores were significantly lower. When adjusted for socioeconomic factors, black participants scored similarly to their white peers, but still slightly lower.

Morning participants scored highest compared to those in the afternoon and evening. This was consistent across all educational modalities except for interactive education, where participants scored best in the afternoon compared to morning. This was expected as it is understood that test scores tend to decrease throughout the day [16]. It is not completely understood why those receiving interactive education performed best in the afternoon.

This pilot study focused on the correlation between various educational formats and the retention of information. Overall, this study shed light on factors that healthcare providers should keep in mind while educating their patients. This study has shown that the choice of an educational modality alone, while having a mild effect, is not a significant determinant of information retention. Household income, highest level of education, and time of the day a patient was educated had the greatest impact on mean quiz scores and therefore information retention.

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