Impact Analysis of GleasonESP®

A statistical analysis of claim experience before and after loss prevention monitoring

Shelter Island Risk Services
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Introduction

This study evaluates the impact of the GleasonESP® System (ESP) on reducing the cost of claims in retail premises. We concentrated attention on claims arising from 'slip and fall' accidents. Such claims would be those most impacted by the ESP System. The most important measurement was the decrease in the number of claims, rather than reduced individual claim costs. Many external factors (often outside the control of the retail establishment) affect the cost of a claim once an accident occurs. The most effective way to demonstrate a reduced cost of risk is to eliminate claims in the first place.

Shelter Island Risk Services, established in 1994, provides risk management information services to some of the largest organizations, brokers, claim administrators and insurers in the world. Our experience and expertise is in interpreting claim and related data for many applications. These applications include building data interfaces, integrating systems, performing actuarial calculations, analyzing claim costs, and accounting for the internal cost of risk. In this assignment, we received claim experience and store characteristics from Gleason for those retail stores participating in the study. Although the data are consistent with our expectations, we did not independently audit or otherwise verify the raw data.

The cost of claims to retail food business is among their most significant expense items. According to the survey sponsored annually by the Risk & Insurance Management Society[1], the cost of risk for retail food stores averages $4.57 per $1,000 of revenue—a rate that exceeds the profit margin for many of these organizations. A single claim can wipe out the profits from thousands of sales dollars. The overall retail food industry has an average cost of risk per $1,000 revenue that is comparable to the average for *all* industries combined. When you consider that high severity claim industries such as Construction, Transportation, Energy Oil and Gas contribute to this overall average, the Retail value above reflects why casualty claims are so financially significant to this sector.

The impact of a claim is not completely reflected in the cost of the claim alone. The auxiliary cost of other non-measured cost components (such as, lost time, bad publicity, extra expense, customer ill-will, etc.) is often estimated to be five or ten times the value of the claim itself. Thus, there is even more incentive to control claims than reflected in the statistics presented here.

Any attempt to use claim experience to validate the effectiveness of the ESP must start with understanding the data. In this case, we have a particularly difficult challenge. We had raw data from 107 supermarkets in seven states representing a total of 5,117 discrete monthly exposure periods. There were a

[1] 2000 RIMS Benchmark Survey, Risk & Insurance Society, 2000.

total of 568 claims in our experience base. For each of these, we recorded the store ID, various store characteristics (such as State, Store Size and Store Location), whether or not ESP was in use, and the number and financial value(s) of any claims. We were equally careful to record the equivalent information for any experience months that did not generate a claim. We constructed a Microsoft Access database for maintaining this experience.

For a given store, our raw data, sometimes had considerably more experience prior to installing ESP than afterwards. This was a common result when ESP was recently installed. In other cases, we had available little data reflecting experience before the ESP installation. Since such non-symmetrical ESP or non-ESP experience might introduce a bias in our results, we defined a "Benchmark" variable. Its purpose was to construct an equal experience time period before and after the installation of ESP. For example, if ESP was installed in January 2001, and we had 12 months of experience following this installation, then the Benchmark period limited the pre-ESP experience also to 12 months prior to ESP install. If, in this case, we had had less pre-ESP experience than 12 months, then we would have used that smaller value to 'crop' the Benchmark period. By this balancing, we avoid bias. Consider, for example, if ESP were adopted in a store with a very high initial claim frequency rate. If the store had only a few months of documented experience before the ESP install, then even if ESP cut the claim frequency, the absolute rate still might be higher than that in some non-ESP stores. This is what statisticians refer to as a paradox when the data structure masks the correct conclusion. To balance this kind of bias, we restricted our conclusions here to the analysis of the 2,961 Benchmark monthly periods that contained 356 claims. This experience base is equivalent to approximately 250 retail store years when you pool experience across all the participating stores.

The evaluation of claim frequency requires certain conventions. In this study, we used the frequency of non-zero valued claims as the standard for measurement and counting. Zero valued claims (that is a recorded claim that never had an expense or indemnity payment) are akin to incidents. Our experience and most industry practice shows that the enthusiasm and subjective opinion of whoever keeps the records is a significant factor in recording incidents. They can be more rigorously recorded in one time period than another. One third-party claim administrator will record an incident while another will merely add them to a pending file to see if a claim develops over time. They can easily distort the analysis. In many general liability studies, we have eliminated such claims because of this potential inconsistency. This is the practice adopted here.

Conclusions

1) ESP produces a statistically significant reduction in 'slip and fall' claim frequency in retail food operations. Based on the study of 2,961 months (evenly divided between ESP and Non-ESP experience), ESP reduced the expected probability of incurring a claim in a store-month period by 30.5% (the actual mean claim rate per month dropped from 0.142 to 0.099). The rate difference is statistically significant at a 95% confidence test[2] level. These findings treat a store as either having ESP installed or not. There was no 'credit' for stores that only partially installed the service or did so at a level less than recommended by Gleason.

2) The observed benefits of ESP were not isolated. We found supporting evidence of the claim rate reduction in nearly every combination of variables studied. This frequency reduction for ESP occurs for store Location (urban or rural), Size (based on square footage), State[3], month, and Year. The clear trend showed that ESP did have a beneficial result in cutting frequency. Figures 1 and 2 show a summary of the performance studied.

Figure 1A

	STATE							
ESP	**DE**	**FL**	**GA**	**MA**	**NJ**	**PA**	**RI**	**Total**
False	0.000	0.183	0.134	0.133	0.071	0.153	0.250	0.142
True	0.050	0.150	0.080	0.064	0.071	0.138	0.139	0.099
% Reduction		-18.182	-40.000	-51.852	0.000	-9.900	-44.444	-30.523
All	0.025	0.167	0.107	0.099	0.071	0.145	0.194	0.120

Figure 1B

	SQRFOOT			
ESP	**LT25K**	**25K - 50K**	**OVER50K**	**Total**
False	0.099	0.146	0.279	0.142
True	0.064	0.106	0.163	0.099
% Reduction	-35.135	-27.588	-41.667	-30.523
All	0.082	0.126	0.221	0.120

[2] We evaluated both the mean and the standard errors for the ESP and NonESP store performance. Using established statistical methods (see A. Agresti, An Introduction to Categorical Data Analysis, John Wiley, 1996, p. 20), the results showed that with more than 95% confidence, using ESP reduced the frequency of store accidents.

[3] The small experience in base in Delaware and New Jersey –two claims in Delaware and four in New Jersey—made it impossible to draw statistically valid conclusions.

Figure 2

RURALURBAN			
ESP	**RURAL**	**URBAN**	**Total**
False	0.136	0.147	0.142
True	0.080	0.114	0.099
% Reduction	-40.659	-22.785	-30.523
All	0.108	0.130	0.120

3) The average rate advantage of ESP means that a retail store chain that expects 100 claims before ESP, would experience approximately 70 claims after installation. These frequency reductions, as discussed below, translate directly into equivalent cost reductions because the claims that ESP eliminates cost on average the same as claims overall.

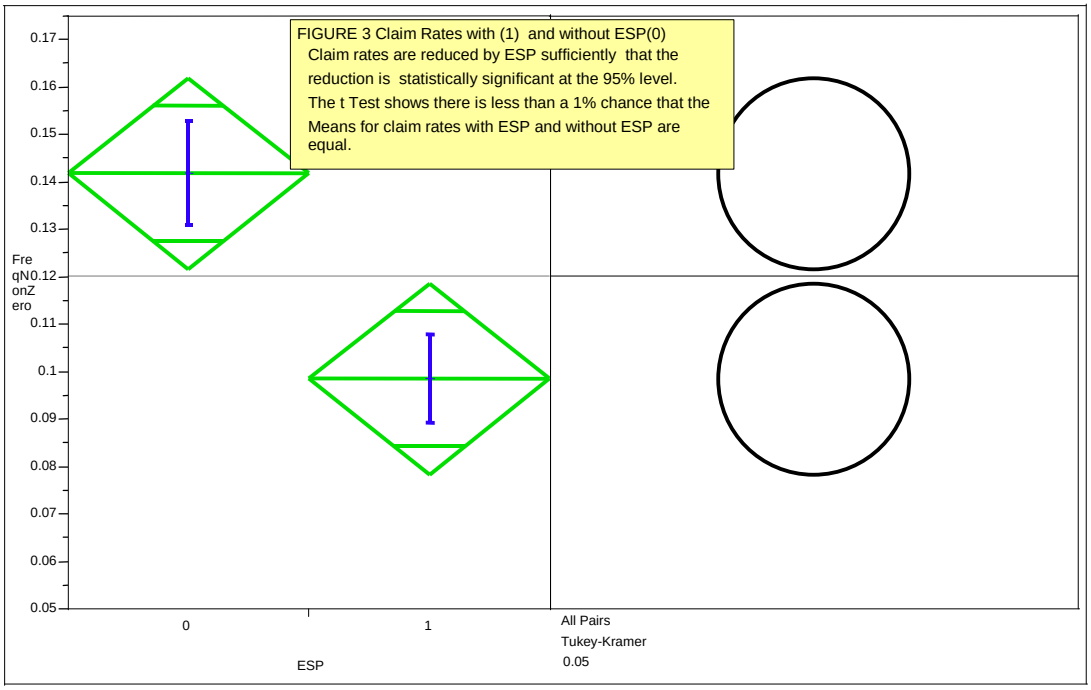
4) ESP provides the means for quicker, more effective attention to incidents that might result in lower values to settle claims. There are a number of reasons that make us cautious in how we interpret the claim values available currently. First, loss development is a time dependent phenomenon where losses slowly increase to their ultimate value over a period of many years. This is relevant here because non-ESP claims are generally 'older' (occurred at earlier points in time) than ESP claims. That fact could bias the non-ESP results. Second, in such small samples, even a single claim can have a huge financial impact. Evaluations based on averages do not necessarily reflect the underlying severity risk. Finally, the claim cost is only a fraction of the effective total cost of an accident. The impact on lost productivity, bad publicity, premium increases, loss of customers and goodwill represents perhaps five to ten times the direct cost of a claim. The elimination of a claim through better loss prevention is the most effective, reliable and dramatic way to reduce cost.

Discussion

Basic Performance Statistics

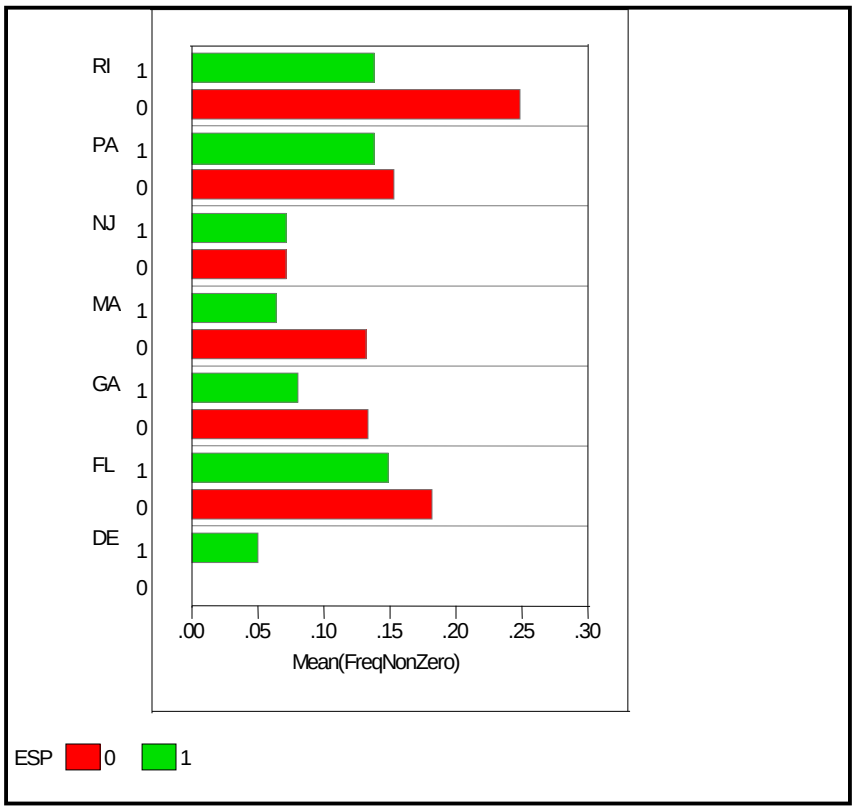
One advantage in working with statistics is the ability to distinguish differences in results that arise by chance versus true differences in the underlying process. The example here is in comparing the mean rate of claims reported per month with and without ESP. Our statistical computer system, JMP, computes the mean rates and the probability distribution in those rates. If the difference in the means is large relative to these distributions, then you can conclude that the difference is significant at a given level of statistical confidence.

Figure 3 shows that average number of claims with (1) ESP is statistically significantly lower than without (0) ESP:

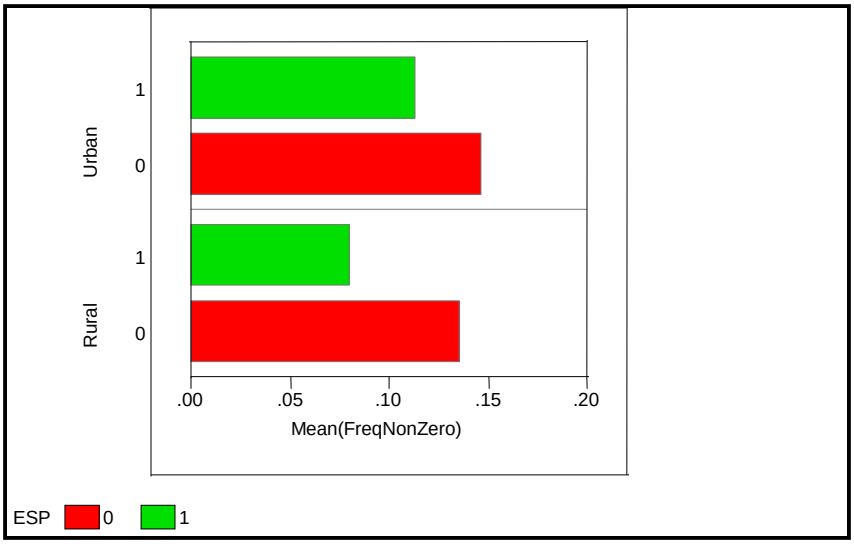


ESP shows a consistent reduction in frequency in stores located in both Urban and Rural environments. In Urban stores, ESP lowers the claim rate to a level below that measured for stores in Rural locations without ESP. See Figure 4. For store size measures, the large stores have the worst claim rate performance. ESP does not eliminate their relative high rates relative to smaller stores, but it does produce a percentage improvement that is greater than any other size. In absolute terms, these Large store rate reductions correspond to the highest absolute savings.

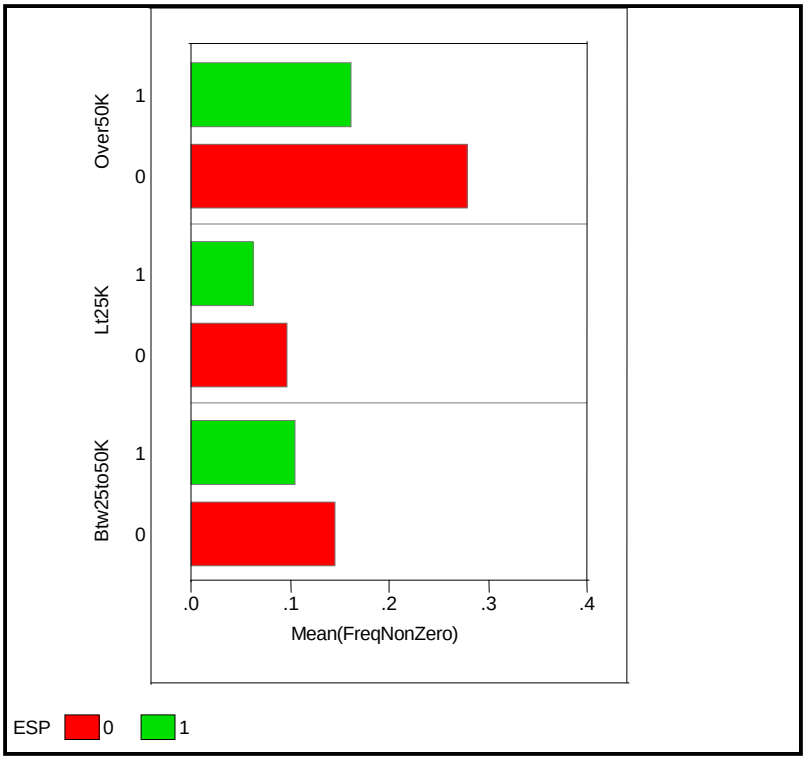
Figure 4: States



Store Type



Store Size



Statistical Methods

The statistical methods used in this analysis employ the most current computer software to identify patterns and relationships within a body of data. Specially, Shelter Island Risk Services used JMP (version 5) as the statistical platform to do this analysis. The SAS Institute developed and maintains JMP as the premier interactive statistical analysis package in the world. SAS, head quartered in Cary, NC, is one of the largest software companies in the USA. It dominates the field of analytical, statistical and graphical systems. The statistical tools available in JMP cover traditional analysis and also include quality control, 'Six Sigma, data mining, Pareto Analysis, and partition methods. JMP went into production in October 1989.

JMP supports a wide array of statistical platforms. We did experiment with several, but the two that offered the most value were:

1) **Oneway Layout**: The principal purpose is for comparing the mean claim rates or claim values per store or per month, with and without ESP. We computed claim rates by dividing the number of claims by the corresponding number of experience months. Then JMP plots the mean of these rates against various categorical variables. The easiest, and most important, categorical variable, is whether or not ESP was used in the particular store for the month measured. We also examined the impact of other categorical variables, including: State, Store Location (Urban/Rural), and Store Size (based on three store square-foot area ranges). There is interaction between these variables that we considered in the analysis.

   A difference in the means is expected. What is important is whether the difference is statistically significant. JMP performs this determination through the calculation of a statistical measure of the Student's t test. The method computes the standard error in the difference of the claim rates and then multiplies that value by the Student's t statistic (the factor is typically chosen to test whether the means are different with a 95% probability. If the actual difference in rates is greater than this value, one has confidence that the rates are truly different and not the result of just random variation. See the calculations in Figure 5.

2) **Tests of Association (for determining if the claim counts in stores with ESP and without are significantly different**.

   This test is simpler to employ than the means comparison above. We take two categorical variables (say, ESP (TRUE or FALSE) versus the number of claims that occur per month (that is, 0, 1, 2, 3. etc.). JMP organizes the actual cell experience counts from the data. It then compares the counts 'expected' if there were no association between the

variables. The expected calculation is simple and can be easily verified with a calculator. The objective of the statistical method is to develop a statistical basis to reject this equality assumption. In fact, when we examined the GleasonESP® data the assumption of no relationship was rejected with over a 99% probability. Figure 5 summarizes the results in a very powerful way because it compares the entire range of claim counts per month for ESP and without ESP.

FIGURE 5

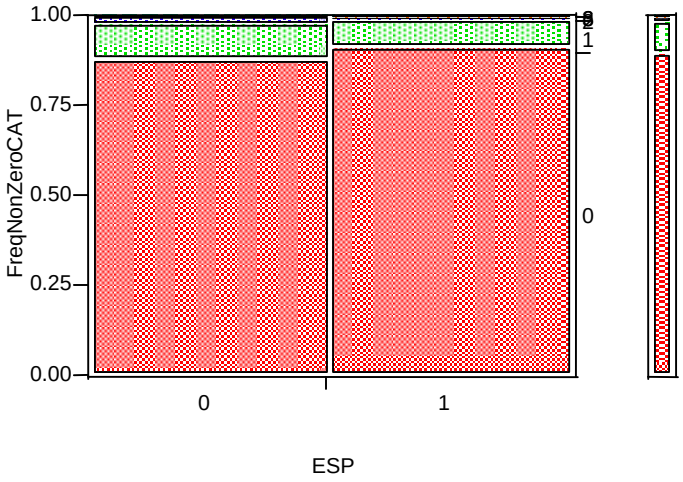
t Test

Assuming equal variances

	Difference	t Test	DF	Prob > |t|
Estimate	0.043310	2.989	2959	0.0028
Std Error	0.014489			
Lower 95%	0.014901			
Upper 95%	0.071719			

UnEqual Variances

	Difference	t Test	DF	Prob > |t|
Estimate	0.043310	2.989	2900.93	0.0028
Std Error	0.014489			
Lower 95%	0.014901			
Upper 95%	0.071719			



Contingency

FreqNonZeroCAT

ESP	Count Expected Cell Chi^2	0	1	2	3	6	
	0	1305 1330.05 0.4718	146 127.957 2.5443	23 17.4941 1.7329	6 3.99865 1.0017	0 0.49983 0.4998	1480
	1	1356 1330.95 0.4715	110 128.043 2.5426	12 17.5059 1.7317	2 4.00135 1.0010	1 0.50017 0.4995	1481
		2661	256	35	8	1	2961

Test

Source	DF	-LogLike	RSquare (U)
Model	4	6.5261	0.0058
Error	2953	1115.0819	
C. Total	2957	1121.6080	
N	2961		

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	13.052	0.0110
Pearson	12.497	0.0140

Warning: 20% of cells have expected count less than 5, ChiSquare suspect

Richard F. Denning, President, founded Shelter Island Risk Services in 1994 after serving as President of Risk Sciences Group (Crawford & Company) for nine years. He focuses on the practical application of analytical and statistical methods to challenges, of loss forecasting, risk financing, loss control analysis, claim modeling, reserve estimation, cost allocation and budgeting. He has authored over thirty articles and is a popular speaker on risk technology issues. Rick began his career of one of the first employees at Anistics (Aon) where we pioneered the use of financial planning, mathematical modeling and database systems in Risk Management. He holds a CPCU designation and is a member of the New York Association of the Bar. Academically, he earned a BS in Metallurgy from Case Western Reserve University, an MBA from New York University, a Juris Doctor from Fordham University and served as Adjunct Professor at the College of Insurance.

Richard L. Aman, Vice President & Regional Director, when Rick joined Shelter Island in 1997, he brought twelve years of risk management experience from Risk Sciences Group. Rick's career at RSG progressed to his managing the New Jersey office. Rick brings practical creativity, mathematical skills, system expertise and accounting discipline to his role. Clients value his ability to communicate and his honesty in providing accurate, even if unpopular, information. Rick earned an MBA (in Finance) and BS in Electrical Engineering from Ohio University.

Dave J. Quinn, Senior Associate, brought ten years of in-depth technical experience when he joined Shelter Island from Risk Sciences Group. This technical acumen and his strong desire to achieve client satisfaction have proven extremely valuable to his clients. His work includes customized user interfaces, development of reporting programs that create charts and graphics, and analytic/financial reporting. His experience at American Express Bank, where helped streamline and improve financial reporting, provided an excellent and powerful base of experience. Dave received his BS in Accounting from Dominican College.
