

Effectiveness of an Asthma Summer Camp in Educating Children on How to Prevent and Control Asthma Symptoms

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ABSTRACT

Pediatric asthma continues to be a difficult burden for 10% of American children and their parents and interferes with lifestyles and economic impacts on the household, state, and national levels. This study aims to evaluate a pediatric asthma summer camp, Camp Superstuff, in its ability to educate children about asthma knowledge and asthma control. I collected pre- and post-educational test scores from 2008 and 2010, as well as the 2010 campers' asthma medical history, and camp evaluations from Breathe California of the Bay Area in order to measure the effectiveness of the camp in the dissemination of knowledge about asthma. My results indicated that there was a significant difference between pre- and post-test scores suggesting that campers accumulated knowledge through their participation in the camp. However, the correlation test between numbers of medical appointments and pre-test scores revealed that campers who got higher scores on the pre-test did not necessarily know more about asthma, showing that the campers only learned little asthma information during each physician visit. The camp evaluation demonstrated that campers and staff are generally satisfied with the camp environment and asthma information provided. Thus, Camper Superstuff seems to be an effective pediatric asthma-teaching program.

KEYWORDS

pediatric asthma, asthma interventions, asthma control and prevention, education programs, camp evaluation

INTRODUCTION

Pediatric asthma has troubled 6.5 million American children and their parents by causing school absences and nighttime awakenings; they suffer from asthma symptoms, life impairment during asthma attacks, and huge burden of medical expenses (Weitzman et al., 1992). Based on a study by Weitzman et al. (1992), asthma has become the most common chronic pediatric disease with a prevalence rate of 5% to 10% among American children. Asthma also interferes with the children's life and school activities because it causes sleeplessness and school absences (Diette et al., 2000). In addition, children with asthma require more health-care expenses and parental involvement. This contributes to a huge economic burden, representing over \$3 billion per year of total US medical expenses (Lozano et al., 1997). As a result, there has been a push to encourage asthmatic children and their parents to participate in asthma education programs to control and reduce the current high prevalence of asthma among kids.

Several pediatric asthma education programs are designed to teach children asthma information and help children control their asthma condition (Evans et al., 1987). For example, staff nurses in hospitals provide asthma education after patients visit clinics and emergency rooms for asthma related symptoms (Taggart et al., 1991). Some schools incorporate basic asthma knowledge into curriculum to meet children's needs (Evans et al., 1987). Some clinic centers offer asthma-related movies online to provide access for families to obtain access to asthma information at any time (Vahlkvist, 2010). Asthma summer camps are easier to understand and participate in because asthmatic children can study and have fun with friends at the same time (Coffman et al., 2008). Based on an analysis of Kelly et al. (1998), pediatric asthma education programs like summer camps have shown many positive results, such as decreasing emergency room visits, less asthma attacks, and fewer school absences.

Camp Superstuff is an annual asthma summer camp designed for children ages 6 to 12 that focuses on teaching different aspects of the disease, helping children to recognize asthma attack triggers, and instructing them how to use medications responsibly and effectively. The camp is directed by Breathe California of the Bay Area (BCBA), a non-profit organization. At the camp is staffed by trained camp counselors

who give two one-hour lectures every day during the camp based on the camp curriculum topics, including human's respiratory system, airway changes during asthma attack, asthma triggers, and asthma warning signals. The camp counselors lead breathing exercises after outdoor activities and teach them how to use a spirometer, stethoscope, and inhalers during the asthma classes.

This research study evaluates the effectiveness of a pediatric asthma summer camp – Camp Superstuff – as a way to educate asthmatic children about asthma knowledge and symptom control techniques. My specific research questions are, “how effective is Camp Superstuff in educating children on basic asthma knowledge and asthma control techniques?” and “what are strengths and weaknesses of Camp Superstuff and what can be improved in the future?” My first hypothesis is that Camp Superstuff is effective at educating children because most campers did better on their camp post-tests than their pre-tests. My second hypothesis is that after attending this camp, the campers feel more confident in controlling their asthma because they are able to realize when an asthma attack will come and how to deal with it; also, I expect to see children with higher pre-test scores have more school absences or ER visits, as they may receive asthma information from their physicians.

METHODS

Study population

The study population contained a total of 75 asthmatic children that attended Camp Superstuff during the summers of 2008 and 2010. Based on children's age and medical information, Breathe California of the Bay Area (BCBA) divided the campers into two groups – age 6-8 and age 9-12. In 2008, 15 campers were ages 6 to 8, and 20 campers were ages 9 to 12. In 2010, 17 campers were categorized to the age 6-8 group, and 23 campers were in the age 9-12 group. The majority of the camp participants were current or former residents of Santa Clara County, and the Santa Clara Family Health Plan and the Valley Health Plan subsidized the children's participation.

Data collection

I coordinated the 2010 camp under the direction of BCBA and obtained test scores and camp evaluation results. 2010 Camp Superstuff ran from July 26th to July 30th at Hoover Middle School in San Jose, California. BCBA required campers to finish pre- and post-asthma educational tests on the first and last day of camp for the purpose of evaluating camp achievement. After the post-test session, I sent out camp evaluation forms to campers and counselors and gathered the forms after 10 minutes. BCBA also asked each camper's past year asthma medical record to ensure the camper's eligibility of attending a day camp. I obtained the raw data of educational test scores, evaluation forms, and campers' medical history from BCBA. Any identifiable information was removed from all data upon data compilation.

Camp pre-/post-educational tests

The pre- and post-tests took 40 minutes to complete, and consisted of 20 multiple choices and 3 short-answer questions that focused on asthma information that was taught during the camp such as human's respiratory system, airway changes during asthma attack, asthma triggers, and asthma warning signals. I gave different tests to the different age groups, but the content in each test was identical; the test given to the younger kids showed corresponding figures under answer choices to account for variable levels of reading and writing abilities among the young children. To address effectiveness of the conveyance of asthma knowledge to children by Camp Superstuff, I analyzed differences between the pre- and post-tests scores.

Camper and staff evaluation

The anonymous camp evaluation measured the overall satisfaction and educational experience at the camp. Campers were asked to choose what they had learned from a list of asthma education topics and then selected the asthma-related activities that they most enjoyed. This piece of information was important because with

campers' responses, I would be able to evaluate if the campers were satisfied with Camp Superstuff. In addition, staffs' evaluations revealed how the staff liked the camp and what it could be changed in the future for improvement.

Campers' asthma medical records

BCBA obtained basic asthma histories of each child in the camp application in order to understand applicants' current asthma status. For the purpose of grouping the children, the camp application asked for basic campers' asthma medical history from the past year, including number of school absences, emergency room visits, physician room visits, and hospitalization specifically due to asthma. BCBA used these pieces of information to judge the severity of campers' asthma.

Statistical analysis

I calculated averages and percentage differences within 2008 and within 2010 pre- and post-tests, separately, to evaluate how campers performed overall on the tests. I checked the normality of the dataset and then used paired t-test on the pre- and post-test scores to investigate if the differences were significant. Additionally, I ran an unpaired t-test comparing the 2008 pre-test scores to the 2010 pre-test scores to reveal if the campers performed differently between years. Lastly, I made scatter plot diagrams and ran the Spearman's rank correlation tests for campers' pre-test scores versus school absences, physician visits, and emergency room visits, to investigate the correlation between the campers' asthma knowledge and missing school days or clinical visits as a result of asthma attacks. However, as the data for campers' medical records were not normally distributed, I did a log transformation on them and then ran correlation tests between the variables in my data.

RESULTS

Pre- and post-educational tests

There were 75 asthmatic children that attended 2008 and 2010 Camp Superstuff; I analyzed 67 pairs of valid test scores, and the rest of the test scores were dropped either because they had missing camper ID numbers or they did not have a paired pre-/post-test scores available. As shown in Table 1, the average post-test scores were 13.16 (out of 23) for year 2008 and 16.32 for year 2010; these scores were generally higher than the average pre-test scores which were 10.93 and 13.85 for year 2008 and 2010, respectively. The percentage difference values were 22.1% for year 2008 and 27.8% for 2010; they were positive for both years meaning that there was an improvement on test scores after children attended the camp. Consistently, figure 1 also revealed that the score data were normally distributed based on the boxplots except for a couple of outliers; thus, I would be able to use paired t-test and compare the difference between pre- and post-test scores. Paired t-test for camp pre- and post-test scores showed that the percentage difference for year 2008 was 22.1% ($p = 0.000943$), and the percentage difference for year 2010 was 27.9% ($p = 2.250e-06$). Both p values indicated that the difference between pre- and post-test scores were statistically significant.

Table 1. Statistical summaries of 2008 and 2010 Camp Superstuff pre-/post-. I collected pre- and post-test scores and calculated the average and percentage gain of them.

Year	Average Pre-test (out of 23)	Average Post-test (out of 23)	Percentage difference	p-value
2008	10.93	13.16	22.10%	0.000943
2010	13.85	16.32	27.90%	2.250e-06

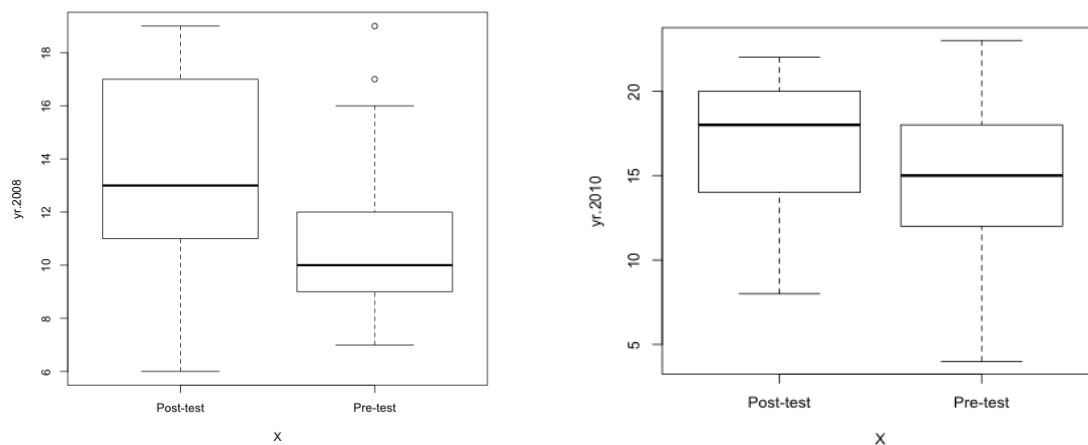


Figure 1. Boxplots of post- and pre-test scores in year 2008 and 2010. I found that the test scores data were normally distributed and the average of post-test scores for both year were better than the pre-test scores, showing that campers had improved their asthma knowledge after attending the camp.

Camper and staff evaluation

Based on 28 camper evaluations and 6 staff evaluations, I found 18 campers enjoyed 2010 Camp Superstuff and felt they learned about asthma. Camp staff thought the camp was impressive but could still improve in some ways. Seventy percent of the campers were glad they came to the camp because they felt that it was fun as well as effective at disseminating asthma information. In addition, about 50% of the campers thought that their asthma got better and would recommend the camp to their asthma peers. In addition, when asked what the campers gained from the camp, approximately 60% of them wrote that they learned basic asthma information, asthma inhaler instruction, medication usage techniques, and some appropriate outdoor activities they could engage with during nice days. About half of the campers indicated that they wanted to return to the camp the following year.

Moreover, about 70% of the camp staff felt that communication between the director and staff was decent as their responsibilities were clearly described; therefore, the camp was impressively manageable. All the staff thought they had received enough training and asthma information before the camp and they enjoyed the experience of working with asthmatic kids. At the same time, I found that all the staff ranked the camper-to-staff ratio as “average” or “above average”. However, two camp staff recommended a better planning and coordination, as the camp didn’t follow the schedule tightly.

Correlation between medical records and pre-test scores

No statistically significant relationships were found in the relationships between pre-test scores and school absences, doctor room visits, emergency room visits. I got twenty-one pairs of valid data on school absences versus pre-test scores; the scatter plots (Figure 2) showed that the regression line between the two variables slightly went down. However, the Spearman’s rank correlation revealed that p-value was equal to 0.3144, which indicated an insignificant correlation.

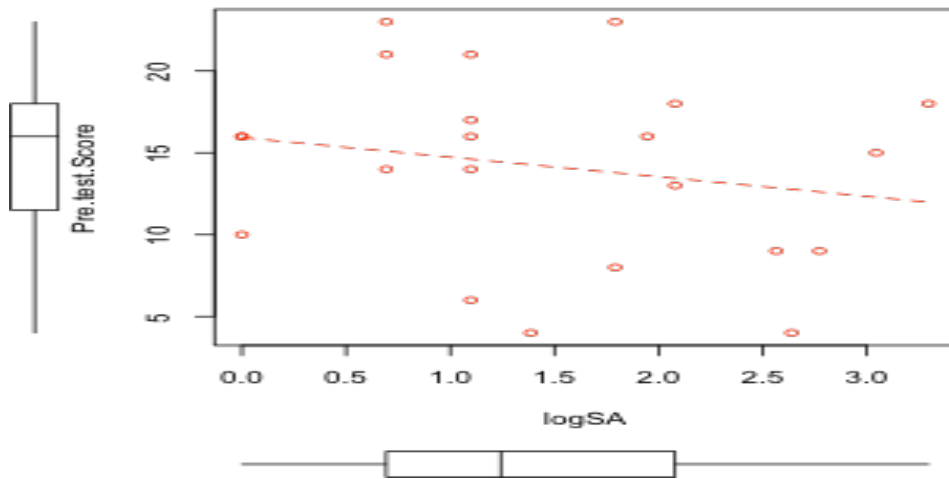


Figure 2. Correlation between the 2010 campers’ school absences (log value) and pre-test scores. I plotted 21 pairs of valid data into the diagram above, but I couldn’t find any strong correlation.

Likewise, the scatter plots diagrams of 2010 campers’ doctor office visits and emergency room visits versus pre-test scores (Figure 3 and Figure 4) didn’t show significant correlation between variables. Both p-values showed that there wasn’t significant correlation between these variables ($p = 0.75$ for doctor office visits versus pre-test scores; $p = 0.73$ for emergency room visits and pre-test scores).

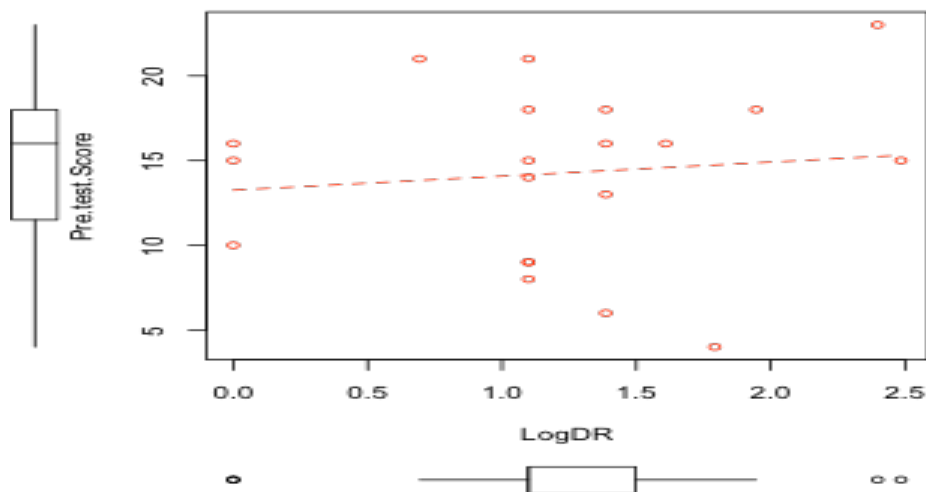


Figure 3. Correlation between the 2010 campers’ doctor office visits (log value) and pre-test scores. I plotted 19 pairs of valid data into the diagram above, no strong correlation was found.

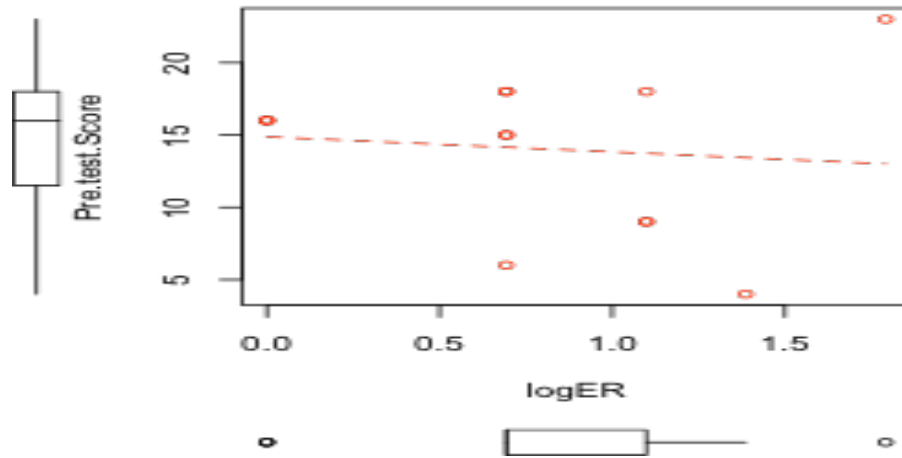


Figure 4. Correlation between the 2010 campers' emergency room visits (log value) and pre-test scores. I plotted 10 pairs of valid data into the diagram above, and I didn't find any strong correlation.

DISCUSSION

Overall, the statistically significant differences between Camp Superstuff pre- and post-test scores indicate that campers' asthma knowledge and control techniques have improved. Campers' improved performances on the post-test show that they are able to answer more questions correctly after attending the camp. This suggests that campers may be able to deal with asthma attacks with better disease control skills such as appropriate medication and water intakes, emotional control, and emergency action plans.

Comparison between pre- and post-test scores

My study shows that campers performed significantly better on the post-camp tests than on the pre-camp tests. This indicates that the camp was effective at providing asthma education and teaching campers asthma control techniques. This finding disagrees with Punnet and Thurber's (1993) study results, which didn't uncover any significant improvement in asthma knowledge before and after the camp. However, Kelly and colleagues (1998) conducted a study that looked at intervention test outcomes of an asthma summer camp in Norfolk, Virginia. They found positive results such as campers' post peak flow meter reads were higher than pre reads, indicating that campers

generally had more airflow through the bronchi and less obstruction in the airways; consequently. They also found that most participants had significantly fewer numbers of school absences and emergency room visits. In addition, Nesvold et al. (2006) noted that asthma camps provided children with the unique experience of being independent from their parents who afforded them the opportunity to enhance their social skills. Thus, considering the benefits being passed to the campers, the programs were valuable. Al-Motlaq & Sellick (2011) found that the camp educational tests lacked a standard; thus, the test used by Nesvold et al. (2006) might potentially have information bias, which means that the wording of questions or the language used might mislead the campers. The camp test that I used for Camp Superstuff was written by BCBA, so it may have the same issue due to the lack of standardization among asthma educational tests. Moreover, considering the limited reading and comprehension among children, the educational tests need to use simple language as well as accurate asthma terms. But Camp Superstuff used easy medical terms that were mostly understandable to school age children and tested them on the same way.

Correlation between patients' pre-test scores and medical records

The weak correlation between campers' pre-test scores and medical records suggests that even though many campers went to see doctors more often, they still didn't know significantly more about basic asthma information than those that went to the doctor less frequently. Possible explanations could be that most of the language used in clinics are highly professional terms making it difficult for children to absorb the information and that children who are not native English speakers find it difficult to understand. Few studies have evaluated how well children understand their disease after physician visits, but this study shows that there is no correlation between campers' asthma knowledge and the number of physician or emergency room visits. Parent's health literacy, which includes the ability to understand prescriptions, basic disease information, and doctors' directions, could also be a critical barrier to a child's comprehension of information at medical appointments (Health literacy, 2011). A guardian's education level might affect a child's comprehension because some guardians

might not understand physician's instruction fully, nor could they teach their children correct information. In Camp Superstuff, there was little concern of this because the camp counselors taught all asthma classes using simple language so that campers could understand the camp curriculum. Also, the educational tests used in this study were designed for children ages 6 to 12. This allowed campers to learn about asthma and its control strategies easily and made the test understandable and clear for school age children.

Camper and staff evaluation

Fairly high satisfaction of Camp Superstuff from campers and the staff suggests that people generally enjoyed their involvement in the camp environment. More importantly, campers thought they would feel more comfortable and confident about asthma control during future attacks since most of the children felt that they could handle asthma independently of their parents. Campers believed that the camp not only provided asthma education, but also taught proper lifestyles that could be beneficial to the campers. The campers ranked field trips as their favorite things, indicating that asthmatic children were eager to play outdoor physical activities. This is very important to control their asthma because a study done by Vahlkvist et al. (2010) showed that moderate level of exercise and physical activities such as field trips and walking were highly recommended among asthmatic children, as they could facilitate relieving of asthma symptoms by decreasing numbers of attacks and emergency room visits. In addition, the evaluation reveals that more than 50% campers liked the fruits and vegetables that were given out as snacks at the camp. This could be very helpful since a research done by Arvaniti et al. (2011) indicated that a healthier life style would be supportive for an asthma control. Camp Superstuff gave healthier food choices instead of high calories snacks and entrees because dietary habits played important roles on life style. Therefore healthier food suppresses serious asthma symptoms, as kids were taking in sufficient vitamins and minerals.

Camp staff thought that the camp was very well organized and helpful to children because most camp staff were satisfied with the asthma education program, medical

supplies, the health care team, and the camper-to-staff ratio. These components were key to an effective asthma educational camp. However, most camp staff had never worked in an asthma camp before; therefore, they were less experienced on asthma knowledge and in educating children despite the fact that BCBA was an organization with extensive experience. Limited funding could also be a major explanation for this situation as this non-profit could only hire minimally paid staff or volunteers (Nesvold et al., 2006). This might have influenced the quality of the camp because camp staff might only learn about asthma information just before they teach the campers.

Limitations

There are several limitations of my study design that could have affected the results. First of all, the camp curriculum and educational tests were written by BCBA and thus, these materials may lack a general standardization, which could cause some information bias, and thus the results of this study are difficult to generalize to other camps. Secondly, the population size of this study is relatively small, making the statistical power low as well. Moreover, although the camp population size was 40 asthmatic children in 2010, only about 60% of the campers' parents filled out medical record information correctly. This low participation rate could possibly cause selection bias, which could further distort my results. The majority of the attendees are insurance carriers of Santa Clara Family Health Plan (SCFHP). This may introduce another type of selection bias into my study design. For example, children who attended the camp were all members of Valley Health Center. Consequently, they were possibly more likely to have a more significant grasp of asthma information compared with children who didn't have access to a clinic. Therefore, this study population might not be an accurate representative sample of low-income children with asthma, even in the Santa Clara area. In addition, the survey results revealed that the camp lacks adequate coordination and experienced staff, which could be due to the shortage of program funding. Nesvold et al. (2006) talked about the funding difficulty of camp programs and how they might influence the quality of teaching and learning. The authors believed that less experienced staff might not give as comprehensive of an asthma education as the program desired

initially, and therefore lessened the effectiveness of the camp program (Nesvold et al., 2006). Finally, the study lacks a long-term design. This is the first study that evaluates Camp Superstuff; thus, future study is required in order to justify the effectiveness of this asthma education program.

Future directions

In the future, I would recommend to increase the program population size in order to reduce information bias and selection bias; also, introducing the camp to more insurance carriers would help asthmatic children, as those with other insurance plans or even no insurance would be able to attend and learn from this program. However, it's difficult to put into practice, as each camp session is limited to 40 kids; increasing sessions could be a way to solve this problem. In addition, campers' complete medical records would be preferable because with correct and comprehensive asthma history, the correlation between the medical records and pre-test scores would be easily interpreted. Finally, one way that could improve the camp is to hire more experienced staff who had worked with asthma children before such as school nurses. The intervention would be more effective and help asthma children to understand the disease and control techniques.

Conclusion

This study suggests that Camp Superstuff is an effective asthma education program for children between the ages of 6 to 12. Campers' improved performance on the post-tests reveals that children increased their knowledge base about asthma and asthma control techniques relative to before they arrived at the camp. Children might be able to improve the understanding of their health conditions because the camp changed professional medical terms into simple language so that school-age children could understand. Moreover, from the camper evaluation, children revealed that they felt more confident about their asthma after attending the camp because they might apply the control techniques learned from the camp to relieve their symptoms during future attacks. Additionally, campers would like to return to the camp in the future, as they could learn

more and consolidate their asthma knowledge through this intervention program. Therefore, asthma summer camp, as a newly developed pediatric asthma intervention program, should be recommended and spread out to asthmatic children. As the children learn more about asthma information and the disease control techniques, they would be able to understand their health conditions, avoid preventable asthma attack cases, and further reduce medical expenses for asthma treatment.

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