Impact of LabPiQture on Mortality Slippage of Preferred Classification in Non-fluid Underwriting

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Introduction

LabPiQture (LP) is a commercial data product of ExamOne. An LP hit could instantaneously return some historical physician ordered clinical lab test results for insurance applicants. There has been growing interest in using LP to enhance non-fluid life underwriting in which insurance lab testing is waived. This is not only due to the increasing business desire for having non-fluid or accelerated life underwriting, but also the perceived similarity between physician ordered lab tests and insurance lab testing. However, research on some specific questions is still needed before the underwriting value of LP can be fully understood and accepted. The questions may include:

- How much can LP recover the loss of the exclusive protective value of insurance labs? The protective value refers to the ability of identifying risk higher than standard, i.e. substandard and declined risk.
- How much can LP offset mortality slippage due to the misclassification on preferred risk?

In the past, we published a white paper that specifically addressed the first question. In this paper, we focus on the second question. Data limitations allowed us to narrow this down even further to two specific questions:

- What is the mortality slippage of preferred risk misclassification caused by not having measured blood pressure from paramedical exams and blood cholesterol from insurance lab testing?
- How much of the above mortality slippage can be offset by blood cholesterol in LP?

Key features/findings of the study

- Using a dataset provided by ExamOne, we simulated a comparison between full underwriting (FUW) vs. non-fluid UW with or without LP. Mortality slippage of standard and better risk classes were assessed and compared. We focus on quantification of mortality slippage due to missing blood pressure and cholesterol at non-fluid UW and their impact by LP.
- Mortality slippages of non-fluid UW are due to class "upgrading," in which cases are classified as a better risk class than FUW. Without LP, the three simulated non-fluid UW classes have estimated mortality slippage of 5.0%. The contribution split between missing BP and missing cholesterol are 3% and 2%, respectively. With LP hit, which has about a 50% chance of having at least one historical cholesterol test result available, the mortality slippage is reduced to 3.0%, but only to 4.3% if all "downgrading" cases, which were reclassified into a higher risk class than FUW, are excluded. It appears mortality slippage due to missing cholesterol from insurance lab are recoverable by LP, but mostly through "downgrading."

Defining different types of underwriting by data elements being considered

Preferred classification is mostly based on inputs of smoking status, BMI, blood pressure (BP reading and BP treatment), and cholesterols (total cholesterol, total vs HDL ratio and lipid treatment).

Full underwriting receives measured BMI and blood pressure via paramedical exam. Smoking status can be self-reported but is confirmed by insurance lab testing of urine nicotine. Lipid profiles are acquired through insurance labs and BP/lipid treatment are indicated from Rx or disclosure.

Non-fluid UW either with or without LP uses a self-reported BMI and smoking status plus BP/lipid treatment from Rx. Paramedical exams and insurance labs are waived in non-fluid UW.

In this study, we excluded consideration of smoking, by only including non-smokers in the analysis. We also do not differentiate measured and self-reported BMI. By doing so, we intentionally narrowed down the study question and excluded assessing mortality slippage due to self-reporting bias. Our reasoning is as follows: 1) Even though the overall mortality slippage by non-fluid UW would be underestimated in our analysis, it does not impact the specific goal of our study, which is to estimate mortality slippage due to missing cholesterol and slippage recovery of LP; 2) The self-reporting bias in the context of non-fluid UW is well recognized and has been studied elsewhere.

Table 1. Data element considered for each type of UW

UW type	Build	BP	Cholesterol
Full UW	BMI (measured at paramedical exam)	Readings at paramedical exam	Readings from insurance lab testing
Non-fluid UW without LP	BMI (measured at paramedical exam)	N/A	N/A
Non-fluid UW with LP	BMI (measured at paramedical exam)	N/A	Readings from LP

Dataset

A dataset provided to RGA by ExamOne consisted of test results for a unique subset of de-identified insurance applicants from 2017 to 2019. All applicants had an LP hit and insurance lab testing done. We excluded cases confirmed as smokers and only included cases ranging between age 18-60, who had no missing value of BMI, insurance lab test reading of total cholesterol and total vs. HDL ratio. We also excluded cases who admitted as having diabetes or using any diabetes treatment medications. After the exclusion, the study dataset totaled 53,250 study cases, all having LP hits, and about 50% of those LP hits contained either a total cholesterol reading or both total and HDL cholesterol readings. 80% of cases had an Rx hit.

Preferred classification:

We simulated a preferred risk classification by applying guidelines published by a representative life insurance carrier. It included three standard and better classes, namely Preferred Plus (PP), Preferred (P) and Standard (STD). We used RGA's global underwriting manual to assigns debits for any substandard situation related to BMI, BP or cholesterol. A "knock-out" principal was applied for PP and P class classification, meaning all considered data elements needed to be qualified for the given preferred cut. For example, to be qualified as PP, the case needed to meet PP qualification for BMI, BP and cholesterol.

With the simulated full underwriting (FUW), if any considered data element was substandard, then "debits/credits" principal was applied. For example, a case with elevated total/HDL ratio was rated as 50 debits. If the same case also met BMI cut for PP, it was regarded as having 50 credits. The credit could offset the debits, resulting in a standard case classification. Credits could only bring the class up to standard. In other words, the best class allowed was standard if any of the data elements were substandard with debits.

With non-fluid UW, any cases with any data element suggesting substandard were grouped together to simulate the action of "kick out" (KO) in non-fluid UW.

Mortality slippage assessment

We used a widely adopted methodology in our mortality slippage calculation. A confusion matrix, a classification cross table between FUW (as rows) and non-fluid UW (as columns), were created. Expected relative mortality for classes of PP, P and STD were assumed as 50%, 75%, and 100% respectively. Substandard mortality used debits as a multiplier. For example, +25 is 125%, +50 is 150% etc. The FUW decision was treated as a surrogate of mortality. The "true" mortality was calculated as the weighted average of FUW classifications. "Expected" mortality was calculated as the weighted average of non-fluid classifications. Mortality slippage was the ratio of the above two minus 1.

Results

Table 2. Confusion Matrix, Cross-Classification FUW vs. Non-Fluid UW Without LP

		Non-Fluid UW without LP					
		PP	P	STD	KO		
FUW	Rel Mort	50%	75%	100%		Sub total	%
PP	50%	24,490	0	0	0	24,490	46%
P	75%	1,937	6,688	0	0	8,625	16%
STD	100%	1,739	671	14,277	1,919	18,606	35%
T1	125%	19	14	36	387	456	1%
T2	150%	14	3	22	257	296	1%
T3	175%	10	2	8	261	281	1%
T4	200%	18	1	9	138	166	0%
T5	225%	4	1	6	59	70	0%
T6	250%	1	3	15	151	170	0%
T7	275%	0	0	3	46	49	0%
T8	300%	0	1	0	37	38	0%
T9	325%	0	0	0	1	1	0%
T10	350%	0	0	0	2	2	0%
	N	28,232	7,384	14,376	3,258	53,250	
	%	53%	14%	27%	6%		

Slippage of three classes combined 5.0%

Table 3. Confusion Matrix, Cross-Classification FUW vs. Non-Fluid UW With LP

		Non-Fluid UW with LP					
		PP	P	STD	KO		
FUW	Rel Mort	50%	75%	100%		Sub total	%
PP	50%	23,543	557	381	9	24,490	46%
P	75%	1,581	6,669	357	18	8,625	16%
STD	100%	1,453	662	14,512	1,979	18,606	35%
T1	125%	19	14	35	388	456	1%
T2	150%	14	3	22	257	296	1%
T3	175%	10	2	6	263	281	1%
T4	200%	17	1	10	138	166	0%
T5	225%	4	1	6	59	70	0%
T6	250%	1	3	15	151	170	0%
T7	275%	0	0	3	46	49	0%
T8	300%	0	1	0	37	38	0%
T9	325%	0	0	0	1	1	0%
T10	350%	0	0	0	2	2	0%
	N	26,642	7,913	15,347	3,348	53,250	
	%	50%	15%	29%	6%		
Slippage of three classes combined				3.0%			

Table 2 shows that mortality slippage was due to class "upgrading." For example, while FUW had 46% of PP, it increased to 53% in non-fluid UW without LP, indicating 7% of cases were "upgraded" into PP class. Without considering LP, the three simulated non-fluid UW classes had estimated mortality slippage of 5%. This was due to the combined impact of missing BP and cholesterol values. Additional detailed analysis shows the contribution split between BP and cholesterol was 3% and 2%, with BP having a slightly stronger impact than cholesterol.

After taking the LP results into consideration (Table 3), assuming there was an LP hit, the slippage was reduced to 3%. In other words, the LP reduced the slippage by 2% (5%-3%=2%). It appears almost all the mortality slippage due to missing cholesterol was recovered by LP.

While the mortality slippage of not having insurance labs was exclusively due to "upgrading" (Table 2), the slippage recovery of LP could be from either a decrease of "upgrading" or the addition of "downgrading" (Table 3). "Downgrading" occured for cases classified as a higher risk class than FUW, as showed in the three highlighted cells in Table 3.

If those "downgraded" cases were excluded, then the mortality slippage would be 4.3%, meaning slippage reduction would be only 5%-4.3%=0.7%. This 0.7% represents "upgrading" reduction. It also means the 1.3% (2%-0.7%=1.3%) mortality slippage reduction was due to the "downgrading." Overall, "downgrading" appeared to have a stronger impact.

The reason why "downgrading" occured was because the historical cholesterol was worse than current cholesterol, therefore classifying cases into a higher risk class. The reason LP reduced "upgrading" was that LP cholesterol could also capture the elevated cholesterol detected by insurance labs. Data shows that if there is an LP hit, 50% of those hits would contain at least one cholesterol value. Overall, the test values found in LP indeed appeared to be close to what was found in insurance labs. The correlation coefficients, which measure the linear similarity between any two values, were 0.66 for total cholesterol and 0.73 for total over HDL cholesterol ratio. (Value of 1 means a perfect match, and 0 means totally non-related.)

It is expected that if we limit the data to cases having more recent LP cholesterol values, then the LP cholesterol would be closer to replacing insurance labs and decrease morality slippage through "upgrading" reduction.

Table 4 shows how the recency of LP results (time between underwriting and cholesterol tests performed) impacts the correlation coefficient between LP and insurance lab cholesterol. As expected, the correlation coefficients increased as the LP results were more recent, while the percentage of cases with the more recent value decreased significantly. For example, there were only 7% of cases where the LP hit returned a cholesterol value within 6 months.

Table 4. Correlation coefficients for total cholesterols and total vs HDL ratio between LP and insurance lab, stratified by LP cholesterol value's recency

	<6 months	<12 months	<24 months	<36 months	All
Total cholesterol	0.72	0.72	0.70	0.69	0.66
Total/HDL	0.76	0.78	0.77	0.76	0.73
% coverage	7%	12%	20%	25%	50%

Table 5 shows mortality slippage with different data inclusion criteria. Mortality slippage for all LP hits was 3.0%, and only 1.4% if LP hits without cholesterol values were excluded, a net improvement of 1.6% (3.0-1.4=1.6%). This net improvement was due to the data exclusions. The net improvement was 0.5% (4.3-3.8=0.5) if "downgrading" was not considered. Again, this means "downgrading" still plays a bigger role. Further, limiting the data to cases having an LP hit cholesterol within 12 months further reduces the slippage by 0.3% (1.4-1.1=0.3%). However, this time, the improvement remains the same without "downgrading" (3.8-3.5=0.3). It means this further mortality slippage reduction was all due to reduction of "upgrading". It was expected because cholesterol for LP and insurance labs become very similar.

Table 5. Mortality slippages with different inclusion criteria

	All LP hits	LP with cholesterol	LP with cholesterol test within 12 months
N (% of all LP hits)	53,250 (100%)	26,831 (50%)	6,508 (12%)
Total mortality slippage	3.0%	1.4%	1.1%
Mortality slippage after excluding "downgrading"	4.3%	3.8%	3.5%

Although our analysis only focused on standard and better risk classes, the group of "kick-out" or KO should not be completely ignored because the majority of the KO cases were "down-graded." KO are all cases with at least one of the data elements suggesting a substandard class, but most of them are standard by FUW due to the "debits/credits" offset as explained earlier.

The key finding from this study was that although cholesterol values in LP were similar to those in insurance labs, the mortality slippage reduction was more from class "downgrading" than reduction of "upgrading."

"Downgrading" means classification of cases into higher risk classes than FUW. In practice, the impact of this on non-fluid UW mortality might depend on the specific context in which the answers of the following two questions matter: (1) Will those downgraded cases have a significantly lower placement rate? (2) Do those "downgraded" cases have elevated mortality? Different answers to the above questions would impact the value assessment of LP on preferred risk classification.

The significance of this study is that it demonstrates how alternative UW evidence alleviates the mortality slippage due to missing traditional UW evidence. Alternative UW could either reduce the class "upgrading" by recovering the missing information or creating additional "downgrading" by discovering information that is not seen in traditional UW. As underwriters, we tend to hope alternative evidence would provide more of a "one-to-one" replacement of traditional UW evidence so the "upgrading" can be reduced, but in reality, just like the LP cholesterol example studied here, it is the "downgrading" impact of alternative UW evidence that may be the more important factor. This makes the business decision of adopting alternative UW evidence more complicated than simply assuming a "one-to-one" replacement.