

บทที่ 10

การติดตามและการประเมินผล



บทที่ 10 การติดตามและการประเมินผล



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10.1 การติดตามและประเมินผลหลังการก่อสร้าง

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10.3 การประเมินผล

10.3.1 การทดสอบ Chi-Squared และ Tanner-k Test

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 ') #% % % \$ 5%% (" 2
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10.3.2 การทดสอบแบบ Chi Square

' & & 3 ") , /))! #" +\$&0
 . Chi-squared '2 () , " (\$ 3 .'2
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Chi-squared .'2 " ! ! 2 ()
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% (Chi-squared (X²) . ('2 MS Excel (\$& " '%
 .% (&

" !

❖) % " + 5' 2 (P) . % ' " (*)
 &%) +

❖) \$ " Yatesks . ('2 " 5 ' %!
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 ! " 5+ &% . %% (*)

❖ 2))!()) % % (! ! 10 " ! "

❖ \$% 5" Regression to the mean Crash Migration '
) !" +! ! '2 3) "

2 1 % " 5

❖ &2) '2 0 2) #3 J &
 .1 % . \$3, J1 . " \$ \$

+ \$& " Chi-squared

$$\chi^2 = \sum_{i=1, k=1}^{n,m} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

where O_{ij} is the observed value in column j, row i of the table
 E_{ij} is the expected value in column j, row i of the table
 m is the number of columns
 n is the number of rows

ตัวอย่างการทดสอบ χ^2 ก่อน/ หลัง

((Work sheet) " MS Excel ' () χ^2 + P)+&
)& (" % (! ! / ' 2 (P) , 2 %) () " χ^2
 % (! !) % " " +))! &
 Tanner ok '2 ('2" +))! \$& (" " ! !
 \$ 3,))! &
 Chi-squared '2 \$& " ! ! () * .
 ' % (! ! ' KbeforeL KafterL ' 2 (")

Tanner-k test for single site - uses the control data to compute the size of any change in Accidents relative to the control
 Chi-squared is used to estimate if any reduction in accidents at the site is statistically significant

Enter the 'before' and 'after' accidents in the cells (white)

The intervention site accidents are distributed differently than the control accidents
 The size of change relative to control is 67.7%

period	site	control	site expected count	chi-squ. values
before	20	418	13.5	3.15
after	6	388	12.5	3.39
	26	806	26.0	6.5

Size of Reduction at site = 67.7% - adjusted for control, Tanner test value
 Probability of Sign Difference = 1.05% - probability that there is a difference between the site before and after accident numbers, allowing for any trend in control

The probability of the Chi-squared value is less than 5% (pink cell), i.e. there is an effect

ตัวอย่างของเวิร์กชีตสำหรับการคำนวณ Chi-squared test

() χ^2 & 6.5) # ") () * " !
 " 1.05 %
 . +) , , %) (& χ^2 ' แผ่นชีต (Tanner Test.xls)
 (2 x 2 / " /))! χ^2 '2 1 degree of freedom

() χ^2 #6.5 ' (1 degree of freedom .) % #
) () * + 0.02 0.01) % # 5% (0.05) &K1 ' 20L %
 () *

Table of χ^2

Degrees of Freedom, v	0.99	0.98	0.95	0.90	0.50	0.10	0.05	0.02	0.01	0.001
1	0.000	0.001	0.004	0.015	0.455	2.710	3.840	5.410	6.640	10.830
2	0.020	0.040	0.103	0.211	1.386	4.610	5.990	7.820	9.210	13.820
3	0.054	0.101	0.216	0.352	1.213	4.108	5.541	7.378	8.528	12.838
4	0.078	0.136	0.260	0.411	1.064	3.745	5.191	7.042	8.313	12.401
5	0.097	0.160	0.293	0.445	0.975	3.541	5.024	6.902	8.236	12.258
6	0.112	0.175	0.312	0.464	0.915	3.455	4.903	6.783	8.155	12.188
7	0.124	0.189	0.327	0.479	0.872	3.378	4.848	6.709	8.083	12.124
8	0.134	0.200	0.339	0.490	0.841	3.317	4.799	6.645	8.017	12.060
9	0.143	0.210	0.349	0.500	0.816	3.260	4.756	6.589	7.955	12.000
10	0.150	0.219	0.357	0.509	0.793	3.207	4.717	6.541	7.897	11.943
11	0.156	0.227	0.364	0.517	0.772	3.158	4.681	6.499	7.843	11.889
12	0.161	0.234	0.370	0.524	0.753	3.113	4.647	6.463	7.793	11.838
13	0.166	0.240	0.375	0.530	0.736	3.071	4.615	6.431	7.746	11.789
14	0.170	0.246	0.380	0.535	0.720	3.031	4.584	6.402	7.702	11.742
15	0.174	0.251	0.384	0.540	0.706	2.993	4.555	6.375	7.660	11.697
16	0.178	0.256	0.388	0.544	0.693	2.957	4.527	6.350	7.620	11.653
17	0.182	0.261	0.392	0.548	0.681	2.923	4.500	6.326	7.582	11.611
18	0.186	0.266	0.395	0.552	0.670	2.890	4.474	6.303	7.546	11.570
19	0.189	0.270	0.398	0.556	0.660	2.859	4.450	6.281	7.512	11.530
20	0.193	0.274	0.401	0.559	0.651	2.829	4.427	6.260	7.479	11.491
21	0.196	0.278	0.404	0.562	0.643	2.800	4.405	6.240	7.447	11.453
22	0.199	0.282	0.406	0.565	0.635	2.772	4.384	6.221	7.416	11.416
23	0.202	0.285	0.408	0.568	0.628	2.745	4.364	6.202	7.386	11.380
24	0.205	0.288	0.410	0.570	0.621	2.719	4.344	6.184	7.357	11.344
25	0.208	0.291	0.412	0.573	0.615	2.693	4.325	6.166	7.329	11.309
26	0.211	0.294	0.414	0.575	0.609	2.668	4.306	6.149	7.301	11.274
27	0.214	0.297	0.416	0.577	0.603	2.643	4.287	6.132	7.274	11.240
28	0.217	0.299	0.417	0.579	0.598	2.619	4.269	6.116	7.247	11.206
29	0.219	0.302	0.418	0.581	0.593	2.595	4.251	6.100	7.221	11.173
30	0.222	0.304	0.419	0.583	0.588	2.571	4.233	6.084	7.195	11.140
31	0.224	0.306	0.420	0.584	0.584	2.548	4.216	6.069	7.170	11.107
32	0.226	0.308	0.421	0.585	0.580	2.525	4.199	6.054	7.145	11.074
33	0.228	0.310	0.422	0.586	0.576	2.502	4.182	6.039	7.120	11.041
34	0.230	0.312	0.423	0.587	0.572	2.479	4.165	6.024	7.095	11.008
35	0.232	0.314	0.424	0.588	0.568	2.457	4.148	6.009	7.070	10.975
36	0.234	0.315	0.425	0.589	0.564	2.435	4.131	6.000	7.046	10.942
37	0.235	0.316	0.425	0.589	0.561	2.413	4.114	5.991	7.022	10.909
38	0.237	0.317	0.426	0.590	0.557	2.391	4.097	5.982	7.000	10.876
39	0.238	0.318	0.426	0.590	0.554	2.369	4.080	5.973	6.977	10.843
40	0.239	0.319	0.427	0.591	0.551	2.348	4.063	5.964	6.955	10.810
41	0.241	0.320	0.427	0.591	0.548	2.326	4.046	5.955	6.933	10.777
42	0.242	0.321	0.428	0.592	0.545	2.305	4.029	5.946	6.911	10.744
43	0.243	0.322	0.428	0.592	0.542	2.283	4.012	5.937	6.889	10.711
44	0.244	0.323	0.428	0.592	0.539	2.262	3.995	5.928	6.867	10.678
45	0.245	0.323	0.429	0.593	0.536	2.241	3.978	5.919	6.845	10.645
46	0.246	0.324	0.429	0.593	0.533	2.220	3.961	5.910	6.823	10.612
47	0.247	0.324	0.429	0.593	0.530	2.199	3.944	5.901	6.801	10.579
48	0.248	0.325	0.429	0.593	0.527	2.178	3.927	5.892	6.779	10.546
49	0.249	0.325	0.429	0.593	0.524	2.157	3.910	5.883	6.757	10.513
50	0.250	0.325	0.429	0.593	0.521	2.136	3.893	5.874	6.735	10.480

10.3.3 การทดสอบแบบ Tanner k

Tanner k Test '2 (% (! ! " +))!'
 " " % # \$ &

(1 & !" ! "
 a= ! !
 b= ! !
 c= ! !))!
 d= ! !))!

$$k = \frac{b/a}{d/c}$$

& . #0 ' \$ ½ ' 2

$$k = \frac{(b+1/2) \times (c+1/2)}{(a+1/2) \times (d+1/2)}$$

- . k < 1 ! !))!
 - . k = 1))!
 - . k > 1 ! \$ "1))!
- ,P5 ;)&(k o 1) x 100 %

ตัวอย่างของ Tanner k test

'2%(! % (% χ^2 ") # ! " Tanner k test " +))!
'2)&! ! ' 2 3 J 3 J

อุบัติเหตุมีการบาดเจ็บรวม ในช่วงเวลาสามปีบริเวณที่แก้ไขกับบริเวณที่ควบคุม

))!	
	20 (a)	418 ©	438 (g)
	6 (b)	388 (d)	394 (h)
รวม	26 (e)	806 (f)	832 (i)

Tanner k test % (! - 4

Tanner k Test - '2" +))!)(" " ' ! ! \$ 3,
))!

Chi squared '2 \$& " ! ! () * &
' " +K L K L ' 2 (")

Tanner-k test for single site - uses the control data to compute the size of any change in Accidents relative to the control

Chi-squared is used to estimate if any reduction in accidents at the site is statistically significant

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The probability of the Chi-squared value is less than 5% (pink cell), i.e. there is an effect

$$k = \frac{6/20}{388/418} = 0.323$$

\$ Q

) k < 1 " ! ! \$ 3,))!
(k-1) x 100 % = 67.7 % ' (

\$ χ^2) " ! !
 %))! . ! #%

10.3.4 การวิเคราะห์อื่นๆ

. " + ! 5 .) , P P "1	2
! (Crash rates)	Pair t-test
" ! (Variance)	F-test
(Proportions)	z-test
& % (Distribution shifts)	Kolmogorov-Smirnov

5) % (") , . #

เอกสารอ้างอิง

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