

## A COMPENDIUM OF COVID-19 CONSEQUENCES ON INLAND WATERWAY ACCIDENTS IN BANGLADESH

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### ABSTRACT

The COVID-19 pandemic is an ongoing pandemic of corona virus disease caused by Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2). This was first identified in December 2019 in Wuhan, China. World Health Organization (WHO) declared an outbreak in January 2020 and a pandemic in March 2020. To tackle the situation, Bangladesh implemented measures such as lockdown and restricted public transportation. Bangladesh being a riverine country, waterway transportation plays a vital role in the communication and trade sectors, which has been perturbed by the pandemic. The country sees an alarming rate of waterway accidents every year. The pandemic resulted in an aberration in the waterway accidents, which is objectified in this study. The analysis has been conducted using two years (2019-2020) of daily newspaper-based data. The descriptive statistics show that the waterway accidents decreased by 10% in the post-pandemic period. It was also found that 6% of the total accidents of after pandemic have occurred during the lockdown period claiming 9% of the fatalities. The study also includes hotspot analysis using ArcGIS showing the frequency of accidents in different districts of Bangladesh before and after the pandemic lockdown. The significance of these major results is that it allows us to identify the regions most affected by the pandemic. Furthermore, the data was used to infer some reasons behind the inland waterway accidents in Bangladesh.

**Keywords:** COVID-19 Pandemic, Waterway Accidents, Maritime Safety

### 1. RESEARCH BACKGROUND

Bangladesh being a riverine country depends vastly on its waterways for transportation. The network of the rivers is so diverse that this mode of transportation has been a cheap option. Besides transporting passengers, the waterways are used for transporting commercial goods across the country. According to Bangladesh Inland Water Transport Authority (BIWTA), Bangladesh has about 24,000 km of waterways. Of this, the navigable length is 5,968 km in the rainy season and 3,865 km during dry seasons.

The inland waterway transport carries half of total arterial freight traffic and one-fourth of total passenger traffic. Despite being such a crucial mode of transport, this sector sees an alarming rate of accidents. The following chart represents the number of accidents from 2005-2020 along with the number of fatalities caused by those accidents.

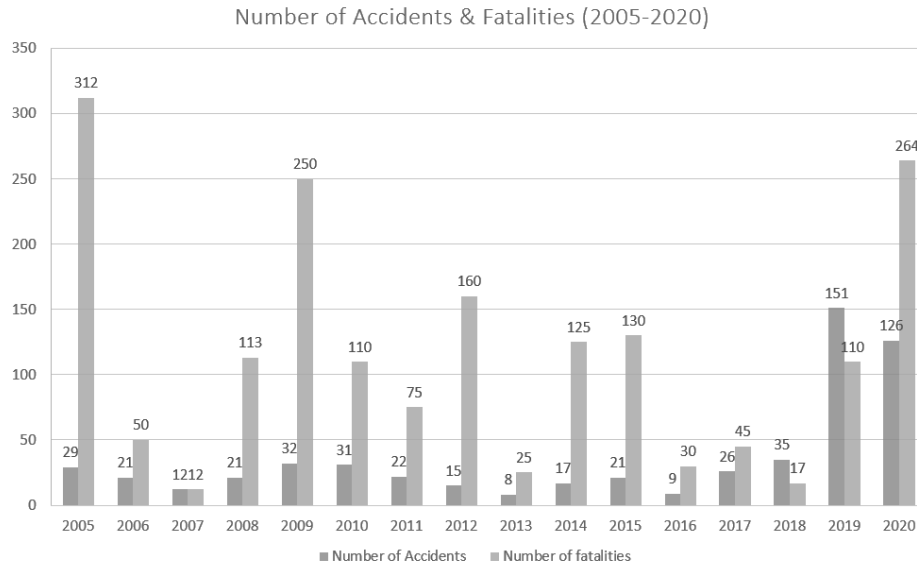


Figure 1: Number of waterway accidents and fatalities in Bangladesh from 2005 to 2020

Most of these accidents are fatal. When such accidents occur, there is major loss of commercial goods or life or both. Factors such as weather, loading conditions, vessel type, season, weekday and collision have been identified among others. It is important to know these factors because by controlling these it may be possible to control the frequency of accidents. Now, a new factor has been added to these factors, namely, the pandemic. This paper analyzes the effect of the COVID-19 pandemic on the waterway accidents of Bangladesh.

Literature review showed that some of the leading factors of waterway accidents are collisions, unfavorable weather and overloading of passenger vessels. The lack of skilled crew and the slacked intervention of governing bodies have also been pointed out. It was also seen that global warming, leading to increased soil erosion and relocation of land are affecting the water routes. (Rabiul Islam & Rashid, 2015) stated that the two major causes of waterway accidents are overload and weather conditions. It was also stated that overloading calculations during vessel design is not effective in reducing the problem and also that the socioeconomic condition of Bangladesh is not suitable for designing a vessel against wind effects. (Zobair Ibn Awal & Hasegawa, 2017) said that the causes of accidents are a complex set of events. The causes have been analyzed using various theories of accidents in their paper. The Logic Programming Technique was used to analyze the causes of accidents. (Z. I. Awal, 2007) also stated that the two major causes of accidents are overloading and wind. (Uddin et al., 2017) studied a total of 229 accidents from 2005 to 2015 and categorized the accidents according to their causes. Hot spots of accidents were found using the Geographical Information System (GIS). Study of such a long list of accidents allowed the authors to identify reasons beyond overweight and wind, such as collision, stability failure, excessive current and bottom damage. (Rahman, 2017) has identified causes such as collisions, contacts, explosions, fire, bad weather and overloading as causes of accidents. (Uddin & Awal, 2017) identified collision as a common cause of accidents. Common ship types in accidents were found to be passenger vessels and cargo vessels. (Khaled & Kawamura, 2015) quantified the proportion of accidents due to collision and grounding from 1981 to 2013 to be 57.96%. Chattogram Port (CP) was identified as a hotspot with 76.92% of collisions and groundings. (Zobair Ibn Awal et al., 2010) found that most of the accidents were caused by collisions and northwester storms. It was also found that 80 per cent of the accidents occurred due to cargo vessels colliding with other vessels. (Raiyan et al., 2017) used event tree and probabilistic analysis to find reasons for accidents. Using event tree, a sequence of events was identified which led to the accident. The probabilistic approach identified poor visibility during overload conditions.

(Imran Uddin et al., 2017) identified collisions for a major reason. The types of vessels most involved in accidents were claimed to be cargo and passenger vessels. (Rabiul Islam et al., 2015) identified design and construction to be responsible for capsizing and sinking of vessels. (Huq & Dewan, 2006) said that the most common causes were collision, foundering and overloading. A list of factors causing the least number of accidents was also identified. (Zobair Ibn Awal et al., 2010) found in their work that leading causes were collision and loss of stability due to northwester storms. (Iqbal et al., 2007) also indicated collision to be the main factor of accidents. It was found that intact stability failed due to bad weather and overloading. (Iqbal et al., 2008) identified unfavorable weather, storms and crowding to either side of a vessel as main reasons of accidents. (Rashid & Islam, 2017) listed a number of reasons behind the accidents, as such lack of knowledge of good practices, unfit ships, overcrowding on board, crew of low skill, bad maintenance of the water routes, inaccurate forecasting of weather, inclination towards profit and corruption. Risk Analysis of Marine Accident in Inland Waterways of Bangladesh Using Fault Tree Analysis Method by Ehtasham Ahmed Quraishi identified intense congestion of traffic, complex navigation situations and exceptional locations as reasons. Human error was also listed as a main reason. A number of other reasons such as not following rules of procedure, lack of skills in crew and improper/ uncoordinated operation were also listed. (AZAD, 2009) stated that the routes connecting Chandpur and associated areas to Dhaka and Chattogram have a high number of accidents. As factors of accidents unfit ships, passenger overcrowding, crew skills, governing bodies and maintenance of water routes were listed. (Wilson et al., 2017) said that the new land formed by the deposition of eroded soil is causing the water routes to change. (Zobair Ibn Awal, 2015) identified passenger and cargo ships leading the charts in accidents. (Uddin & Awal, 2020) applied the Systems Theoretic Process Analysis (STPA) method to identify the factors leading to accidents. Human error was highlighted as a prime factor. (Brammer, 2014) studied the effects of water level rise and soil erosion due to global warming.

## 2. METHODOLOGY

The data was collected from daily newspapers. Then factors such as month, day of week, time of day, type of vessel, region and reason of accident were compiled and summarized in charts.

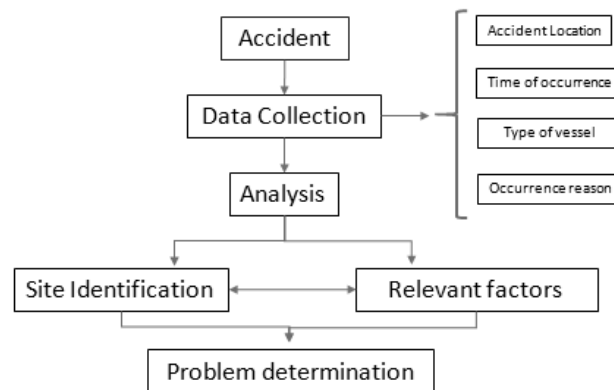


Figure 2: Study Design

## 3. RESULTS AND DISCUSSION

In this study, a before- after COVID-19 pandemic analysis has been carried out. Table 1 includes summary of the analysis and shows a decrease of 10 % on number of waterway accidents occurring but an increase of 55% on number of fatalities caused by the 108 accidents that occurred in after pandemic period.

Table 1: Summary of Number of Waterway Accidents Before and After COVID-19

Summary	Before	After
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No. of Accident	120	108
No. of Fatality	129	201
No. of Injury	101	26
No. of Missing	289	118
<b>Total No. of Casualty</b>	<b>519</b>	<b>345</b>

Figure 3 comprises the data that represents the number of accidents 299 days before the pandemic (May 14, 2019 - March 7, 2020) and 299 days after the pandemic (March 8, 2020 – December 31, 2020). Comparative study shows that the number of accidents occurring in May and June in 2020 is significantly less than in corresponding months in the year 2019. Drastic increment is observed in July and August of year 2020. Following this, a decrease in numbers of accidents is visible.

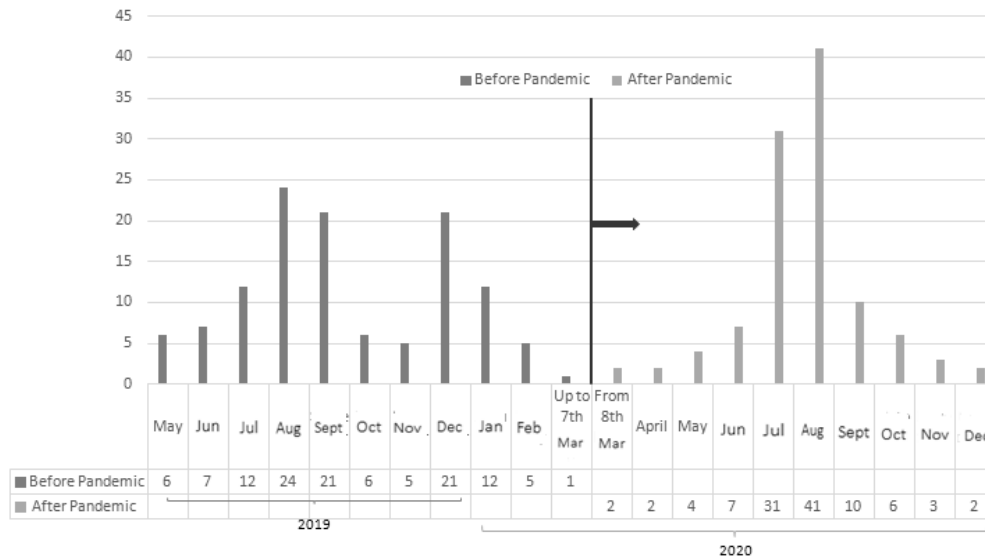


Figure 3: Number of accidents shown month wise from May 2019 to December 2020

The greater the number of vehicles in service, the more the number of accidents. April, May and June of year 2020 had a significantly lower number of vessels being operated due to the first phase of lockdown throughout the country.

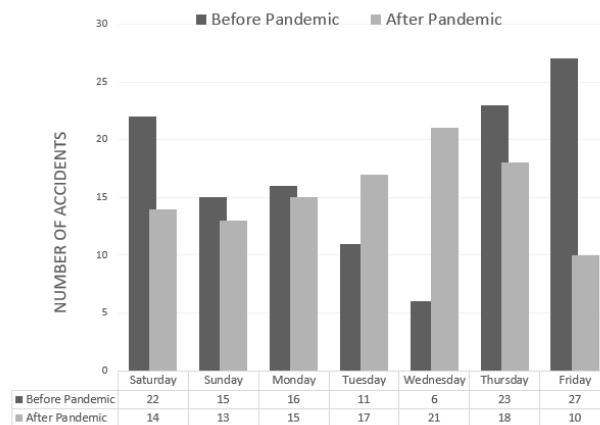


Figure 4: Number of accidents shown according to day of the week

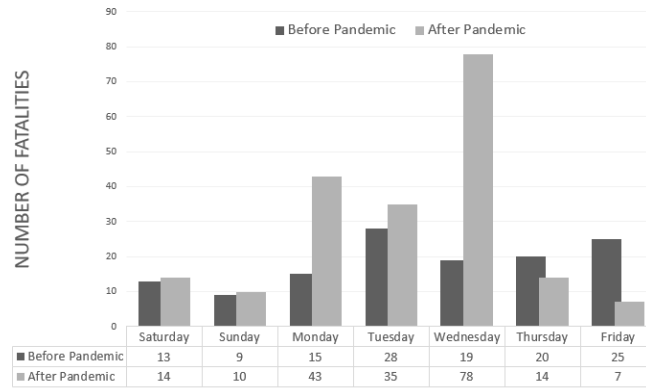


Figure 5: Number of fatalities shown according to day of the week

Figure 4 represents the number of accidents on weekday basis. According to the analysis before the pandemic, the number of accidents was much higher on Thursday, Friday and Saturday, compared to the other days. After the pandemic started, accidents on Friday reduced in number significantly compared to the before pandemic period. In the after-pandemic period number of accidents shows an increasing trend from Sunday to Wednesday and a fall on Thursday.

Due to centralization of jobs in the major cities in Bangladesh, majority of the people have to stay in the urban areas. During lockdown, lack of intercity travelling medium was not forthcoming. This explains the disparate trends observed in the weekends of the corresponding periods.

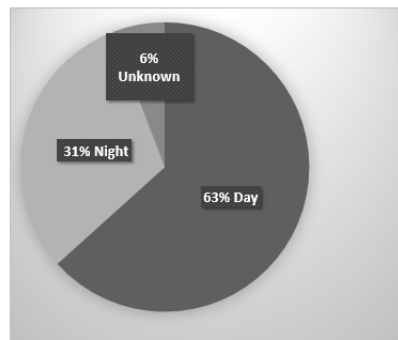


Figure 6: Proportions of accidents occurring during the daytime and nighttime (before the pandemic)

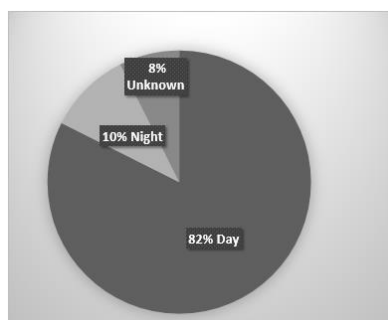


Figure 7: Proportions of accidents occurring during the daytime and nighttime (after the pandemic)

Figure 6 shows that number of accidents occurring at night before pandemic period was significantly higher than the number of accidents occurring at night after pandemic. But number of accidents that took place at the day time increased almost 18% in after-pandemic period. According to the pie chart,

the occurrence time of some accidents went unreported. Those accidents fall under the ‘unknown’ category. Almost 6% to 7% accidents belong to this criterion in both of the period. This study comprises a comprehensive analysis of the accidents occurred in May 2019- December 2020 and the water vehicles involved are given below:

Cargo Ship, Trawler, Passenger Vessel, Fishing trawler, Speed Boat, Country Boat, Ferry, Others

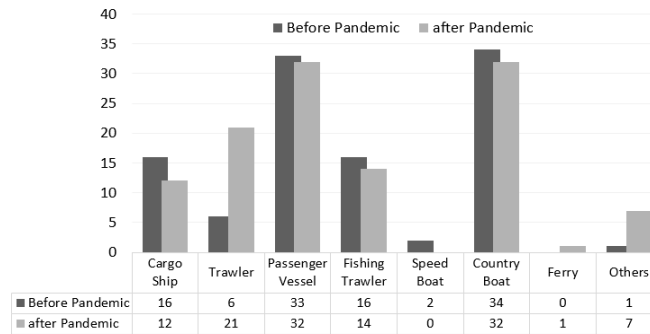


Figure 8: Number of different types of vessels involved in accidents, before and after the pandemic

The chart represents that most of the accidents in both of the period involved country boat and passenger vessel. The number of trawler accidents more than doubled after pandemic compared to the preceding period. Waterway accident factors can be divided into following categories:

Hostile weather, Bottom Damage, Collision, Head on damage, Rear End damage, Stability/ lost control, Overload, Passenger casualty due to falling from the ship, Unknown/ other

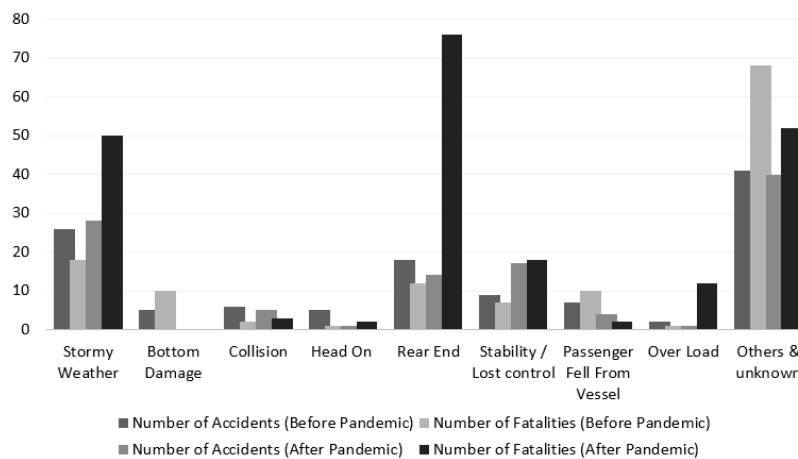


Figure 9: Factors resulting in accidents and fatalities

Significant increment in accident fatalities is observed in after pandemic time period in stormy weather condition, rear end collision and over load. Adverse weather is always an important factor for accidents in water vehicles. But increase in fatalities of rear end collision and overloading can be explained by the fact that even though a partial lockdown was imposed, overcrowding in water vessel was observable due to the tendency for people to travel back to their homes before the lockdown had started.

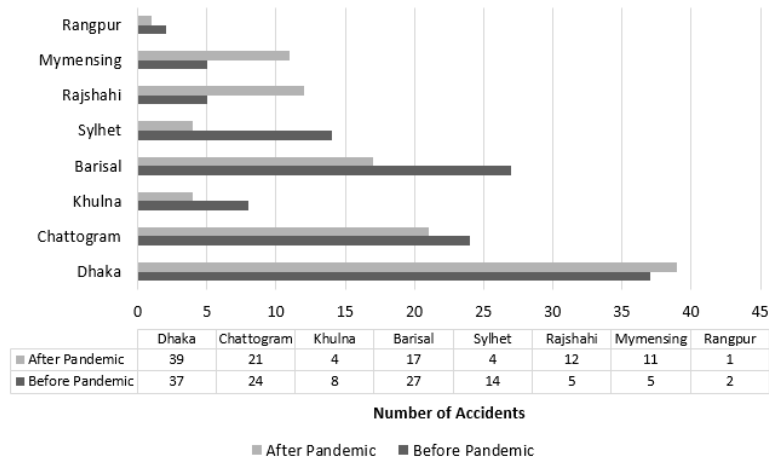


Figure 10: Number of accidents shown according to divisions

The bar chart shows that Dhaka has a lot more number of accidents in both before-pandemic and after-pandemic period. People heading towards the major city all the time can be a factor behind the enormous number of accidents. The number of accidents has increased in Rajshahi and Mymensingh division whereas the corresponding number decreased in all the other divisions. The number of accidents after pandemic in Sylhet and Barisal divisions reduced significantly compared to the before-pandemic situation. The lowest number of accidents has been found in Rangpur division.

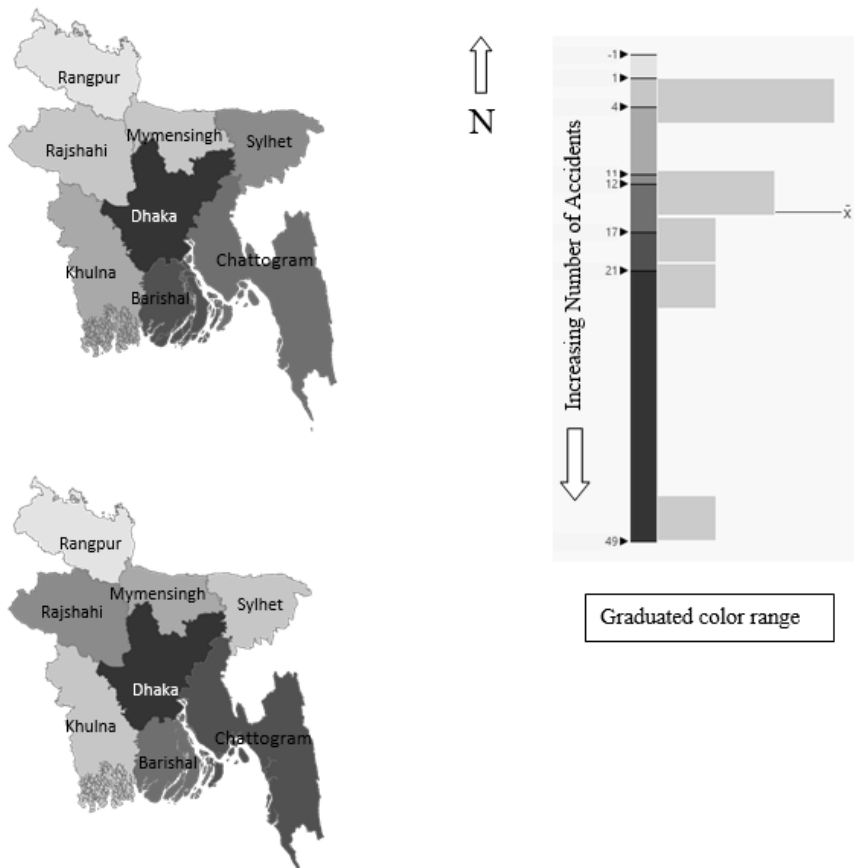


Figure 11: Accident hotspot analysis using ArcGIS

The number of accidents in different divisions with consecutive graduated color range shown in Figure 11. According to the figure, before pandemic period the severity of accident was in Dhaka and Barisal division, Chattogram and Sylhet was second highest. After pandemic period the number of accidents in Chattogram increased compared to the preceding time but the accident number of Barishal, Khulna, Sylhet and Rajshahi decreased. Dhaka was on top in both periods.

#### 4. CONCLUSIONS

Comprehensive study on effects of COVID-19 on waterway accident factors verifies some very important observations. For instance, the decreased number of accidents (10%) instigated an abnormal increased number of fatalities (55.81%). This can be due to the fact that people did not travel much in the pandemic period. However, when they did, they did in large volumes, which resulted in overcrowding, and hence an increase in the frequency of accidents. The database which is used to build this analysis is based on daily newspapers. Recurring factors should be pointed out and government should come up with possible measures to prevent those. In this study it has been shown that the number of fatalities was augmented significantly from the previous year due to overloading and passenger vessels were mostly involved in accidents. To prevent this situation number of vessels should be increased according to carry the huge number of passengers travelling through the waterway transportation system. Safety campaign is a must. Finally, this study opens up new opportunities for further research on this matter if the factors discussed in this paper are consistent with the second wave of COVID-19. In Figure 11, the Accident hotspot analysis using ArcGIS shows that Dhaka, Chattogram and Barishal have had high frequencies of accidents since before the pandemic. However, Sylhet and Rajshahi saw remarkable increase in the frequency of accidents after the pandemic, as demonstrated by the darker shade of color. It is worth noting that a large number of accidents are often unreported. So, a huge amount of accident details was not found. Therefore, to better the current scenario, a proper database should have been formed and updated on a regular basis. Thus, the study has room for improvement based on an improved database.

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