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Health and Wellness in New Orleans 15 Years after Hurricane Katrina: Implications for Primary Care

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Abstract

Hurricane Katrina caused devastation among the Gulf Coast of the U.S. and New Orleans. This study evaluated the impact on health and wellness 15 years post-Katrina. The study compared New Orleans with Louisiana and the United States. Changes in health and wellness overall the 15-year period were studied. Data was abstracted from multiple sources; local, state, and national. The study found population number and composition changes in New Orleans, which were not seen in Louisiana and the U.S. Crime statistics, indicate a dramatic increase in violence and criminal acts. Age-adjusted cause-specific mortality rates in New Orleans increased immediately after Hurricane Katrina for homicide, but, over time, rates decreased. Racial differences were observed among non-Hispanic Blacks, who had higher rates in heart disease, cancer, homicide, stroke, accidents/unintended injuries, and infant deaths. These differences were also seen in morbidity, especially in new cases of HIV. It appears that racial health disparities are exacerbated by disasters. Additionally, the inequities in social (i.e., income, poverty, education) and neighborhood (i.e., crime) characteristics are prevalent, and, in part, influence the documented health disparities, as well. The implications for primary care include expansion and modification of behavioral and mental health services, increased health equity promoting activities through community-based collaboration for outreach and political advocacy, data-driven population health management strategies, as well as a newfound emphasis on health-related quality of health.

Keywords: Hurricane Katrina; Type 2 diabetes; New Orleans; Population Health

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Introduction

On August 29th, 2005 flood waters associated with Hurricane Katrina caused the greatest natural disaster in history in the Gulf South. New Orleans and its surrounding communities were flooded for weeks until the waters could be pumped out. After the flood waters were pumped out of New Orleans, the city's infrastructure was in shambles. Homes were destroyed, city services were, for the most part, slow to return, and the health care system was greatly affected. It has now been 15 years since Hurricane Katrina adversely impacted New Orleans and the Gulf South. To determine the status of health and health care services, a community-based analysis was conducted in New Orleans.

Community-based analyses have been done for many years, especially over the past decade. These analyses have typically focused on a specific disease or condition. A 5-year prospective community-based analysis evaluated the relationship between fasting and postprandial blood glucose, amount people with type 2 diabetes on central arterial stiffness [1]. Nearly 900 people were studied, with 21.3% with central arterial stiffness. The study found that type 2 diabetes had an independent effect on central arterial stiffness. A community-based analysis studied differences in health behaviors and outcomes among non-Hispanic Whites and Arab Americans in California [2]. Data from the California Health Interview Surveys were evaluated for risky behaviors among Arab Americans and non-Hispanic Whites. The study found that more Arab Americans were uninsured, living in poverty, and exhibited lower levels of home ownership. Additionally, Arab Americans had lower risk of alcohol consumption, binge drinking, and hypertension. Non-Hispanic Whites had a lower risk of diabetes.

Community-based analyses have been completed in several countries; in addition to the U.S.A community-based study in Singapore evaluated the relationship of mushroom consumption and

mild cognitive disorders [3]. This analysis studied over 650 people 60 years of age and old, as part of the Diet and Healthy Ages Study. The study found that those who consumed mushroom at least twice weekly had reduced risk of mild cognitive disorders, independent of socio-demographic factors or their health status. Tanzanian community-based analysis studied the relationship of health care seeking behavior and individuals' perceptions of chest pain [4]. The study of over 700 people resulted in the common cause mentioned for chest pain was weather and exercise. Community awareness of the causes of chest pain is low, and most people do not present to a hospital due chest pain. Education and health promotion are an urgent need in Tanzania.

A community-based analysis in Paris studied the effect of exaggerated exercise blood pressure on carotid artery stiffness and neural baroreflex sensitivity [5]. In this study almost 9,000 people between the ages of 50 and 75 years were evaluated as part of the Paris Prospective Study III. Findings of the analysis were impaired neural-baroflex sensitivity was affected by exaggerated exercise blood pressure, independent of the level of carotid stiffness. An English longitudinal study of aging evaluated the effects of socio-demographic factors on health of the elderly [6]. Over 6,000 people over the age of 65 years were included in the study. Principal findings were that health trend, physical activity, and personal-fitted variables were major predictors of health.

It is important to base health and wellness analysis at the community level because of the effect of social, economic, and environmental factors. It has been recognized that health care is a weak determinant of health [7]. Health behaviors and social determinants of health are more important determinants of health [8]. Additionally, it is known that stress has a life-long negative impact on health [9]. Environmental factors have been shown to have a multi-generational impact [10].

In a study of cardiovascular disease incidence and the effect of neighborhood aspects and social conditions among non-Hispanic Black adults, racial residential segregation was found to be a contributing factor [11]. The study used data from the Jackson Heart Study of non-Hispanic Black adults residing in Jackson, Mississippi. The construct neighborhood disadvantage was determined using U.S. Census data. Social conditions consisted of social cohesion, violence, and disorder. The study found that neighborhood disadvantage and social conditions may contribute to an increased risk of cardiovascular disease in non-Hispanic Black women.

Residential segregation indicates the need for community-based analysis. Residential segregation has been defined as separation, physically, of two or more groups, with different demographic characteristics, into different neighborhoods in a community [12]. This results in differential health risks and health care resource availability across a community. Additionally, racial segregation, a side effect to residential segregation, has been linked as a fundamental cause of health disparities because of the differing social and environment risks [13].

This paper will describe a study of the relationship between demographics and health and wellness in the metropolitan New Orleans area 15 years after Hurricane Katrina. The trend in health and wellness, as well as changes in the social determinants of health, will be evaluated. Implications for primary care will be addressed.

Material and Methods

Information and data from several sources were used to compare New Orleans over the past 15 years. The New Orleans Department of Health conducted community analyses in 2011 and 2019 on the health and wellness of the city [14-15]. Theses analyses were evaluated for health outcomes and health behaviors. The community health needs assessment report by LCMC in October 2018 was also reviewed [16]. This report focused on zip code-specific health outcomes, behaviors, and health needs. This study will focus on the health and wellness of New Orleans residents in 2010 and 2020. An assumption is that the first five years post-Katrina were a time of recovery and rebuilding.

Additionally, data from the Centers for Disease Control and Prevention was obtained on health outcomes and behaviors from the Behavioral Risk Surveillance System (BRFSS) [17]. These data were used to fill-in any gaps in the information from the other sources. Means were calculated using SPSS version 26 and Mann-Kendall trend analysis was accomplished using Microsoft Excel.

Results

New Orleans was compared to Louisiana and the U.S. New Orleans has experienced many changes in the 15 years post-Katrina. Included in these changes was the composition of the population (Table 1). As a point of reference, the New Orleans population before Hurricane Katrina was 454,845. This number quickly decreased to under 300,000, but increased to 367,770 in 2010 [18]. This study begins in 2010 because it is assumed that by this time the population had stabilized. From 2010 to 2020 the population in New Orleans grew by 36,156 residents. This increase occurred primarily in Hispanics and non-Hispanic Whites. Population density increased 25%, 448.1 residents per square mile. Louisiana's population increased by 167,902 people, and the U.S. grew by 20,160,878. The increase in population density was less in Louisiana with an increase of 6.6 people per square mile. The population density in the U.S. essentially remained constant.

The percentage of the population of Non-Hispanic Whites in New Orleans increased 4% and Non-Hispanic Blacks decreased 1.9 percent. Louisiana experienced a percentage increase of Non-Hispanic Whites and Non-Hispanic Blacks, 2.6% and 1 percent. The U.S. saw a decrease in the percentage of Non-Hispanic Whites and a less than 1% increase in Non-Hispanic Blacks. The Hispanic percentage in the population increased in New Orleans, Louisiana, and the U.S. The Asian population remained constant in New Orleans, but slightly increased in Louisiana and the U.S. This was also seen for foreign born residents (Table 1).

Table 2 presents socioeconomic characteristics from 2010 to 2020. Educational attainment levels increased in New Orleans in those with some college (25.9% to 26.4%). Those attaining bachelor's degree and higher increased in New Orleans increased from 21.4% to 23.4% (Table 2). However, the percentage of people completing high school decreased from 26.8% to 23.0%. These similar changes were seen in Louisiana. In the U.S., the percentage of the population who were high school graduate remained constant, but less entered college. The proportion of those who had a bachelor's degree or higher increased from 27.9% to 34.9%, a 25% increase.

The median household income increased slightly less than $1,000 in New Orleans and Louisiana, but it decreased nearly $10,000 in the U.S. In 2019 the overall median household income in New Orleans was $39,576 and is 37% lower in non-Hispanic Blacks, at $24,813

Table 1: Demographic characteristics, 2010 and 2020.

	Orleans Parish		Louisiana		United States	
Characteristic	**2010**	**2020**	**2010**	**2020**	**2010**	**2020**
Population	3,54,850	3,91,006	44,92,076	46,59,978	30,70,06,556	32,71,67,434
Population density	1,761.30	2,209.40	98.2	104.8	86.7	87.4
Race/Ethnicity						
Non-Hispanic White	29.80%	33.80%	61.30%	63.90%	64.90%	61.50%
Non-Hispanic Black	61.20%	59.30%	31.80%	32.80%	12.40%	12.70%
Asian	3.00%	2.90%	1.40%	1.90%	4.50%	5.40%
Hispanic	4.70%	5.40%	3.60%	4.20%	15.80%	17.60%
Other	1.20%	1.40%	1.80%	2.80%	2.40%	2.80%
Foreign Born	5.80%	5.80%	3.10%	4.10%	12.50%	13.50%

Source: U.S. Census Bureau, 2017 American Community Survey
Note: Other includes American Indian and Alaska Native, Native Hawaiian and other Pacific Islanders
Note: Population density is population per square mile

Table 2: Socio-economic characteristics, 2010 and 2020.

	Orleans Parish		Louisiana		United States	
Characteristic	**2010**	**2020**	**2010**	**2020**	**2010**	**2020**
Educational attainment						
Less than high school	16.10%	14.2	17.80%	15.70%	14.70%	10.30%
High school graduate	26.80%	23	34.30%	33.80%	28.50%	28.50%
Some college	25.90%	26.4	26.40%	27.10%	28.90%	26.30%
Bachelor's degree or higher	31.10%	36.5	21.40%	23.40%	27.90%	34.90%
Income and poverty						
Median household income	$38,721	$39,576	$46,710	$47,942	70,850	$60,293
Per capita income	$29,275	$30,177	$26,205	$27,027	$31,177	$32,621
Persons in poverty	25.40%	23.80%	19.60%	18.60%	14.60%	11.80%
Children (<18 years) in poverty	41%	39%	---	26%	---	23%
Single-parent households	61%	61%	---	43%	---	23%

Source: U.S. Census Bureau, 2017 American Community Survey

Table 3: Crime rates, 2009 and 2019.

	Orleans Parish		Louisiana		United States	
	2010	**2020**	**2010**	**2020**	**2010**	**2019**
Violent crime	777	2,325.00	638.7	537.5	465.5	368.4
Murder/non-negligent homicide	51.7	58	11.8	11.4	5	5
Forcible rape	29.1	35.9	30.3	44.7	28.7	30.9
Robbery	277	502	135.9	98	133	86.2
Aggravated assault	419.1	1,406.00	442	383.4	262.8	248.8
Property crime rate	3,846.30	10,548	3,794.60	3,276.00	3,036.10	2,199.50
Burglary	1,135.80	1,017.10	1,029.50	668.1	716.3	376
Larceny-theft	1,943.20	8,055.10	2,504.30	2,360.40	2,060.90	1,594.60
Motor vehicle theft	776.4	1,476	260.8	247.6	258.8	228.9

Source: FBI Uniform Crime Report *per 100,000 population

[19-20]. The per capita income remained basically the same for New Orleans, Louisiana and the U.S. The percentage of the population living in poverty decreased in New Orleans 6.3%, 5.1% in Louisiana, and 19.5% in the U.S. The rate of children (<18 years of age) living in poverty in New Orleans is 34%, a 7% decrease from 2010, but still well above the state rate of 26% and 18% for the U.S [21]. The rate of children living in a single-parent household is 61%, a rate for New Orleans that hasn't changed over the past 10 years, and is now 44% for the state, a 1% increase over the same period [22]. The current U.S. rate is significantly lower at 35%, 1% above 2010 [23].

Crime has been an issue in New Orleans for many years. The crime rates in 2010 and 2020 show increases in most measures in New Orleans (Table 3). Violent crime rate per 100,000 populations increased from 777.0 to 2,325.0. A 200% increase. Louisiana experienced a decrease in violent crimes, as was seen in the U.S. The murder rate increased in New Orleans from nearly 14%, while there was a decrease in Louisiana and the U.S. This increase was also seen for forcible rape, robbery, and aggravated assault. The rate of forcible

Table 4: Cause-specific Age-adjusted mortality, overall, by race, Orleans Parish, 2002-2017*.

Health Outcome	2002	2007	2012	2017	Mean
Heart disease	248	239	198	198	223
Cancer	241	208	182	158	199.5
Homicide	47	66	42	36	41.5
Stroke	73	60	43	46	59.5
Accidents/Unintended Injury	29	51	57	62	45.5
Non-Hispanic Whites					
Heart disease	224	179	157	176	200
Cancer	185	171	152	151	168
Stroke	60	45	36	36	48
Alzheimer's	32	19	19	33	32.5
Accidents	27	57	60	62	44.5
Non-Hispanic Blacks					
Heart disease	192	299	226	219	205.5
Cancer	219	243	202	165	192
Homicide	65	94	68	55	60
Stroke	58	74	50	53	55.5
Accidents	26	49	55	64	45

Source: *per 100,000 population

Table 5: Health outcomes and behavior, Orleans Parish, 2013-2017.

Health Outcome/Behavior	2013	2014	2015	2016	2017	Mean
Diabetes*	12	11.5	11.9	12.7	11.9	11.7
Obesity*	30	31	31	32	32	31.5
Drug-poisoning deaths+	---	27.3	24.9	36	36.3	30.6
Murder rate+	41.4	38.7	41.7	43.8	39.5	39.1
Tobacco use*						
Current Smokers	24	22	19	14	22	22
Ex-Smokers	20	26	20	21	19	22.5
Never Smoked	56	52	61	64	59	55.5
Drug-poisoning visits to ED^	---	352	341	354	407	374
Opioid-related prescriptions#	---	103.5	98.8	96.1	80.7	89.5
New cases, HIV^	271	246	251	235	203	224.5
Non-Hispanic Blacks	196	173	181	176	149	161
Non-Hispanic Whites	59	56	51	42	33	44.5
Hispanics	11	12	16	15	17	14.5
Males	209	194	202	176	157	175.5
Females	56	44	45	54	48	46

Sources: Louisiana Department of Health, Louisiana Opioid Data and Surveillance System
CDC, BRFSS; FBI Uniform Crime Report; Louisiana Department of Health, HIV Surveillance System; *percent; +per 100,000 population; ^absolute numbers; #per 100 population

rate increased from 23.4%, the robbery rate increased 81.2%, and the rate of aggravated assault increased more than two-fold.

New Orleans experienced significant increases in property crime rates, except for burglary, but Louisiana and the U.S. had decreases. Overall, the property crime rate increased more than one and half times. The increase in the larceny/theft rate was staggering, from 1,943.2 cases per 100,000 to 8,055.1 cases per 100,000 (314%) from 2010 to 2020. The rate of motor vehicle theft nearly doubled.

To gain a better understanding of the effect of Hurricane Katrina on health and wellness of New Orleans residents, age-adjusted cause-specific mortality was evaluated over a 16-year period, 2002 through 2017 (Table 4). Heart disease mortality showed a stable trend and a mean of 223.0 heart disease deaths per 100,000 populations. Cancer mortality showed a decreasing trend ($p<0.05$), with a mean of 199.5 deaths per 100,000. Stroke mortality had a stable trend, but deaths due to accidents and unintended injuries had a statistically significant increasing trend ($p<0.05$).

When age-adjusted cause-specific mortality is stratified by race, it is obvious that rates were higher in non-Hispanic Blacks compared to non-Hispanic Whites. Non-Hispanic Whites had a decreasing trend

in cancer death rates (p>0.05) and an increasing trend in accidents (p>0.05). Stable trends were seen in non-Hispanic Whites in heart disease and stroke death rates. No trend was observed in Alzheimer's death rates. Non-Hispanic Blacks had stable trends in death rates due to heart disease, cancer, homicide, and stroke. There was an increasing trend in accident/unintended injury death rates among non-Hispanic Blacks (p>0.05) (Table 4).

Table 5 presents health outcomes and health behaviors data from 2013 to 2017. The prevalence of diabetes and obesity in New Orleans remain constant. The changing trends that occurred are seen in opioid-related prescriptions, and absolute number of new cases of HIV. The trend in opioid-related prescriptions per 100 population decreased 22% from 103.5 to 80.7, with a five-year mean of 89.5. Overall, the absolute number of new cases of HIV decreased 25.1% from 271 to 203 cases annually. Over the five-year period, the mean number of new cases of HIV is 224.5.

When stratified by race differing trends are observed. Among non-Hispanic Blacks the mean number of new cases of HIV is 161, with a stable trend. Among non-Hispanic Whites the mean number of new cases of HIV is 44.5, with a decreasing trend. An increasing trend was seen in Hispanics, with a mean number of new cases equal to 14.5. A higher mean was observed in males, but they experienced a decreasing trend. Females had a steady trend and a mean nearly four times lower than in males.

In the 2019 Healthiest Communities analysis complied by the U.S. News and World Report, Orleans Parish (which consists totally of New Orleans) was scored 40.3 out of 100 points [24]. Orleans Parish fell below the top 500 counties that scored between 62.5 and 100. Life expectancy in Orleans Parish was noted as 75.8 years, identical to that of the state, but 3.8 years below the national average of 79 years. That same report notes "deaths of despair" (e.g., suicide, drug misuse) in Orleans Parish at 41.9, higher than the state rate of 37.4 and the U.S. rate of 36 (Table 5).

Discussion

New Orleans has experienced significant changes in many health outcomes and health behaviors since Hurricane Katrina. These changes have been both positive and negative. In some health outcomes a direct Hurricane Katrina effect can be seen, especially in different races.

Transformations in the health care system were also driven by Hurricane Katrina. One source of the changes was the drastic, and rapid, decrease in population. The New Orleans population realized a nearly immediate decrease of 37 percent. By 2010 the population increased 28%, but it was still 19% less than before Hurricane Katrina.

Since 2010 the New Orleans population continued to increase. This increase in population was primarily in non-Hispanic Whites and Hispanics. The population composition is much different in 2020, compared to 2005. The proportion of non-Hispanic Whites increased 4%, while the proportion of non-Hispanic Blacks decreased 3 percent. An unintended consequence is an increase in population density.

The increase and difference in population composition suggests the influx of population was probably driven by rebuilding the city. This assumption is supported, in part, by the 5.4% increase of residents with a bachelor's degree or higher. The median household income and per capita income have not significantly changed. One positive aspect of the population increase is a decrease in the percentage of persons living in poverty.

However, the children living in poverty remains alarmingly high compared to the state and U.S. rates. The rate of children living in a single-parent household is also an area of concern since, combined with rates of poverty, crime, and other factors, it can negatively influence health and earnings potential across a lifespan. Research that examined childhood neighborhood effects on intergenerational mobility found that because of the negative characteristics in New Orleans for low-income families, income as an adult would be reduced and likely impede the ability to move upwards in income and socioeconomic status. New Orleans ranked last out of 50 cities and the findings estimated the likelihood of a 13% reduction in income [25].

From 2010 to 2020 the crime rate increased dramatically. The violent crime rate increased nearly 300% and the property crime rate increased over 250%, according the FBI Uniform Crime Report. Similar increases occurred in all categories of crime. These increases were much greater in New Orleans than what was observed in both Louisiana and the U.S. In fact, some crime categories showed decreases in Louisiana and the U.S. The increasing crime rates are troubling because the effect of crime on health has been researched previously. Public insecurities related to crime are assumed to be detrimental to individual wellness, as well as community cohesion. Using the Whitehall II study, it was shown crime, and fear of crime, has statistical effect on physical functioning and mental health [26]. Fear of crime results in an array of social anxieties that negatively affect health. This results in neighborhood disadvantage and disorder which negatively correlates with health [27].

It has been shown that the aftermath of natural disasters is characterized by increases in morbidity and mortality. A study of the aftermath of Hurricane Katrina showed a significant excess mortality for the immediate two-year period [28]. A study in Australia evaluated morbidity and mortality in non communicable diseases after disasters. The study found that the risk of increased severity, and death, of cancer, cardiovascular conditions, diabetes, renal diseases, and respiratory diseases was greater post disaster [29].

Age-adjusted mortality was essentially stable after Hurricane Katrina in New Orleans. However, there was an immediate impact of Hurricane Katrina in deaths due to heart disease, homicide, and accidents across all races. In 2007 the overall homicide age-adjusted mortality increased to 66 per 100,000, a 40% increase from 2002. Among non-Hispanic Blacks the mortality rate increased for heart disease, cancer, homicide, stroke, and accidents in 2007. Among non-Hispanic Whites the only mortality rate that increased was for accidents. This illustrates that the impact of disasters may exacerbate the health disparities between non-Hispanics Blacks and non-Hispanic Whites. After 2007 the cause-specific mortality rates decreased overall, as well as across race, except for accidents in 2017.

Morbidity rates, for the most part, did not change between 2013 and 2017. Overall, opioid-related prescriptions and new cases of HIV decreased 22% and 45%, respectively. New cases of HIV among males decreased 25%, while new cases increased 55% among Hispanics. With respect to trends, either no or stable trends were observed in all categories of health outcomes and behaviors, except for obesity, opioid-related prescriptions, and new cases of HIV. The percent of obese residents had a statistically significant increasing trend, and

new cases of HIV had a statistically significant decreasing trend. Significant decreasing trends were observed in new HIV cases among non-Hispanic Blacks, non-Hispanic Whites, and males. Males, non-Hispanic Blacks, and Hispanics have the highest rates of HIV. These racial disparities are more prominent post-disaster [30]. In fact, non-Hispanic Blacks are at higher risk of delayed HIV diagnosis due to issues with access to testing and education [31].

There are several implications for primary care. It has been shown that disasters have both a short and long-term effect on mental health, especially anxiety [32]. Additionally, emotional instability, stress, trauma and other psychological symptoms are common, all which adversely affect health and wellness. Primary care services may need to be adjusted given this expected increase in demand for mental health care [33]. Mental health treatment at the primary care level may need modification. It has been shown in low- and middle-income populations, like New Orleans, single session therapies have been effective. This is particularly helpful in communities with either no or limited mental health services [34].

Louisiana coastal residents, including New Orleans had to deal with the aftermath of Hurricane Katrina in 2005, and then five years later in 2010, the Deepwater Horizon Gulf Oil Spill occurred. Multiple disasters, whether natural or man-made, can lead to compounded mental stress especially for sociologically disadvantaged communities. It has been shown that compounded disasters were detrimental especially to residents that had economic ties to commercial fishing [35].

In the future, programs should incorporate funding to mitigate the financial burden and job loss that surrounds natural and man-made disasters. Secondly, evidence has shown that social support may decrease post disaster mental distress. Social support services have been identified as a protective factor against post-traumatic stress and depression five years post Hurricanes Katrina and Rita. A sense of community and staying in touch with loved ones and friends after a disaster is important in effectively coping during tough times. Lastly, chronic conditions, current life stressors, and prior lifetime trauma exposures have a negative effect on both physical and mental health as people age [36]. When planning for programs it is imperative to identify members of the community with these factors and focus additional programs and resources towards these vulnerable residents.

Primary care systems must be aware of changes in Health-Related Quality of Life (HRQL) in populations who have been affected by disasters. HRQL is a multidimensional measure of the self-assessed effect of health and disease. HRQL metrics include both physical and mental health. HRQL has become a general measurement of overall health outcomes. Assessment of HRQL needs to become an essential primary care measure of health and wellness because it incorporates both mental and physical dimensions [37].

Primary care should be keenly informed through data analysis of the health needs of its community and design services to meet these needs. Participation with communities through outreach and advocacy for policies that promote healthy conditions aligns well with a primary care role for the integration of public and population health principles, a strategy that is endorsed by the American Academy of Family Physicians [38]. An additional benefit of such a strategy could be gaining a deeper understanding of public health practice that continues to be a national challenge in health care and public discussions. Advocacy on policies for resource allocation alignments with priority health care needs and care reimbursement models are clear examples [39]. Developing interdisciplinary structures for this level of integrated collaboration could be a first step.

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