

Munich Re Life US

ExamOne LabPiQture™

An In-depth Exploration of Clinical Lab Histories

Munich Re Life US reviewed the LabPiQture™ product from the ExamOne HealthPiQture™ suite as part of a collaborative effort to better understand the value of various medical data sources and tools. LabPiQture provides clinical laboratory test history for an insurance applicant, obtained from ExamOne's extensive clinical laboratory database. ExamOne shared a sample of de-identified, LabPiQture results for recent U.S. life insurance applicants who completed insurance exams with ExamOne and also had a LabPiQture hit – for example, at least one clinical lab test found within the prior seven years, regardless of test type. We provide an overview of common lab tests identified in this sample and explore the potential value of this clinical lab data for risk assessment in this article.

LabPiQture™ Overview

A LabPiQture report from ExamOne will contain up to seven years of clinical lab test results. These results are obtained from the vast network of Quest Diagnostics and LabCorp, and are populated with physician-ordered laboratory tests related to preventative care, disease monitoring and diagnostic purposes, with some additional coverage from biometric screenings. Additional medical context returned with the test results are date of service, ordering physician specialty, submitted diagnosis codes (ICD-9/10-CM), and a standardized test type identifier. This data is HIPAA compliant with applicant authorization and meets FCRA requirements.

Key Findings:

- Clinical laboratory histories from ExamOne's LabPiQture product contain tests results that are relevant to life underwriting. Lipids and most liver function tests are available on about 50-60% of LabPiQture records, and in those cases, multiple measurements for each lab over time are also common.
- The range of clinical tests available, such as Complete Blood Count panels that are typically not ordered as part of an insurance exam, may provide additional health insights. On the other hand, some lab tests that are commonly used in life underwriting, such as GGT and cotinine, are rarely available.
- Hit rates vary by age, gender, and geography. In this study dataset where all individuals had a LabPiQture record, insurance-relevant tests are found in the clinical histories at higher rates for males and for older ages.
- The most recent clinical test results are older than the corresponding insurance exam labs by a median difference of slightly under two years. Older issue ages have more recent clinical test results compared to younger ages for most insurance-relevant tests.
- Most applicants show alignment between the LabPiQture clinical test values and the insurance exam labs. The alignment tends to be stronger when the clinical test is more recent.

Study Data

The sample LabPiQture data supplied by ExamOne consists of approximately 72,000 unique life insurance applicants with LP hits. Additional processing of the raw LabPiQture records was necessary given the range of tests and result types returned. We decided to focus on lab tests that are typically ordered during life underwriting. Filtering down to those tests of interest was facilitated by LOINC codes, an international standard for uniquely identifying health measurements. Carriers looking to incorporate LabPiQture will also need to clean and filter the raw data as not all lab results returned are relevant to current underwriting practices, and may require unit standardization.

Table 1. Data Summary

Who	<p>72k recent US life insurance applicants who completed insurance exams with ExamOne and had a LabPiQture hit within 7 years of the date of insurance exam (proxy for underwriting date).</p> <ul style="list-style-type: none"> • 52% Female, 48% Male • Females skewed slightly younger, with a median age of 44 vs 48 for males. • Nearly 50% of the individuals are from the South, with the remainder evenly distributed between the Northeast, Midwest, and West.
What	<ul style="list-style-type: none"> • LabPiQture records: Over 10 million individual clinical test results, representing 5,000+ unique test types. Clinical results from multiple dates for a single test type/applicant may be observed. • Additional fields specific to this study: <ul style="list-style-type: none"> • Applicant demographic profile • Insurance exam lab results
When	Insurance applications from 2017 Q2 to 2019 Q3

Insurance Related Lab Tests with High Prevalence in LabPiQture

Table 2 identifies lab tests that are typically ordered as part of life insurance exams that also have high prevalence in the LabPiQture records. The rates in this table represent the percent of people in this sample for whom the specific laboratory test can be found in their clinical history. For each lab listed in Table 2, approximately 50-60% of LabPiQture clinical histories have at least one valid result for the specified lab test. HbA1c is the exception with only 26% prevalence. However, we observe that the prevalence of HbA1c more than doubles (58%) for individuals whose insurance exam test result for HbA1c indicates pre-diabetes or diabetes (5.7% or above). This implies that HbA1c is ordered for cause in clinical settings, and confirms that LabPiQture does capture relevant HbA1c results.

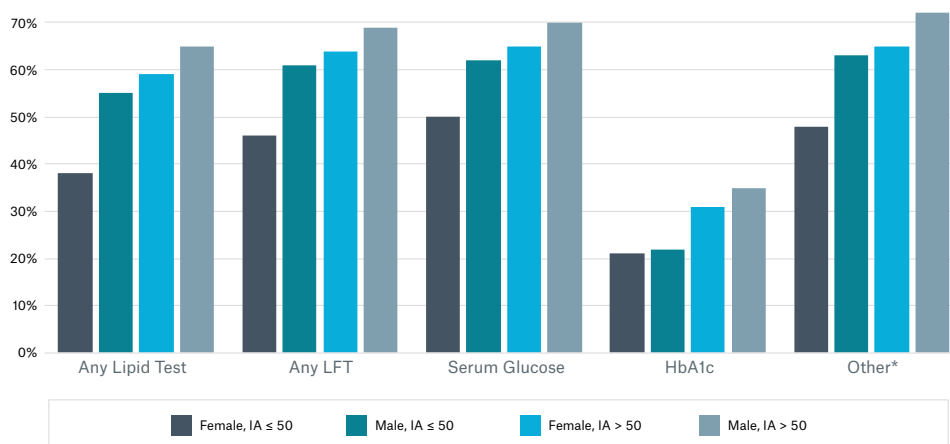
Table 2. Test Prevalence in LabPiQture (LP)

Test Name	# LP hits with test / Total # of LP hits for each test listed
Lipids <ul style="list-style-type: none"> • Total Cholesterol • HDL • LDL • Triglycerides 	51-52%
Liver function <ul style="list-style-type: none"> • AST • ALT • ALP • Bilirubin 	57-58%
Sugar metabolism <ul style="list-style-type: none"> • Serum Glucose • HbA1c 	<ul style="list-style-type: none"> • 60% • 26%
Other blood tests <ul style="list-style-type: none"> • Albumin • Globulin • Serum Creatinine • BUN 	56-59%

Prevalence Patterns by Age and Gender

In this sample data, male records are more likely than female records to have at least one clinical result for the core test groupings identified in Table 2. This is depicted in Figure 1, which also shows that these gender differences are larger at younger issue ages. This is partially explained by Ob/Gyn related tests for younger females, where having an Ob/Gyn related clinical encounter may generate a LabPiQture hit for a female applicant, but does not necessarily result in insurance-relevant tests. Most of the clinical results identified in Table 2 are generated by general/family practice or internal medicine related visits.

Figure 1. % of LP Hits with Given Clinical Test, by Gender and Issue Age



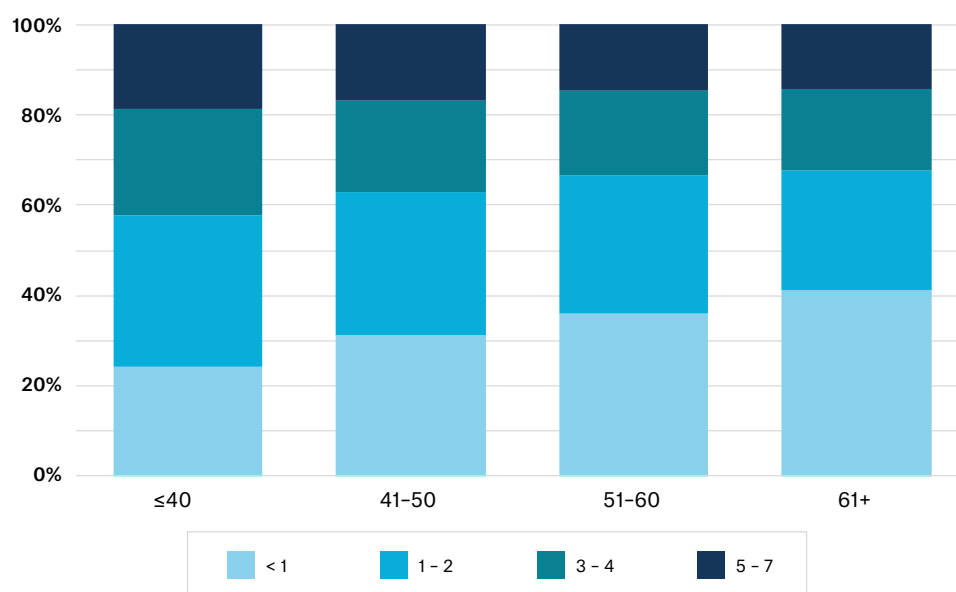
Aggregated clinical test prevalence among LP hits by gender and issue age. Test groupings align with Table 2, where "Other" refers to serum albumin, globulin, creatinine, or BUN.

Figure 1 also shows that older issue ages have higher prevalence for these clinical tests compared to younger ages (after controlling for gender). Differences are also observed by region, with lower prevalence in the Midwest (not shown). Please note that these patterns relate to individuals with LabPiQture records (i.e. any clinical lab history), and not overall hit rates.

Time Difference Between Clinical Tests and Underwriting

For each of the tests listed in Table 2, the most recent clinical test results are older than the corresponding insurance exam labs by a median difference of just under two years. There is a strong age effect, with older issue ages returning more recent clinical test results than younger ages, as shown in Figure 2, which uses male total cholesterol as an illustrative example. Females exhibit a similar pattern to males, but the trend by age is less steep. For issue ages under 40, female clinical labs on average are slightly more recent than male tests. Timing differences between the genders diminish with increasing issue age and are largely negligible by issue age 60.

**Figure 2. Time Since Most Recent Clinical Test:
Male Total Cholesterol (Distribution by Issue Age)**



Distribution of the difference in years between the most recent clinical total cholesterol result and the insurance exam, by 10-year issue age bins, males only.

Clinical Test Results From Multiple Dates

Each of the common lab tests listed in Table 2 are frequently available at multiple dates, representing different clinical encounters over time. These multiple measures could potentially construct a clearer view of how an applicant's health has been trending, particularly for complex cases. For each of the labs listed in Table 2, over half of the individuals with at least one clinical result for a given lab actually have multiple results for that same lab throughout the span of their clinical history. In these multiple result scenarios, two or three results per test are most likely, although some individuals have many more.

Clinical vs Insurance Exam Result Consistency

As this sample dataset was populated with both LabPiQture hits and insurance exam lab test results, we could compare the consistency of lab values obtained from these two sources. An example of the graphical approach used is detailed in the sidebar below (Figure 3), shown specifically for male total cholesterol.

We generally observe positive association each for the lab tests addressed previously in Table 2. The clinical test result and the insurance exam result also tend to be more similar in value when the time difference between the two is shorter. Blood glucose clinical tests do show more variance relative to the corresponding insurance exam value than most of the other lab tests, which may be related to lower stability of blood glucose measurements over time, different fasting regimes prior to testing, and/or degradation of samples due to glycolysis.

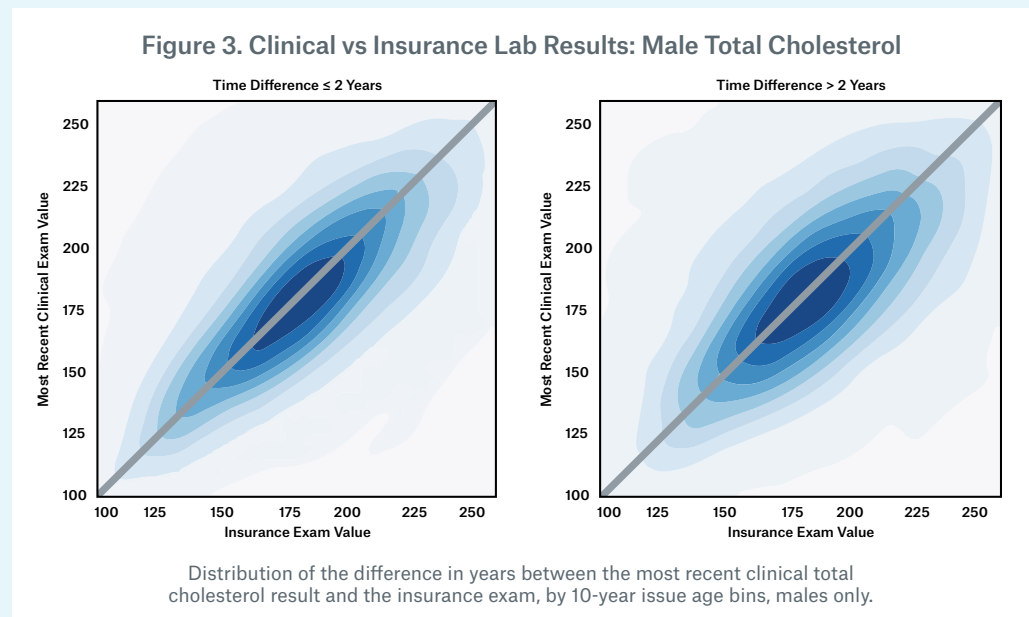
Example: Clinical vs Insurance Exam Result Consistency

This collaborative study dataset was populated with both LabPiQture records and insurance exam lab test results, enabling a comparison of the consistency of lab values obtained from these two sources and the impact on underwriting outcomes. We used several approaches including graphical comparisons which are described here.

Figure 3 shows example plots for males comparing the alignment of total cholesterol values from the actual insurance exam (on the x-axis) with the most recent clinical total cholesterol result (on the y-axis). Since a large number of applicants are considered and can't be clearly shown as individual datapoints, the plot uses colored bands to summarize where the datapoints are located. Each colored band represents the position of 12.5% of the total datapoints for a given plot. The visualization below is also split on the age of the clinical result relative to the insurance exam test in order to investigate if the magnitude of the time difference influences how closely the values align. Specifically, the left plot shows clinical labs that are less than 2 years older than the insurance lab test, and the right plot shows clinical labs that are over 2 years older.

The applicants largely track with the gray line of equality (where clinical total cholesterol exactly equals insurance exam total cholesterol), showing alignment between the clinical and insurance results, although it is not perfect. Some differences between the clinical and insurance exam values are expected, possibly related to aging and change in health status over time

or different laboratory protocols. The narrower the colored bands are and the tighter the bands lie along the gray line of equality, the greater the share of people where the clinical test values are most similar to the insurance exam values. So the narrower bands of the left plot indicate a slightly better consistency between the clinical and insurance exam total cholesterol results when the clinical results are more recent.



Insurance Related Lab Tests with Low Prevalence in LabPiQture

Some insurance-relevant labs that are found infrequently in the clinical histories in this sample include:

- **Biometric measurements** such as **height, weight, and blood pressure**: Some results are found for about 2% of hits.
- **Cotinine** (whether obtained from blood serum, urine, or saliva): Very rare as testing for smoking lacks clinical diagnostic significance.
- **GGT**: Available on less than 4% of records in this sample; infrequently ordered in clinical settings compared to the rest of the liver function tests.
- **Qualitative and semi-quantitative urinalysis** (for example, **urine creatinine, protein, glucose or albumin**): Roughly 7-25% prevalence per test, but requires extra refinement to only capture the exact tests of highest relevance.
- **Drug Abuse Screens (Opioids, Marijuana, Cocaine, etc.)**: Present in approximately 3% of records.

In addition, the following labs are found at slightly higher rates, though with strong gender and age patterns:

- **PSA**: Over 50% of records for males over the age of 45 have at least one result.
- **HIV**: For females, the highest test prevalence is observed at issue ages under 40 (~35% of records have a related test), and overall, 21% of female records have a test. Males have a less steep trend by age and an overall prevalence of 12%.
- **Hepatitis B**: Very similar to HIV.
- **Hepatitis C**: Age and gender differentiation is similar to Hepatitis B, but less extreme. Overall, 20% of female records and 16% of male records have a result.

The consequences of not being able to rely on clinical histories for obtaining these labs which have protective value for insurance underwriting depends on the how LabPiQture results are incorporated into an underwriting workflow as well as any overlapping data sources available (i.e. medical disclosures, additional third-party evidence such as prescription drug records, smoker misrepresentation predictive model output, etc).

Additional Lab Tests

Additional labs that are commonly found in LabPiQture records but not typically received from life insurance labs are listed in Table 3. The most notable novel information from LabPiQture is Complete Blood Count panels, available in over 60% of clinical histories. The components of a complete blood count can be used to detect anemia, infection, and certain blood disorders and diseases that wouldn't necessarily be detected by standard metabolic or lipid panels, with potential for additional risk segmentation on top of the traditional labs received.

Table 3. Additional Labs Available From LabPiQture

Panel Name	Prevalence
Complete Blood Count <ul style="list-style-type: none"> • RBC, hemoglobin, hematocrit, WBC, WBC differential, platelets 	Approximately 60% of hits had at least one test.
Thyroid <ul style="list-style-type: none"> • TSH, T3, T4 	More than 50% of hits had at least one test.
Others: Inflammation markers, vitamin deficiency, male/female hormones, urine culture, pap smear, etc.	

Production Hit Rates

Actual production hit rates for the LabPiQture product will vary by carrier due to insurer-specific distributions of applicant age, gender, geography, and socioeconomic attributes. These factors are related to hit rates via differing levels of accessibility to healthcare and engagement with medical providers, varying frequency of in-hospital vs non-hospital lab testing, and the option to use regional laboratory networks. ExamOne states that LabPiQture covers nearly 80% of non-hospital testing and that the all-ages raw hit rate is 53%, with individual regions (including Arizona, Connecticut, D.C., and New Jersey) exceeding 70%.

LabPiQture in Practice

The clinical test histories obtained from LabPiQture can complement current risk assessment practices or be used to develop new ones. For example, clinical test results could be used to trigger a specific underwriting path during accelerated underwriting, with the goal of increasing throughput while minimizing additional mortality cost. Under current COVID-19 pandemic conditions where obtaining insurance labs or APSs has come under additional strain, some carriers are using clinical labs in lieu of insurance exams temporarily, or to move the process along more quickly.

The structured nature of the LabPiQture record means that after an initial exploration stage, automating data cleaning and standardization would be fairly straightforward for common tests. This is particularly relevant if the data is consumed downstream by a rules engine or predictive model. Models may need to be calibrated to reflect some of the characteristics for clinical labs. For example, the presence of an HbA1c clinical test on its own may be informative, given that it tends to be ordered for cause, and so any missing value imputation would need to reflect this. Finally, LabPiQture results may contain additional lab tests not traditionally ordered during underwriting but known to be associated with mortality, which creates new opportunities for additional risk segmentation or protective value.

Summary

Munich Re's analysis based on the collaborative study data provided by Exam One demonstrates that LabPiQture returns clinical test results that correspond with life insurance laboratory testing, as well as additional lab information such as other tests not commonly ordered in insurance exams or multiple measurements over time that could expand current risk assessment. Individual carriers should perform a study on their own block of business to assess hit rates and test prevalence as well as the cost-benefit of adopting this additional data source. Munich Re can work with insurers to set up the validation and cost-benefit study, and assist them in incorporating this additional information in their underwriting process.

We also recently validated ExamOne's HealthPiQture scores, an analytics suite with multiple mortality score components, including a lab mortality score that is derived from LabPiQture clinical histories. Read more for discussion of the effectiveness of this score in segmenting mortality risk.



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