Original Article

Forecasting Incidence of Road Accidents during the 2019 New Year Holiday Season

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Abstract

Introduction: Accidents are a major problem in Thailand for a long time. Accidents, in addition to losing property, can also affect the body. From the results of data analysis obtained from injuries and deaths of the Health Organization and the National Statistical Office, it was found that the trend of the impact of injuries and deaths from accidents has increased rapidly.

Method: The study used secondary data from internet sources and relevant organization of accidents in Thailand, particularly during the 7 dangerous days of New Year's festival (2013 - 2018) with aims to create forecasting incident models as data report during New Year Festival of 2019. The simple seasonal model is used to predict the number of accidents during the 7 dangerous days of New Year Festival, 2019

Result: The result shows the total number of road accidents during the 7 days' holidays of New Year Festival in 2013, 2014, 2015, 2016 and 2017 as 3,176, 3,174, 2,996, 3,379, 3,919 and 3,841 respectively. The presented data shows that the number of road accidents during New Year Festival is increasing from 2015 to 2017.

Conclusion: The predicted value of numbers of overview accident in 2019 is 3,871. The accidents occurred mostly on the 3rd day of New Year Season.

Key words: Seven days, New Year Festival, Accident

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Introduction

Accidents have long been considered as a crucial problem of Thailand, which cause not only property damages, but causing danger to the life of its inhabitants. Accidents may cause injury from soft tissue to organ losses, or even death, depending on the severity. As mentioned above, accidents not only lead to the direct loss of human organs, but there are many indirect impacts, economically as well as socially, due to accidents such as, damage to properties, including damage to vehicles, and loss of life, resulting to death of close family members or friends. So, the impact of accidents is considered as an important problem of Thailand.

According to a report from a study on injuries and death of World Health Organization (WHO), injury and death due to traffic accidents tend to be continuously increased. Several causes of accident are observed. Most accidents are caused from reckless driving e.g. drunken – drivers, speed violation, dozing off, cutting abruptly in front of another cars and running at red light and so on. Another factors that results to massive accident impact are, found during yearly traditional festivals, where large crowds rush home driving to attend or gather together with their families, for instance, New Year Festival, Christmas etc., resulting high traffic accidents.[1-4]

Recently, accident reduction campaign has been raised as national agenda in Thailand, especially on consecutive holidays, such as New Year Holidays, where massive crowd drive along with their family to rush to their hometown nationwide, for joining festivity in various places, thereby, resulting to increasing traffic volumes on main roads, during these holidays. This made related agencies to set up effective measures to try to control accidents at various zones or points of traffic during these holidays. For instance, roadway surveillance, driver check-point to locate and monitor traffic accidents at each location, traffic restraint measures.[5] Data collection was made to analyze working guidelines of related agencies. Statistical method was substantially developed to forecast accidents in 2019 as guideline of accidents prevention and mitigation during the New Year Holidays.

This research aimed to forecasting incidence of Road Accident during the 2019 New Year Holiday Season under the Government Policies to Reduce Accidents from the secondary data that was collected between 2013 to 2018.

Research Method

1. To collect secondary statistical data about reported traffic accidents during New Year Festival, 2013 - 2018 from website of Road Safety Directing Center of accident reduction network office (www.accident.or.th) in order to establish baseline of new information for making accident prediction model during New Year Festival.

2. Create prediction model by calculating prediction value of numbers of accident during New Year Festival (2013 - 2019) as applicable to the accident prediction model.[6-9]

3. As numbers of accident during New Year Festival (2013 - 2018) have only seasonal component, so the simple seasonal[10] is applied as prediction model. Moreover, Seasonal variation is relatively constant over time, so it is namely additive seasonal variation. In this connection, the data consists of all 'p' seasons and, each season consists of 'S' values according to steps in respect of following equations: (1)

where

(1) $$\hat{Z}_n = \hat{\beta}_0(n) + \hat{S}_{n-7}$$

(2) $$\hat{\beta}_1(0) = \frac{\overline{Z}_p - \overline{Z}_1}{(p-1)S}$$

(3) $$\hat{\beta}_0(0) = \overline{Z}_1 - \frac{S}{2}\hat{\beta}_1(0)$$

$\overline{Z}_p$ = Average of the last seasonal

$\overline{Z}_1$ = Average of the 1st seasonal

p = amount of seasonal for this case study, p = 6 seasonals are 2013 to 2018.

s = Interval of each seasonal for this case study, s = 7 days.

for this case s = 7 When 1 < n < 7, to assess component fluctuations varied to seasonality of each cycle of data to predict the 1st seasonal interval or $\hat{S}_{n-7}$ that are S_{-6}, S_{-5}, S_{-4}, S_{-3}, S_{-2}, S_{-1} and S_0 values from SPSS's Calculation.

when n > 7,

(4) $$\hat{\beta}_0(n) = \alpha_1(Z_n - S_n(n-s)) + (1-\alpha_1)((\hat{\beta}_0(n-1) + \hat{\beta}_1(n-1))$$

(5) $$\hat{S}_n(n) = \alpha_3\left[Z_n - \hat{\beta}_0(n)\right] + (1-\alpha_3)\hat{S}_{n-7}$$

where,

Z_n = observed value of n .

α_1 =constant value in adjusting by eradication of seasonal influences where $0 < \alpha_1 < 1$.

α_3 = constant value in adjusting according to adjusting in respect of seasonal changes where $0 < \alpha_3 < 1$.

α_1 and α_3 was calculated by SPSS as same as $\hat{S}_{n-7}$.

Tools for data presentation

1. Table shown numbers of annual accidents by day from 2013 - 2018.

2. Default are $\bar{Z}_1$ $\bar{Z}_p$ $\hat{\beta}_0$ (0) $\hat{\beta}1$ (0) $\hat{s}_{n-7}$ α_1 and α_3.

3. Linear graphs shown numbers of accident trend each day from 2013 - 2018 including predicted values in 2019.

4. Table representing forecasting values each day from 2013 – 2019.

Results

The findings were that casualties of accidents during 2013 - 2018 tend to increasingly occur each year was shown in Table 1. In comparisons of increasingly annual percentage, it was found that in 2015 comparing to 2016, the figure represents 12.78%, while 2016 comparing to 2017 increases 15.78%.

Table 1 Numbers of accidents during 7 dangerous days of New Year Days from 2013 - 2018 by date

Year	Date							
	1	2	3	4	5	6	7	Total
2013	27 Dec 12	28 Dec 12	29 Dec 12	30 Dec 12	31 Dec 12	1 Jan 13	2 Jan 13	**3,176**
	313	495	513	505	524	533	293	
2014	27 Dec 13	28 Dec 13	29 Dec 13	30 Dec 13	31 Dec 13	1 Jan 14	2 Jan 14	**3,174**
	392	474	456	496	537	536	283	
2015	30 Dec 14	31 Dec 14	1 Jan 15	2 Jan 15	3 Jan 15	4 Jan 15	5 Jan 15	**2,996**
	508	625	604	367	342	285	265	
2016	29 Dec 15	30 Dec 15	31 Dec 15	1 Jan 16	2 Jan 16	3 Jan 16	4 Jan 16	**3,379**
	439	590	662	647	415	339	287	
2017	29 Dec 16	30 Dec 16	31 Dec 16	1 Jan 17	2 Jan 17	3 Jan 17	4 Jan 17	**3,919**
	524	680	757	751	445	422	340	
2018	28 Dec 17	29 Dec 17	30 Dec 17	31 Dec 17	1 Jan 18	2 Jan 18	3 Jan 18	**3,841**
	477	575	648	678	677	400	386	
Total	**2,658**	**3,439**	**3,640**	**3,444**	**2,940**	**2,515**	**1,854**	**20,485**

Based on the tabular data, default values in prediction of numbers of accident during 7 dangerous days of New Year Season 2019 can be identified as following:

According to data, interval numbers of seasonal or S = 7 and Numbers of seasonal or p = 6, so that default values are obtained. The default forecast parameters and seasonal period was shown in Table 2 and 3, respectively.

$$\overline{Z}_1 = 454 \qquad \overline{Z}_6 = 549$$

$$\hat{\beta}_1(0) = \frac{549 - 454}{(6-1)7} = 2.7143$$

$$\hat{\beta}_0(0) = 454 - \frac{7}{2(2.7143)} = 444.4999$$

Table 2 The default forecast parameters

Model	Estimate	SE	t	Sig.
α_1	0.8	0.154	5.190	< 0.0009
α_3	4.9E-6	0.442	1.11E-5	1.000

Table 3 Seasonal period

n	Sn
-6	-24.695
-5	91.734
-4	132.134
-3	84.882
-2	-29.009
-1	-60.895
0	-194.152

Create prediction values of numbers of accident during New Year Festival 2013 to 2019 from default follow equation (1), (4) and (5), prediction values shown on Table 4.

Table 4 Prediction values of numbers of accidents during 7 dangerous days of New Year Season from 2013 to 2019 regarding the following default values

Year	Date							Total
	1	2	3	4	5	6	7	
2013	27 Dec 12 323	28 Dec 12 446	29 Dec 12 519	30 Dec 12 481	31 Dec 12 416	1 Jan 13 432	2 Jan 13 403	**3,020**
2014	27 Dec 13 448	28 Dec 13 534	29 Dec 13 520	30 Dec 13 436	31 Dec 13 400	1 Jan 14 439	2 Jan 14 406	**3,183**
2015	30 Dec 14 441	31 Dec 14 626	1 Jan 15 659	2 Jan 15 582	3 Jan 15 326	4 Jan 15 268	5 Jan15 171	**3,073**
2016	29 Dec 15 379	30 Dec 15 558	31 Dec 15 617	1 Jan 16 620	2 Jan 16 558	3 Jan 16 373	4 Jan 16 236	**3,341**
2017	29 Dec 16 410	30 Dec 16 632	31 Dec 16 704	1 Jan 17 714	2 Jan 17 660	3 Jan17 417	4 Jan 17 311	**3,847**
2018	28 Dec 17 467	29 Dec 17 606	30 Dec 17 615	31 Dec 17 609	1 Jan 18 580	2 Jan 18 587	3 Jan 18 327	**3,791**
2019	507	638	672	639	555	484	374	**3,871**
Total	**2,976**	**4,041**	**4,305**	**4,082**	**3,495**	**2,999**	**2,228**	**24,125**

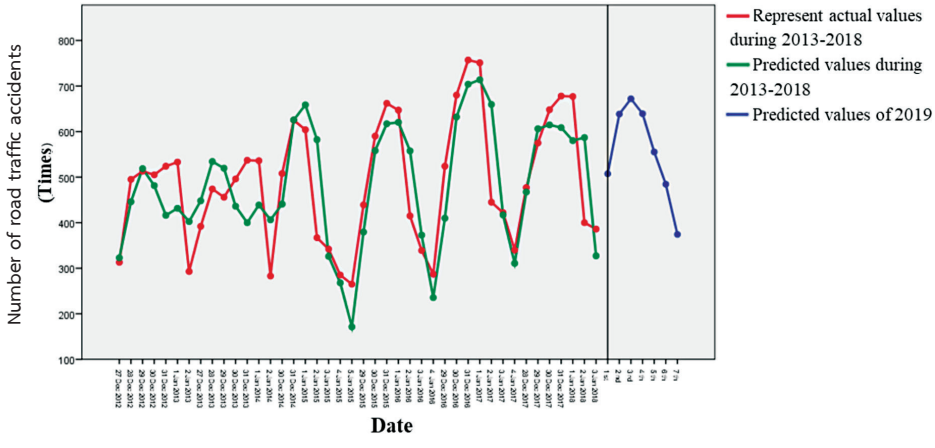

Figure 1 Graphs represent casualties of accidents during 7 dangerous days in New Year Festival and predicted values from equation during 2013 to 2018 by day and predicted values in 2019

From Figure 1, the data shows an additive seasonal component, with fluctuation upward and downward not more than 1 seasonal, namely, additive seasonal variation. The Simple Seasonal is applied to develop component calculation according to seasonal variation of time series regarding determined equation. Program represents actual values during 2013 to 2018 (red lines); predicted values during 2013 to 2018 (green lines). Such values are calculated in model equation, predicted values of numbers of accidents during 7 dangerous days of New Year Season in 2019 are obtained (blue lines).

Conclusion

From accident prediction during the 7 dangerous days of 2019, the trend and tendency is more increased than those in 2018. Predicted values of numbers of overview accident in 2019 is increased 30 times than those in 2018. In details, the numbers are increased from 3,841 to be 3,871 with 4 times average increase in casualties from accidents. The accidents are taken placed mostly on the 3rd day of New Year Season. The result of this study can be used for making future policies with regard to prevent accident during 7 dangerous days of New Year Festival in both microstructure and macrostructure level, including definition of Key Performance Indicator for this operation with assurance of operational success of Key Performance Indicator.

Suggestions

As the research is a short - term prediction, that is 7 days per interval obtained from the last 6 consecutive years, the data set may be not constant or same with the new obtained data in prediction model. Thus, new data in 2019 should be carried out for 2020 prediction too. The data set in 2014 to 2019 are not sufficient for the time series process. The prediction model is subjected to fluctuate depending on data component. So, these variation factors, such as trend, seasonality and direction should be considered while making prediction model of traffic road accident during New Year Holidays.

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บทคัดย่อ

การพยากรณ์จำนวนการเกิดอุบัติเหตุในช่วงการเดินทาง 7 วันอันตรายเทศกาลปีใหม่ 2562 ตามนโยบายการลดการเกิดอุบัติเหตุของกรมป้องกันและบรรเทาสาธารณภัย

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บทนำ: อุบัติเหตุถือเป็นปัญหาสำคัญของประเทศไทยมาอย่างยาวนาน การเกิดอุบัติเหตุนอกจากจะทำให้เสียทรัพย์สินแล้วยังอาจส่งผลต่อร่างกายด้วย จากผลการเก็บข้อมูลการบาดเจ็บและเสียชีวิตขององค์การอนามัยและสำนักงานสถิติแห่งชาติ พบว่าแนวโน้มการเกิดผลกระทบจากบาดเจ็บและเสียชีวิตจากอุบัติเหตุเพิ่มสูงขึ้น จุดประสงค์ของงานวิจัยเพื่อนำข้อมูลจำนวนการเกิดอุบัติเหตุบนท้องถนนในช่วง 7 วันอันตรายเทศกาลปีใหม่ ปี 2556 ถึง ปี 2561 มาหาตัวแบบที่เหมาะสมในการพยากรณ์จำนวนอุบัติการอุบัติเหตุจราจรบนท้องถนนในช่วง 7 วันอันตรายเทศกาลปีใหม่ พ.ศ. 2562

วิธีการศึกษา: นำข้อมูลรายงานจำนวนการเกิดอุบัติเหตุในช่วง 7 วันอันตรายเทศกาลปีใหม่ ในระหว่างปี พ.ศ. 2556 - 2561 โดยข้อมูลสถิติได้จาก www.accident.or.th ซึ่งเป็นข้อมูลทุติยภูมิ นำไปทำเป็นข้อมูลสารสนเทศใหม่และใช้สร้างตัวแบบในการพยากรณ์ข้อมูลรายงานอุบัติเหตุช่วงเทศกาลสงกรานต์ โดยตัวแบบ simple seasonal ถูกใช้ในการพยากรณ์จำนวนอุบัติเหตุในช่วง 7 วันอันตรายเทศกาลปีใหม่ พ.ศ. 2562

ผลการศึกษาและอภิปรายผลการศึกษา: จำนวนอุบัติเหตุช่วง 7 วันอันตรายช่วงเทศกาลปีใหม่ช่วงปี พ.ศ. 2556, 2557, 2558, 2559, 2560 และ 2561 คือ 3,176, 3,174, 2,996, 3,379, 3,919 และ 3,841 ครั้ง ตามลำดับ จากการศึกษาดังกล่าวแสดงให้เห็นว่าจำนวนอุบัติเหตุที่เกิดขึ้นในช่วง 7 วันอันตรายช่วงปี พ.ศ. 2558 ถึง 2560 มีค่าเพิ่มขึ้นทุกปี

สรุปผลการศึกษา: การศึกษาข้อมูลรายงานจำนวนการเกิดอุบัติเหตุในช่วง 7 วันอันตรายเทศกาลปีใหม่ ในระหว่างปี พ.ศ. 2556 - 2561 และนำมาสร้างแบบพยากรณ์ ทำให้ทราบว่าค่าพยากรณ์จำนวนอุบัติเหตุโดยรวมในปี พ.ศ. 2562 คือ 3,871 ครั้ง และจะเกิดอุบัติเหตุมากที่สุดในวันที่ 3 ของช่วงเทศกาลปีใหม่

คำสำคัญ: เจ็ดวันอันตราย, เทศกาลปีใหม่, อุบัติเหตุ