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FEATURED ARTICLES

THE ROLE OF THE TOBACCO CONTROL PROGRAM AND ITS COLLABORATORS IN THE EFFORTS TO TRANSFORM PUERTO RICO IN A SMOKE-FREE ISLAND

Alex Cabrera-Serrano, MS, Antonio Cases-Rosario, MPA and
Suzie Rivera-Pacheco, JD, LLM

Abstract

Over the last 20 years, it has been shown that the adoption of more restrictive public policies regarding tobacco use has had a major impact in preventing and controlling tobacco use and their derivatives. The objective of this study was to establish how the efforts made by the Puerto Rico Tobacco Control Program (PRTCP) and its collaborators contributed in the transformation of the island into a smoke-free jurisdiction. To evaluate the role of the PRTCP and its collaborators, data of the following sources were analyzed: Microjuris, Puerto Rico Behavioral Risk Factor Surveillance System (PRBRFSS), Puerto Rico Youth Substance Abuse Survey (PRYSAS), and the Puerto Rico Department of Revenue (PRDR). The results of this report demonstrate that reducing tobacco use is a public health concern that implies the development of multiple strategies in collaboration with multiple sectors of the population. This has been the key strategy of the PRTCP to meet its goals despite its budgetary constraints.

Keywords: tobacco, smoking, Tobacco Control Program, tobacco policies, smoke free countries

Resumen

En los últimos 20 años, se ha demostrado que la adopción de políticas más restrictivas sobre el uso de tabaco ha tenido un impacto importante en la prevención y control de este vicio y sus derivados. El objetivo de este estudio fue establecer cómo los esfuerzos realizados por el Programa de Control del Tabaco de Puerto Rico y sus colaboradores han contribuido a la transformación de la isla en una jurisdicción libre de humo. Para evaluar estos esfuerzos, datos de las siguientes fuentes fueron analizados: Microjuris, Puerto Rico Behavioral Risk Factor Surveillance System, Consulta Juvenil y el Departamento de Hacienda. Los resultados de este informe demuestran que la reducción del consumo de tabaco es un problema de salud pública que implica el desarrollo de múltiples estrategias, en colaboración con múltiples sectores de la población. Esta ha sido la estrategia clave del Programa de Control del Tabaco y sus colaboradores para cumplir con sus metas a pesar de sus limitaciones presupuestarias.

Palabras claves: tabaco, fumar, Programa de Control del Tabaco, leyes sobre tabaco, países libres de humo

INTRODUCTION

Cigarette smoking is the single cause of preventable disease and death in United States. It is also responsible for more than 400,000 deaths annually (1). Irrefutable scientific evidence in the past 50 years shows that tobacco use or exposure to tobacco smoke damages the human body with deadly consequences (2). Although for 2011 the tobacco use prevalence remains lower in Puerto Rico (14.8%) than in the United States (21.1%) (3), seven of the twelve leading causes of death in the Island are associated with smoking (heart disease, malignant tumors, Alzheimer, cerebrovascular disease, chronic pulmonary disease, nephritis, and hypertension) (4). In relation to the exposure to second hand smoke (SHS), it is worth mentioning that it is associated with a variety of chronic diseases including cancer, cardiovascular disease, asthma, and obstructive pulmonary disease (5). The SHS protection is among the six most important and effective tobacco control public policy outlined by the World Health Organization (WHO). It is joined by taxes and prices, health warnings, cessation programs, banning on advertising and sponsorships, as well as, careful surveillance of tobacco epidemic and prevention policies (6).



Over the past 20 years, the adoption of new strategies and more restrictive public policies to prevent and control tobacco use has had a major impact on people's health. Undoubtedly, public policies have an enormous influence on people's behavior and lifestyles. Scientific research has shown that public policies that prohibit smoking in hospitality venues such as restaurants and bars are associated with rapid reductions in self-reported respiratory and sensory symptoms among nonsmoking hospitality workers (7).

Currently, Puerto Rico is one of the jurisdictions with the most restrictive and comprehensive public policy in tobacco use, as well as, protection of SHS exposure in the entire United States (8). During the past twenty-one years, there have been many efforts to reduce tobacco consumption in Puerto Rico. Therefore, it is important to determine how the efforts made by the Puerto Rico Tobacco Control Program (PRTCP) and its collaborators contributed in the transformation of Puerto Rico into a smoke-free island, and with that purpose, the authors reviewed the laws and initiatives carried out before and

after the program foundation. This report describes the results of that analysis and what has been the impact on the tobacco use prevalence and the exposure to second hand smoke.

METHODS

To analyze the role of the PRTCP and its collaborators in the efforts to transform Puerto Rico in a smoke-free island, data from the following sources were analyzed: Microjuris 2011, Puerto Rico Behavioral Risk Factor Surveillance System (PRBRFSS) 2011, Puerto Rico Youth Substance Abuse Survey (PRYSAS) 1997 to 2007, and the Puerto Rico Department of Revenue (PRDR) 2011. Microjuris is an electronic legal research tool that offers a complete and updated range of digital content such as laws, regulations and case law that allows the user to consult the legal spectrum of his or her public policy strategic plan. The BRFSS is a telephone survey of non-institutionalized adults conducted annually in all 50 states, the District of Columbia, Guam, Puerto Rico, and the US Virgin Islands. In Puerto Rico, this survey began since 1996 and is part of the Puerto Rico Department of Health. The PRYSAS is a biennially survey conducted since 1990 by the Puerto Rico Substance Abuse and Mental Health Services Administration. This survey consists of a self-administered questionnaire aimed at a representative sample of elementary, middle, and high level students in Puerto Rico's public and private schools. Its purpose is to determine the percentage of students enrolled in 5th to 12th grade who engage in high-risk behaviors such as tobacco, alcohol and drug use, and premature sexual activity, among others. The PRDR is the public agency responsible for administering the public policy related to tax matters, financial and management of public funds. This agency is responsible for collecting the excise tax on cigarettes and grant cigarette's sale permits.

RESULTS

The first step to transform Puerto Rico into a smoke-free island began in the early 90's. Table 1 contains a description of the tobacco control regulations adopted in Puerto Rico before the foundation of the PRTCP. In 1991, the first public policy adopted was the Executive Order 1991-

082. In 1993, three Acts were passed: Act No. 40, Act No. 62, and Act No. 128. In 1996 and 1997, Act No. 133 and Act No. 111 were approved. Finally, in 1998, Act No. 204 was approved.

Table 1. Tobacco control actions performed in Puerto Rico before the implantation of PRTCP

| Action | Year | Description |
|--------------------------|-------------|---|
| Executive Order 1991-082 | 1991 | Banned smoking in public agencies and corporations, as well as, in public transportation owned by any government entity. |
| Act No. 40 | 1993 | Regulates the practice of smoking in public and private places. |
| Act No. 62 | 1993 | Regulates the advertising and promotion of tobacco products. |
| Act No. 128 | 1993 | Establishes the penalties to any person who sell, donate, or distribute tobacco products to people under 18 years of age. |
| Act No. 133 | 1996 | Protect children when they participate in activities aimed at them in certain establishments. |
| Act No. 111 | 1997 | Restrict the location of cigarettes vending machines to places where entry is restricted to persons under 18 years. |
| Act No. 204 | 1998 | Banned the employment of people under 18 years old to sale or promote alcohol beverages and tobacco products. |

Despite all the aforementioned efforts, Puerto Rico did not become a smoke-free island. For this reason, since the foundation of the PRTCP in 1999, the main goal of the program was to prevent the initiation of tobacco use, promote smoking cessation, and collaborate in the transformation of the Island into a smoke free country. Table 2 contains a description of the tobacco control actions performed in Puerto Rico after the implantation of PRTCP.

Table 2. Tobacco control actions performed in Puerto Rico after the implantation of PRTCP

| Action | Year | Description |
|--|-------------|--|
| Act No. 6 | 2000 | Banned the sale of candy cigarettes in or near schools. |
| Act No. 63 | 2002 | Increased the cigarette excise tax from ¢0.83 to \$1.23. |
| Tobacco Control Summit (TCS) | 2002 | Every year the TCS brings together experts in the tobacco control field to discuss tobacco prevention matters with health professionals and the community. |
| Coalition for a Tobacco Free Puerto Rico (CTFPR) | 2002 | The CTFPR was incorporated. The CTFPR is composed by more than 40 agencies or organizations interested in tobacco control. |
| Puerto Rico Quitline (PRQ) | 2004 | Since its implantation, the PRQ has served more than 7,000 smokers across the Island and the quit rate for 2010 was 26%. |
| Act No. 66 (which amended Act No. 40 of 1993) | 2006 | This ban is considered the strongest law in the country, which covers workplaces, restaurants, and casinos. Also, the Act banned smoking in cars with children under 13 years old. |
| Act No. 21 | 2008 | Required health insurance to cover cessation services including NRT. |
| Act No. 35 | 2008 | Creation of the Tobacco Control Special Fund. The fines collected by Act No. 40, as amended, feed this fund. |
| Diabetes Telephone Coaching (DTC) | 2008 | This service provides an alternative way of managing the condition for all diabetic smokers registered in the PRQ. |
| Act No. 7 | 2009 | Increased the cigarette excise tax from \$1.23 to \$2.23. |
| Annual PRQ media campaign | 2010 | This campaign promoted the PRQ services. Previously, the PRQ media campaign covered only three months in a year. |
| LGBTB tobacco use prevalence | 2010 | Considering the high prevalence of tobacco use in the LGBTB community in the United States, and the need to determine this prevalence in the Island, the PRTCP, in collaboration with the PRBRFSS, included questions about sexual identity in the 2011 survey. The same questions were included in the PRQ. |
| Act No. 59 | 2011 | Inclusion of the E-Cigarette in the smoking prohibition of Act No. 40, as amended. |



Through mobilizing different sectors of the population such as health professionals, academics, policymakers and the general community, the first achievement in tobacco control, with the collaboration of the PRTCP, was the approval of Act No. 6 in 2000. In 2002, the approval of Act No. 63 to increase the cigarette excise tax was another accomplishment. During this year, the PRTCP launched the first Tobacco Control Summit (TCS) and the Coalition for a Tobacco Free Puerto Rico (CTFPR) was incorporated. In 2004, the PRTCP implemented the Puerto Rico Quitline (PRQ). After multiple efforts made by the PRTCP and its collaborators in different areas of tobacco control such as prevention, education and smoking cessation, Act No. 66 (which amended Act No. 40 of 1993) was approved in 2006. With the implementation of this Act in 2007, Puerto Rico finally became a smoke-free island. Despite this achievement, the PRTCP and its collaborators have continued their mission to reduce tobacco use prevalence, achieving in 2008 the approval of Act No. 21 and Act No. 35. In addition, in 2008 the PRQ included, as part of their services, the Diabetes Telephone Coaching. In regard to legislation, Act No. 7, which was approved in 2009, increased the cigarette excise tax once again. In November 2010, combining funds of the PRTCP core proposal and the American Recovery and Reinvestment Act funds (ARRA), the program established a first annual media campaign to promote the PRQ services. Also, in 2010, considering the high prevalence of tobacco use in the LGBTT community in the United States, the PRTCP, in collaboration with the PRBRFSS, included questions about sexual identity in the 2011 survey. The same questions were included in the PRQ. Finally, in 2011, the last achievement of the PRTCP and its collaborators was the approval of the Act No. 59.

A review of different data sources showed that the efforts made by the PRTCP and its collaborators have contributed significantly in reducing tobacco use and the exposure to the SHS on the Island. The PRBRFSS data demonstrated that Puerto Rico has remained among the lowest prevalence of tobacco use among the 50 states and territories of the United States (14.8% vs. 21.1%). At the same time, according to the PRYSAS data (2005-2007), there has been a consistent decrease in the percent of

students who report using tobacco products in the past month from 1997 to 2007. The last month's tobacco use decreased in: 9th grade from 22.5% (1997) to 5.6% (2007); 10th grade from 25.4% (1997) to 8.3% (2007); 11th grade from 21.8% (1997) to 10.3% (2007); 12th grade from 24.4% (1997) to 11.7% (2007).

Researchers Marín and Díaz demonstrated the impact of the implementation of Act No. 66 in the reduction of the risk of SHS exposure and the reduction in cigarette packs' monthly sales. In the first research, Marín and Díaz evaluated the effect of the implementation of Act No. 66 in restaurants, pubs and discos in the metropolitan area of San Juan (9). The researchers took samples of particulate concentration level in the air before and after the implementation of the Act (scientific literature showed that smoking is one of the main sources of indoor levels of PM_{2.5}). The research results showed that, after the implementation of Act No. 66, restaurants experienced a reduction of 83.6% ($p = 0.013$) in average PM_{2.5} levels of 0.169 to 0.028 mg/m³ and in pubs and discos there was a reduction of 95.6% ($p = 0.004$) of 0.626 to 0.028 mg/m³. With these results, the researchers concluded that the implementation of Act No. 66 has been successful in reducing the risk of SHS exposure to the population who live and work in the metropolitan area of San Juan. In the second research, Marín and Díaz evaluated the association of the implementation of Act No. 66 and the monthly per capita sales of cigarettes packs in Puerto Rico (10). The evaluation period was from January 1989 until February 2010. The data sources used were the PRDR, the Puerto Rico Planning Board, and the Puerto Rico Department of Labor. After analyzing the data and controlling confounding variables (time trend, monthly seasonal effects, price of cigarettes, exports per capita, and the employment rate), the researchers concluded that the implementation of Act No. 66 was associated with a significant average reduction in the monthly sales of cigarette packs. The reduction was 16.1% [CI_{95%}: 6.9%, 24.5%] from March 2007 to February 2010. This represents a reduction of 5 packs of cigarettes capita per year, which implies a total annual reduction of 19 million cigarette packs using the year 2006 as reference.

DISCUSSION

Restricting smoking in workplaces and public places by regulations, as well as, tobacco advertising and youth access to tobacco products are part of a



comprehensive, evidence-based approach to promote tobacco control (11). Some of the changes in tobacco use shown in this report can be attributed to the multiple tobacco control policies implemented (12). It is worth noting that the legislation adopted in Puerto Rico takes into consideration international efforts to regulate tobacco use and promote prevention. Specifically, the smoking restrictions included in Act No. 66 comply with those promoted under the Framework Convention on Tobacco Control (FCTC) (FCTC's Article 8). The FCTC entered into force in February 2005 and is the world's first global public health treaty. It is also the first treaty negotiated under the auspices of the WHO. Currently, 174 member states have ratified it. United States has not ratified the treaty and, since it is not a party to the FCTC, Puerto Rico is not a member. Nevertheless, the health policy promoted by the PRTCP and its collaborators has not ignored the FCTC's provisions. In fact, the PRTCP has aimed much of its efforts to strengthen public awareness of tobacco control issues in accordance with FCTC's Article 12.

In May 2009, the Morbidity and Mortality Weekly Report (MMWR) reported the largest cigarette excise tax in history (13). The combined federal and average state tax for cigarettes was raised to \$2.21 per pack. Unfortunately, Puerto Rico is not included under the federal excise tax. Therefore, in 2009, Puerto Rico approved the Act No. 7 to increase the excise tax from \$1.23 to \$2.23 to keep pace with the rest of the country. Once again, the PRTCP and its collaborators have made a strategic move to continue to support tobacco prevention initiatives in Puerto Rico. Despite of this achievement, the PRBRFSS 2009 data showed that 90.9% of Puerto Ricans agreed to continue raising taxes on cigarettes.

Tobacco use among youth minors continues to be a problem worldwide. Estimates indicate that in the United States, every day, approximately 6,000 youth under 18 years old smoked for the first time and more than 3,000 became regular smokers (14,

15). Restrict youth access to tobacco products includes different strategies such as businesses' managers and owners education campaigns, signage, required ID checks, bans on self-service displays, the elimination of vending machines, and other strategies designed to make it more difficult for youth to obtain tobacco products (14). The analyzed data of the PRYSAS demonstrated that the combination of these strategies to control tobacco access to young people really works. Consistent decreases in the percent of students who reported using tobacco products in the past month in Puerto Rico have occurred for each group from 9th to 12th grade from 1997 to 2007.

The findings of this report are subject to at least three limitations. First, the PRBRFSS is a self-report survey that only includes non-institutionalized adults with home telephones. This may cause an underestimation of the tobacco use prevalence on the Island. Second, the PRYSAS data is updated up to 2007, which does not led us confirm if the tobacco use diminution trend in adolescents is still happening. Finally, the results of the Marín and Díaz research demonstrated the effectiveness of the implementation of Act No. 66 only in the San Juan metropolitan area. Additional research is needed to verify the effectiveness of the implementation of this Act Island wide.

CONCLUSIONS

Since the eighties, the decrease of the smoking prevalence in the United States has been associated to different tobacco control interventions such as price increases, comprehensive statewide smoke-free air law, and socio-cultural support of tobacco-free regulations (16). These achievements have been supported by comprehensive state tobacco control programs and the implementation of evidence-based interventions (16, 17). Comprehensive tobacco control programs are the most effective means to reduce tobacco use (12). However, comprehensive tobacco control programs require the coordinated efforts of both statewide and local coalitions to advocate for policies, combat the tobacco industry, and influence social norms (18).

Currently, on the Island, the PRTCP is the lead entity for the statewide management of tobacco use prevention and cessation. The findings of this research

demonstrated that the efforts made by the PRTCP and its collaborators have contributed to reducing the use of tobacco and the exposure to secondhand smoke. However, many people are not aware that the success of the program was predicated on a mere \$239,040 budget from the CDC to serve a population of almost four million residents. Although Puerto Rico received Master Settlement Agreement dollars, the PRTCP did not receive anything of these funds, and from the Tobacco Control Special Fund created in 2009, the PRTCP has not yet receive these funds. Nevertheless, with limited funding and a population greater than almost half of the States in the United States, the PRTCP contributed monumentally in the transformation of Puerto Rico into a smoke-free island. Finally, the results of this research demonstrated that reducing tobacco use is a public health concern that implies the development of multiple strategies in collaboration with multiple sectors of the population. This has been the key of the PRTCP to meet its goals despite its budgetary constraints.

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REFERENCES

1. Rumberger JS, Hollenbeak CS, Kline D. Potential Costs and Benefits of Smoking Cessation: An Overview of the Approach to State Specific Analysis. Penn State University, 2010. Available at: <http://www.lungusa.org/stop-smoking/tobacco-control-advocacy/reports-resources/cessation-economic-benefits/reports/SmokingCessationTheEconomicBenefits.pdf>
2. U.S. Department of Health and Human Services. How Tobacco Smoke Causes Disease: The Biology and Behavioral Basis for Smoking-Attributable Disease: A Report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, CDC, 2010. Available at: <http://www.surgeongeneral.gov/library/tobaccosmoke/report/executivesummary.pdf>
3. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System. Available at: <http://apps.nccd.cdc.gov/brfss/>
4. Instituto de Estadísticas de Puerto Rico. Nuevas estadísticas de mortalidad, 2000-08. 2010; 12. San Juan, Puerto Rico. Available at: www.estadisticas.gobierno.pr
5. Shavers VL, Fagan P, Jouridine LA, Clayton R, Coucent J, Baezconde L. Workplace and home smoking restriction and racial/ethnic variation in the prevalence and

- intensity of current cigarette smoking among women by poverty status, TUS-CPS 1998-1999 and 2001-2002. *Journal of Epidemiology & Community Health*. 2006; 60 Suppl 2:34-43.
6. Beauchamp A, Stevenson C. The Importance of Extinguishing Secondhand Smoke Circulation. *Journal of the American Heart Association*. 2009; 120:1339-1341.
 7. Bauer U, Juster H, Hyland A, Farrelly M, Emgelen M, Weitzenkamo D, et al. Reduced Secondhand Smoke Exposure After Implementation of a Comprehensive Statewide Smoking Ban—New York, June 26, 2003—June 30,2004. *Morbidity and Mortality Weekly Report*. 2007; 56 (28):705-708.
 8. Americans for Nonsmoker’s Rights. Smokefree Air: U.S. Commonwealths and Territories. 2009; 28:1. Available at: http://anr.no-smoke.org/site/DocServer/Winter_UPDATE.pdf?docID=161
 9. Marín HA, Díaz-Toro E. The Effect of the Smoke-Free Workplace Policy in the Exposure to Secondhand Smoke in Restaurants, Pubs, and Discos in San Juan, Puerto Rico. *PRHSJ* 2010; 29:279-285.
 10. Marín HA, Díaz T. Effect of the smoking free work places ban law on the cigarette sales in Puerto Rico: a time-series analysis. University of Puerto Rico, Medical Science Campus. Forthcoming 2012.
 11. Griffin M, Babb SD, Tynan M, MacNeil AE. State Preemption of Local Control Policies Restricting Smoking, Advertising, and Youth Access – United States, 2000 – 2010. *MMWR* 2011; 60:1124-1127.
 12. Gunasekara PW, Rahman K, Sinba DN, Warren CW, Lee J, Lea V, Asma S. Tobacco Use among Students Age 13-15 Years – Sri Lanka, 1999 – 2007. *Morbidity and Mortality Weekly Report* 2008; 57:545-552.
 13. Janison N, Tynan M, MacNeil A, Merritt R, Federal and State Cigarette Excise Taxes---United States, 1995—2009. *Morbidity and Mortality Weekly Report* 2009; 58:524-527.
 14. Hobart R, Shopland DR, Shields D, Hallett C, Burms DM. The Role of Public Policy Change in Tobacco Control. *Current State of the Science. Smoking and Tobacco Control Monograph No. 11, Section I*. Available at: http://cancercontrol.cancer.gov/tcrb/monographs/11/section1_mono_11.pdf
 15. Crump C, Packer L. Incidence of Initiation of Cigarette Smoking—United States, 1965-1996. *Morbidity and Mortality Weekly Report* 1998; 47:837-840.
 16. Jay SJ, Torabi MR, Spitznagle MH. A decade of sustaining best practices for tobacco control: Indiana’s story. *Preventing Chronic Disease*. 2012; 9:E37.
 17. U.S. Department of Health and Human Services, Centers For Disease Control and Prevention. Best practices for comprehensive tobacco control program – 2007. Available at: http://www.cdc.gov/tobacco/stateandcommunity/best_practices/index.htm
 18. Centers for Disease Control and Prevention. Best Practices User Guide: Coalitions—State and Community Interventions. Available at: http://www.cdc.gov/tobacco/stateandcommunity/bp_user_guide/pdfs/user_guide.pdf

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MAIN ACHIEVEMENTS FROM THE CIVIL RIGHTS STRUGGLE AND THE REELECTION OF PRESIDENT BARACK OBAMA

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Abstract

This paper presents remarkable events that occurred in the decade of the 1940s and the 1950s related to the struggle for equality between blacks and whites in the United States of America (USA). Rosa Parks, who with her husband worked for this cause, became famous in 1955 when she was arrested for refusing to give up her seat to a white person on a bus in Montgomery, Alabama. Dr. Martin Luther King, Jr. and other partners took advantage of this fact to begin in this city a famous boycott that lasted a little over a year. From then on, there were many achievements for black people. People like Dr. Martin Luther King, Jr. and Rosa Parks, who fought for many years in favor of civil rights in the USA, perhaps never imagined that an African American could be president of this country. To this date, Barack Obama has been elected twice as President of the USA.

Keywords: Montgomery Bus Boycott, Civil Rights Movement, reelection of the President of the USA

Resumen

En este artículo se presentan eventos notables que ocurrieron en la década de los años cuarenta y de los años cincuenta del siglo pasado relacionados a la lucha por la igualdad entre negros y blancos en los Estados Unidos de América. Rosa Parks, quien luchó junto a su esposo por esta causa, se volvió famosa cuando en 1955 fue arrestada por negarse a dar su asiento a una persona blanca en un autobús de Montgomery, Alabama. El Dr. Martin Luther King, Jr. y otros colaboradores tomaron ventaja de este hecho para comenzar en esta ciudad el famoso boicot que duró un poco más de un año. De aquí en adelante, hubo muchos logros para la gente negra. El Dr. Martin Luther King, Jr. y Rosa Parks, quienes lucharon por muchos años en favor de los derechos civiles en los Estados Unidos de América, quizás nunca se imaginaron que un afroamericano pudiera llegar a ser presidente de este país. Para esta fecha, Barack Obama ha sido electo dos veces como Presidente de los Estados Unidos de América.

Palabras claves: Boicot del Autobús de Montgomery, Movimiento de los Derechos Civiles, reelección del Presidente de los Estados Unidos de América

INTRODUCTION

Although the Montgomery Bus Boycott in Alabama officially started on December 1, 1955, several facts had occurred before that could have caused this important event for black people. In 1945, Rosa Parks paid her bus fare and then watched the bus drive off as she tried to re-enter through the rear door, as the driver had told her to do. Later, in 1955, Rosa Parks refused to give up her seat to a white man even though the bus driver ordered her to do that. As a result of the behavior of Parks at the time, the Montgomery Improvement Association was created and Dr. Martin Luther King, Jr. was the president. In that historic day, blacks of Montgomery, Alabama, decided that they would boycott the city buses until they could sit anywhere they wanted, instead of being relegated to the back when a white boarded (Cozzens 55). Decisions made by the leaders and participants of the Montgomery Improvement Association, led to the start and end of the Montgomery Bus Boycott, which achieved a very important legal change issued by the Supreme Court in November 1956.

According to Rosa Parks' biography, the Montgomery city code operated in relation to the treatment of blacks and whites when they used the Alabama buses as a means of public transportation, the code required that all public transportation was segregated and that bus drivers had the powers of a police officer to carry out the provisions of the code. Also, the Rosa Parks' biography said, that "while operating a bus, drivers were required to provide separate but equal accommodations for white and black passengers by assigning seats" (2). This was accomplished with a line roughly in the middle of the bus separating white passengers in the front of the bus and African-American passengers in the back. When an African-American passenger boarded the bus, they had to get on at the front to pay their fare and then get off and re-board the bus at the back door. When the seats in the front of the bus filled up and more white passengers got on, the bus driver would move back the sign separating black and white passengers and, if necessary, asked black passengers to give up their seat (Rosa 3). The era of slavery that existed for hundreds of years, and by which blacks had to tolerate more discriminatory laws in Alabama, caused black people seeking their civil rights equality with whites to rebel. For this reason, Montgomery's black residents had prepared the ground for the bus

boycott long in advance; many had boycotted the buses on their own, or threatened to do so (“Montgomery”).

Development of major incidents that led to the start of the Montgomery Bus Boycott

As Steward Burns pointed, in 1949, the newly formed Women’s Political Council (WPC) of Montgomery, an activist group of black professional women, began organizing the black community and lobbying white officials to modify Jim Crow restrictions in public transportation, with little success (35). Also, Burns said, in May 1954, WPC president Jo Ann Robinson, an English professor at



Alabama State College, warned the mayor in a letter that a bus boycott might be imminent (35). A year later (1955), Claudette Colvin, a 15-year-old high school junior, refused to give up her bus seat to a white person. She was arrested for violating the segregated seating ordinances and mistreated by police (Burns 35). “This angered the black community and sparked a brief, informal boycott of buses by many black residents. In August of the same year, Montgomery’s black community was shaken by the brutal lynching of Emmett Till in Mississippi.” (Burns 35). Two months later, 18-year-old Mary Louise Smith, a house maid, was arrested for refusing to give up her seat.

African Americans in Montgomery felt beleaguered and the protest events continued. In the Montgomery’s Boycott, the person most mentioned has been Rosa L. Parks, who was tailor’s assistant at Montgomery’s largest department store. She and her husband Raymond had been civil rights activists for years. Rosa Parks served as secretary of the local National Association for the Advancement of Colored People (NAACP) branch and as advisor to the NAACP youth council (Cozzens 55). When the bus driver, whom Parks had defied years before, ordered her to give up her seat for a white man, she said no. “Like Colvin and Smith, she was sitting in the unreserved midsection, and no vacant seat was free, so she would have had to stand while carrying her Christmas packages” (Dwyer 664). Parks was arrested and then bailed out that night by friends, who persuaded Parks to allow her arrest to be used as a test case for the constitutionality of bus segregation (“Montgomery”). At this event, Dr. Martin Luther King, Jr., leader

and president of Montgomery Improvement Association, led the actions to the Montgomery Bus Boycott. At the age of thirty-five, Martin Luther King, Jr. was the youngest man to have received the Nobel Peace Prize. He announced that he would turn over the prize money of \$54,123, from the Nobel Foundation, to the furtherance of the civil rights movement (“Martin”). On the evening of April 4, 1968, he was assassinated in Memphis, Tennessee, where he was to lead a protest march in sympathy with striking garbage workers of that city (“Martin”).

The Long Walk Home film, which was presented by New Visions Pictures and starred by Whoopi Goldberg, Sissy Spacek, and Dwight Schultz, dramatized the bus boycott events of 1945-1956 in Montgomery, Alabama. According to the drama of this film, Whoopi Goldberg as Odessa Cotter, worked as a black maid for a white family. In this white family, the Thompsons, Miriam Thompson always supported Odessa but her husband did not (“Long”). Given the situation at that time about the use of Montgomery buses for black people, Odessa felt it was her duty to walk to work although arrived late and exhausted to work. In this sad story, Odessa was nanny of Miriam’s young daughter, Mary Catherine, who played a very important role. Odessa was married and had three children. They had to face many problems of their race such as discrimination and violence among others (“Long”).



The first scene of *The Long Walk Home* movie that showed racism problems was a policeman that forced Odessa to leave the park. He later apologized to Odessa. The next racist scene was when a young person, along with others traveling on a bus, told Odessa’s daughter that she should have been sitting in the back. Subsequently, outside the bus, these young people beat her and her brother. When a boycott of the city buses prevented Odessa from riding the bus to work, Miriam Thompson offered to give her a ride two days a week in order to ensure she arrived to work on time and alleviate the effect the long walk home was having on her. However, as the boycott advanced, tensions rose and giving Odessa a ride to work became an issue with the white prominent members of her community, as well as, with her husband (“Long”). Miriam was faced with the choice between doing what she believed was right or succumbing to pressure from her husband

and friends. After a fight with her husband, Miriam decided to follow her heart and became involved in a carpool group for other workers like Odessa. At the end, Miriam and her daughter join Odessa and the other protesters were standing against oppression. Consequently, Miriam Thompson received insults, beatings and rejection of her family and the white community (“Long”).

Today, laws in the United States of America (USA) provide equality and non-discrimination by race. The struggle for civil rights in the USA has never stopped and the black people still struggling to excel in social, political, educational, and economic fields. In addition, each day blacks continue to gain ground as employees and as entrepreneurs. The public and private companies hire them on an equal basis with others, and to close with a flourish, the American people elected Barack Obama as president. Barack Hussein Obama, Jr. was born on August 4, 1961, in Honolulu, Hawaii. He is the 44th and current President of the USA. Obama was born to a white American mother and a black Kenyan father (“Biography”). His mother is Stanley Ann Dunham; she died in 1995. His father, who died in a car accident in Nairobi, is Barack Obama, Sr. At school, Obama excelled in basketball and graduated with academic honors in 1979. “As one of only three black students at the school, Obama became conscious of racism and what it meant to be African-American.” (“Barack”). In 1983, Obama obtained a degree in political science from Columbia University and, in 1988, he entered at Harvard Law School. In February 1990, Obama was elected the first African-American editor of the *Harvard Law Review*, and he graduated from Harvard, magna cum laude, in 1991. On October 3, 1992, he and Michelle Robinson were married and welcomed two daughters: Malia and Sasha. Obama worked as civil rights lawyer, as teacher, and helped organize voter registration drives during Bill Clinton’s presidential campaign (“Biography”).

The political career of Barack Obama began just after publishing the book *Dreams from My Father: A Story of Race and Inheritance*, in 1995, for which he received two awards. In 1996, Obama won a seat in the Illinois State Senate. “During these years, Obama worked with Democrats and Republicans to draft legislation on ethics, and expand health care services and early childhood education programs for the poor. He also created a state earned-income tax credit for the working poor.” (“Barack”). Obama opposed the war in Iraq, but despite his protests, the war began in 2003. In November

2004 general election, with the 70 percent of the vote, Obama became only the third African-American elected to the U. S. Senate since the Reconstruction. In total, he served three terms representing the 13th District in the Illinois Senate from 1997 to 2004, running unsuccessfully for the United State House of Representatives in 2000 (“Biography”).

The second book of Barack Obama, published in October 2006, was *The Audacity of Hope: Thoughts on Reclaiming the American Dream*. It hit No. 1 on both the New York Times and Amazon.com best-seller lists. Barack Obama won the election with 52.9 percent to 45.7 percent from John McCain as President of the USA on November 4, 2008 (“Biography”). During his inauguration speech he said “Today I say to you that the challenges we face are real. They are serious and they are many. They will not be met easily or in a short span of time. But know this, America: They will be met.” (“Barack”). During his first year in office, Obama made several efforts to improve relations with other countries, ending the war in Iraq, and other peace activities. For all these efforts, he received the 2009 Nobel Peace Prize by the Nobel Committee in Norway. There have been many successes and social challenges, economic and financial, that President Obama has faced, including the death of Al-Qaeda leader Osama Bin Laden in 2011 (“Biography”). President Barack Obama won re-election in 2012. The Latino vote was one of the main factors that helped him because, just before the election, he issued an executive order that allows those who entered the country illegally as children to remain, study, and work without fear of deportation for at least two years (“Biography”).

All protest activities of black people in almost a decade (1945-1955), including the people who refused to give up her seat to a white person on the Montgomery buses, were caused by the laws and customs of discrimination against black people in the USA. Segregation on buses, in public schools and elsewhere, were very significant events for which blacks had to pass and for which they rebelled in 1955 at the Montgomery Bus Boycott. Its success led to a November 1956 Supreme Court decision overturning segregated transportation that was legalized by the 1896 *Plessy v. Ferguson* ruling, an area left untouched by the 1954 *Brown v. Board of Education of Topeka, Kansas* decision to desegregate public schools (Cozzens 55). Blacks returned to the buses on December 21, 1956, over a year after the boycott began. But their troubles were not over. Several blacks were victims of criminal attacks as bombs and gunfire on the buses

(“Montgomery”). To date, Rosa Parks and Dr. Martin Luther King, Jr. have been the most outstanding people for their courage, their willingness, their vision, and their desire for social equality in the United States of America. They, supported by other civil rights activists, achieved their dream. Finally, the Montgomery Bus Boycott, which lasted over a year, helped to launch ten years of national struggle for freedom and justice, the Civil Rights Movement, which changed the life of blacks in the USA. No doubt that a united community can make big changes in a society; the Montgomery Bus Boycott was a decent example that was successful regardless of the skin color of those who performed it. As a result, the USA is now chaired by Mr. Barack Obama.

REFERENCES

- “Barack Hussein Obama, Jr. – Biography.” *Bio. TRUE STORY*. n.d. Web. 23 November 2012.
- “Biography for Barack Obama.” *IMDb.com, Inc.* 2008. Web. 18 November 2012.
- Burns, Stewart, ed. *Daybreak of Freedom: The Montgomery Bus Boycott*. Chapel Hill: University of North Carolina Press, 1997.
- Cozzens, Lisa. “The Civil Rights Movement 1955-1965.” *African American History*. <http://fledge.watson.org/~lisa/blackhistory/civilrights-55-65> (25 May 1998).
- Dwyer, Owen J. “Interpreting the Civil Rights Movement: Place, Memory, and Conflict.” *Indiana University–Purdue University at Indianapolis*. 52.4 (2000): 664-666. 21 November 2012.
<https://resources.oncourse.iu.edu/access/content/user/odwyer/dwyer_2000_PG.pdf>.
- “Martin Luther King, Jr. – Biography.” *Nobelprize.org*. n.d. Web. 20 November 2012.
- “Rosa Parks – Biography.” *Bio. TRUE STORY*. 2012. Web. 16 November 2012.
- “The Montgomery Bus Boycott and the Woman Who Started It: The Memoir of Jo Ann Robinson.” *National Humanities Center Resource Toolbox*, ed. David J. Garrow (1987). Web. 19 November 2012.
- The Long Walk Home*. Dir. Richard Pearce. Perf. Whoopi Goldberg, Sissy Spacek and Dwight Schultz. Platinum. 2003. DVD.

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EL PODER ESTADÍSTICO. DIFERENCIAS OBSERVADAS CUANDO SE CAMBIA EL ALFA ESTABLECIDO EN UN ESTUDIO DE INVESTIGACIÓN

Mylord Reyes Tosta, EdD

Resumen

Se utilizaron dos ejemplos para una prueba de hipótesis pareada, en donde se calculó el poder estadístico utilizando un alfa de 5% y un alfa de 1% con los mismos datos. En el primer ejemplo, utilizando un alfa de 5% con una muestra de 48 sujetos y con una diferencia entre las medias de 40.69, se obtuvo un valor $p = 0.000$ y un poder estadístico de 1.000 en una prueba de hipótesis pareada. En el mismo ejemplo, utilizando los mismos datos, se calculó el poder estadístico utilizando un alfa de 1% y el resultado fue el mismo. Es decir, se obtuvo un poder estadístico de 1.000 en la prueba de hipótesis pareada. En el segundo ejemplo, utilizando un alfa de 5% con una muestra de 30 sujetos y con una diferencia entre las medias de 2.33, se obtuvo un valor $p = 0.012$ y un poder estadístico de .738 en una prueba de hipótesis pareada. En el mismo ejemplo, utilizando los mismos datos, se calculó el poder estadístico utilizando un alfa de 1% y el resultado fue de .483 en la prueba de hipótesis. Es decir, se obtuvo un poder estadístico menor en la prueba de hipótesis pareada. El análisis y las conclusiones de estos resultados se presentan en este artículo.

Palabras claves: poder estadístico, prueba de hipótesis, tamaño del efecto, alfa, beta

Abstract

Two examples were used for paired hypothesis test, where the statistical power was calculated using an alpha of 5% and an alpha of 1% with the same data. In the first example, using an alpha of 5% with a sample of 48 subjects and with a difference between the means of 40.69, yielded a p -value = 0.000 and a power of 1.000 in the paired hypothesis test. In the same example, using the same data, the statistical power was calculated using an alpha of 1% and the result was the same. That is, it was obtained a power of 1.000 in the paired hypothesis test. In the second example, using an alpha of 5% with a sample of 30 subjects and with a difference between the means of 2.33, it was obtained a p -value = 0.012 and a power of .738 in the paired hypothesis test. In the same example, using the same data, the statistical power was calculated using an alpha of 1% and the result was of .483 in the hypothesis test. That is, it was obtained a lower statistical power in the paired hypothesis test. The analysis and conclusions from these results are presented in this paper.

Keywords: statistical power, hypothesis test, size of effect, alpha, beta

INTRODUCCIÓN

El poder de una prueba estadística es la probabilidad de que la prueba va a rechazar la hipótesis nula cuando la hipótesis nula es falsa. Es decir, la probabilidad de no cometer un error de tipo II o tomar una decisión de falsos negativos (Cohen, 1988). Es decir, representa la capacidad de una prueba para detectar como estadísticamente significativas diferencias o asociaciones de una magnitud determinada (Díaz & Fernández, 2003). Cuando el poder aumenta, las posibilidades de un error de tipo II disminuyen. La probabilidad de que ocurra un error de tipo II se refiere a la tasa de falsos negativos (β). Por lo tanto, la potencia es igual a $1 - \beta$, donde β (beta) es el error tipo II que también se conoce como la sensibilidad.

Un análisis de poder se puede utilizar para calcular el tamaño mínimo de muestra requerida. También, puede utilizarse para calcular el efecto mínimo de un tamaño de muestra dado. Además, el concepto de poder se utiliza para hacer comparaciones entre diferentes procedimientos de análisis estadísticos. Por ejemplo, entre una prueba paramétrica y una prueba no paramétrica con las mismas hipótesis (Cohen, 1988).

Factores que influyen en el poder estadístico de cualquier estudio

Los factores que influyen en el poder estadístico de un estudio van a depender de cada situación que es particular de un estudio dado. Los cuatro factores siguientes siempre influyen en el poder estadístico de una prueba.



1. El tamaño de la muestra usado para detectar el efecto. Este determina la cantidad de error de muestreo inherente al resultado de la prueba. Es difícil detectar un efecto en muestras pequeñas. Aumentando el tamaño de la muestra, se puede obtener un poder más alto.
2. La magnitud del efecto de interés en la población. Esta puede ser cuantificada en términos del tamaño del efecto. Donde hay un poder mayor, hay un efecto mayor.
3. El nivel de significancia estadística utilizado en la prueba. Un nivel de significancia estadística es una declaración de lo improbable que puede ser un resultado, si la hipótesis nula es verdadera, para ser considerada significativa.

En otras palabras, cuánto se está dispuesto para tomar el riesgo de asumir una conclusión equivocada. Los criterios más utilizados son las probabilidades de 0.05 (5%, 1 en 20), 0.01 (1%, 1 en 100) y 0.001 (0.1%, 1 en 1000). Si el criterio es 0.05, la probabilidad de obtener el efecto observado cuando la hipótesis nula es verdadera, debe ser inferior a 0.05 y así sucesivamente. Si se utiliza un nivel de significancia de 5%, conocido como alfa o la probabilidad de cometer el error de tipo I, significa que se tiene un nivel de confiabilidad de 95%. Una manera fácil de aumentar la potencia de una prueba, es realizar una prueba menos conservadora al utilizar un nivel de significancia mayor. Esto aumenta la probabilidad de rechazar la hipótesis nula. Es decir, la obtención de un resultado estadísticamente significativo cuando la hipótesis nula es falsa. De esta forma, se reduce el riesgo de cometer un error tipo II. Pero también aumenta el riesgo de obtener un resultado estadísticamente significativo rechazando la hipótesis nula cuando la hipótesis nula es verdadera. En este caso, se aumenta el riesgo de cometer un error de tipo I (Cohen, 1988).

4. La variabilidad de la respuesta o desviación estándar del estudio. Así, cuanto mayor sea la variabilidad en la respuesta, más difícil será detectar diferencias entre los grupos que se comparan y menor será el poder estadístico del estudio. Se recomienda estudiar grupos que sean equivalentes.

Interpretación de los resultados

El análisis adecuado del poder estadístico de una investigación, que es en definitiva la capacidad que tiene el estudio para encontrar diferencias si es que realmente las hay, es un paso fundamental tanto en la fase de diseño como en la interpretación y discusión de sus resultados. A la hora del diseño, por lo tanto, debe establecerse la magnitud mínima de la diferencia o asociación que se considere de relevancia, así como el poder estadístico que se desea para el estudio y, de acuerdo con ello, calcular el tamaño de la muestra necesario (Gordon, Finch, Nothnagel & Ott, 2002). Tanto si los hallazgos son estadísticamente significativos como si no lo son, la estimación de intervalos de confianza pueden también facilitar la interpretación de los resultados en términos de magnitud y relevancia,

proporcionándonos una idea de la precisión con la que se ha efectuado la estimación, de la magnitud y de la dirección del efecto. De este modo, los intervalos de confianza nos permiten tener una idea acerca del poder estadístico de un estudio y, por tanto, de la credibilidad de la ausencia de hallazgos significativos (Díaz & Fernández, 2003). Se pueden considerar los siguientes puntos para interpretar los resultados del poder estadístico:

- a) De acuerdo a Myoung (2003), el estándar adecuado de poder por la mayoría de los investigadores es 0.80
- b) 0.20 = error tipo II
- c) Un poder estadístico ≥ 0.80 indica las probabilidades de decir que hay una relación, diferencia o ganancia. Son las probabilidades que confirman nuestra teoría correctamente.
- d) Un poder estadístico de 0.80 indica que 80 de cada 100 veces, cuando hay un efecto, vamos a decir que lo hay (Myoung, 2003).
- e) Si el poder estadístico es mayor de 0.80, el poder es más dominante.

La Tabla 1 muestra una ilustración de las conclusiones correctas o incorrectas a las que se puede llegar, dependiendo del rechazo o aceptación de la hipótesis nula. En donde α = probabilidad de cometer un error de tipo I y β = probabilidad de cometer un error de tipo II.

Tabla 1. Prueba estadística de contraste de hipótesis

| Posibles conclusiones | | |
|---|---|--|
| Escenarios | Resultado de la prueba | |
| | Existe asociación o diferencia H0 falsa | Asociación o diferencia significativa. Se rechaza la hipótesis nula |
| No error (1- β) Poder estadístico | | Error de tipo II β Beta |
| No existe asociación o diferencia H0 verdadera | Error de tipo I α Nivel de significancia | No error (1- α) Nivel de confiabilidad |

Con el objetivo de analizar el comportamiento del poder estadístico cuando cambia el alfa establecido en un estudio, se presentan dos ejemplos. En el primer ejemplo, se cuenta con los resultados de una preprueba y una posprueba realizadas a un grupo de 48 sujetos. Se asume que son las notas obtenidas por ellos en una escala del 1 al 100. La Tabla 2 muestra una media para la preprueba de 37.19 con una desviación estándar de 17.43. Mientras que la posprueba, tiene una media de 77.88 con una desviación estándar de 12.26 para una diferencia entre las medias de 40.69 en este primer ejemplo. Claramente se puede notar que los resultados de la posprueba superan a los resultados de la preprueba. Para la prueba de hipótesis pareada se utilizó un alfa de 5% y se obtuvo un $p = .000$ que se muestra en la Tabla 3. Con el valor obtenido ($p = .000$) se puede concluir que sí existe una diferencia estadísticamente significativa entre los resultados de la preprueba y la posprueba. Por lo tanto, se rechazó la hipótesis nula. Con este resultado, se procedió a calcular el poder estadístico de esta prueba que se muestra en la Tabla 4. Se obtuvo un poder estadístico de 1.000, lo cual significa una potencia estadística máxima. Es decir, que se puede afirmar con un 100% de seguridad que verdaderamente existe una diferencia estadísticamente significativa entre las medias. Para todos los cálculos estadísticos se utilizó el programa SPSS versión 20.

Se utilizaron los datos del primer ejemplo para calcular el poder estadístico utilizando un alfa de 1%. Como se puede observar en las Tablas 5 y 6, tanto el valor de p en la prueba de hipótesis pareada, como el valor del poder estadístico, son exactamente los mismos que cuando se utilizó un alfa de 5%.

Tabla 2. Media y desviación estándar de la preprueba y la posprueba

| Paired Samples Statistics | | | | | |
|----------------------------------|----------|-------|----|----------------|-----------------|
| | | Mean | N | Std. Deviation | Std. Error Mean |
| Pair 1 | Pretest | 37.19 | 48 | 17.432 | 2.516 |
| | Posttest | 77.88 | 48 | 12.261 | 1.770 |

Tabla 3. Prueba de hipótesis pareada con un alfa de 5%

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|--------|--------------------|--------------------|----------------|-----------------|---|---------|---------|----|-----------------|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | Pretest - Posttest | -40.688 | 20.133 | 2.906 | -46.533 | -34.842 | -14.002 | 47 | .000 |

Tabla 4. Poder estadístico de la prueba de hipótesis pareada con un alfa de 5%

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

| Source | factor1 | Type III Sum of Squares | df | Mean Square | F | Sig. | Noncent. Parameter | Observed Power ^a |
|-----------------|---------|-------------------------|----|-------------|---------|------|--------------------|-----------------------------|
| factor1 | Linear | 39731.344 | 1 | 39731.344 | 196.046 | .000 | 196.046 | 1.000 |
| Error (factor1) | Linear | 9525.156 | 47 | 202.663 | | | | |

a. Computed using alpha = .05

Tabla 5. Prueba de hipótesis pareada con un alfa de 1%

Paired Samples Test

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|--------|--------------------|--------------------|----------------|-----------------|---|---------|---------|----|-----------------|
| | | Mean | Std. Deviation | Std. Error Mean | 99% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | Pretest - Posttest | -40.688 | 20.133 | 2.906 | -48.489 | -32.886 | -14.002 | 47 | .000 |

Tabla 6. Poder estadístico de la prueba de hipótesis pareada con un alfa de 1%**Tests of Within-Subjects Contrasts**

Measure: MEASURE_1

| Source | factor1 | Type III Sum of Squares | df | Mean Square | F | Sig. | Noncent. Parameter | Observed Power ^a |
|-----------------|---------|-------------------------|----|-------------|---------|------|--------------------|-----------------------------|
| factor1 | Linear | 39731.344 | 1 | 39731.344 | 196.046 | .000 | 196.046 | 1.000 |
| Error (factor1) | Linear | 9525.156 | 47 | 202.663 | | | | |

a. Computed using alpha = .01

En el segundo ejemplo, se cuenta con los resultados de una preprueba y una posprueba realizadas a un grupo de 30 sujetos. Se asume que son las notas obtenidas por ellos en una escala del 1 al 100. La Tabla 7 muestra una media para la preprueba de 62.20 con una desviación estándar de 19.04. Mientras que la posprueba tiene una media de 64.53 con una desviación estándar de 16.88 para una diferencia entre las medias de 2.33, en este segundo ejemplo. Claramente se puede notar que los resultados de la posprueba superan a los resultados de la preprueba. Para la prueba de hipótesis pareada se utilizó un alfa de 5% y se obtuvo un $p = .012$ que se muestra en la Tabla 8. Con el valor obtenido ($p = .012$) se puede concluir que sí existe una diferencia estadísticamente significativa entre los resultados de la preprueba y la posprueba. Por lo tanto, se rechazó la hipótesis nula. Con este resultado, se procedió a calcular el poder estadístico de esta prueba que se muestra en la Tabla 9. Se obtuvo un poder estadístico de .738, lo cual significa una potencia estadística débil. Es decir, que solamente se puede afirmar con un 74% de seguridad que verdaderamente existe una diferencia estadísticamente significativa entre las medias.

Se utilizaron estos mismos datos del segundo ejemplo para calcular el poder estadístico utilizando un alfa de 1%. Como se puede observar en la Tabla 10, el resultado en la prueba de hipótesis pareada con un alfa de 1% fue de $p = .012$. Este es igual al obtenido con un alfa del 5%. Mientras que el poder estadístico utilizando un alfa de 1%, como se muestra en la Tabla 11, fue de .483. Este valor es totalmente diferente al obtenido con un alfa de 5% (.738). Este resultado en el poder estadístico indica que

solamente se puede afirmar con un 48% de seguridad que sí existe una diferencia estadísticamente significativa entre las medias de la preprueba y de la posprueba.

A la luz de los hallazgos obtenidos, en el primer ejemplo no hubo diferencia alguna en el poder estadístico cuando se utilizó un alfa del 5% y un alfa del 1%. Mientras que en el segundo ejemplo, cuando se usó un alfa de 5% y se cambió por un alfa de 1%, el valor del poder estadístico de la prueba disminuyó dramáticamente. Este fenómeno radica principalmente en dos factores. El tamaño del efecto es mayor en el primer ejemplo porque la diferencia entre las medias fue mayor (40.69) comparado con la diferencia del segundo ejemplo que fue de 2.33. En la Tabla 12, se muestra el tamaño del efecto observado para el primer ejemplo que dio como resultado .964, lo que representa un tamaño de efecto grande. Por último, la muestra en el primer ejemplo era mayor (48), comparado con la muestra del segundo ejemplo (30). Se concluye que, en el segundo ejemplo, el estudio no tiene el poder estadístico suficiente para asegurar que existen diferencias significativas entre la preprueba y la posprueba. Esto nos indica que en el estudio debe aumentarse el tamaño de la muestra. Finalmente, se puede señalar, también, que al reducir el nivel alfa o error tipo I, si no existe un tamaño del efecto significativo y un tamaño de muestra apropiado, el poder estadístico bajará irremediablemente.

Tabla 7. Media y desviación estándar de la preprueba y la posprueba

| | | Paired Samples Statistics | | | |
|--------|----------|----------------------------------|----|----------------|-----------------|
| | | Mean | N | Std. Deviation | Std. Error Mean |
| Pair 1 | Pretest | 62.20 | 30 | 19.038 | 3.476 |
| | Posttest | 64.53 | 30 | 16.882 | 3.082 |

Tabla 8. Prueba de hipótesis pareada con un alfa de 5%

Paired Samples Test

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|--------|--------------------|--------------------|----------------|-----------------|---|-------|--------|----|-----------------|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | Pretest - Posttest | -2.333 | 4.759 | .869 | -4.110 | -.556 | -2.686 | 29 | .012 |

Tabla 9. Poder estadístico de la prueba de hipótesis pareada con un alfa de 5%

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

| Source | factor1 | Type III Sum of Squares | df | Mean Square | F | Sig. | Noncent. Parameter | Observed Power ^a |
|-----------------|---------|-------------------------|----|-------------|-------|------|--------------------|-----------------------------|
| factor1 | Linear | 81.667 | 1 | 81.667 | 7.213 | .012 | 7.213 | .738 |
| Error (factor1) | Linear | 328.333 | 29 | 11.322 | | | | |

a. Computed using alpha = .05

Tabla 10. Prueba de hipótesis pareada con un alfa de 1%

Paired Samples Test

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|--------|--------------------|--------------------|----------------|-----------------|---|-------|--------|----|-----------------|
| | | Mean | Std. Deviation | Std. Error Mean | 99% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | Pretest - Posttest | -2.333 | 4.759 | .869 | -4.728 | .061 | -2.686 | 29 | .012 |

Tabla 11. Poder estadístico de la prueba de hipótesis pareada con un alfa de 1%**Tests of Within-Subjects Contrasts**

Measure: MEASURE_1

| Source | factor1 | Type III Sum of Squares | df | Mean Square | F | Sig. | Noncent. Parameter | Observed Power ^a |
|-----------------|---------|-------------------------|----|-------------|-------|------|--------------------|-----------------------------|
| factor1 | Linear | 81.667 | 1 | 81.667 | 7.213 | .012 | 7.213 | .483 |
| Error (factor1) | Linear | 328.333 | 29 | 11.322 | | | | |

a. Computed using alpha = .01

Tabla 12. Tamaño del efecto observado para el primer ejemplo**Tests of Between-Subjects Effects**

Measure: MEASURE_1

Transformed Variable: Average

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared |
|-----------|-------------------------|----|-------------|----------|------|---------------------|
| Intercept | 317745.094 | 1 | 317745.094 | 1263.303 | .000 | .964 |
| Error | 11821.406 | 47 | 251.519 | | | |

REFERENCIAS

- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. (2nd ed.). New Jersey: Lawrence Erlbaum.
- Díaz, P. & Fernández, P. (2003). Cálculo del poder estadístico de un estudio. *Unidad de Epidemiología Clínica y Bioestadística. Complejo Hospitalario-Universitario Juan Canalejo. A Coruña, España. Cad Aten Primaria*, 10, 59-63.
- Gordon, D., Finch, S.J., Nothnagel, M. & Ott, J. (2002). Power and sample size calculations for case-control genetic association tests when errors are present: Application to single nucleotide polymorphisms. *Hum Hered* 54, 22-23.
- Myoung, H. (2003). *Understanding the Statistical Power of a Test*. UITS *Center for Statistical and Mathematical Computing*. Indiana University.
- Statistical Package for the Social Sciences (SPSS). IBM SPSS Statistics 21.0. (August, 2012). *IBM Corporation*.

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