Patient Economic Well-being Score™
White Paper
PEWS
by sikka.ai

Understand patient propensity to pay and construct unique payment strategies
WHAT IS PEWS AND HOW CAN PEWS HELP RETAIL HEALTHCARE PRACTICES?

PEWS (Patient Economic Well-Being Score™) is a patient-level score that shows the probability that a patient will pay his or her bill within 60 days. Scores range from 0 - 100 with 0 indicating a low Economic Well-being and 100 indicating a very high propensity to pay. Each patient in each practice on Sikka’s platform, after appropriate consent, is eligible to receive a score.

PEWS is different from a traditional credit score such as FICO®, TransUnion® or Experian®. Credit score is calculated based on credit card payment history, credit utilization, credit history and credit mix, etc. and can be dated, while PEWS is calculated based on a patient’s prior payment behavior for oral health-related procedures.

PEWS has the potential to be a powerful tool to help practices inform decisions about whether they should provide loans to a patient and what loan interest rates for different patients should be. PEWS could also be used in the “Buy Now, Pay Later” (BNPL) business model effectively because it is contextual (knows the past history of the patient) and current (better at obtaining recent information than traditional credit scores such as FICO®).

HOW PEWS WAS CALCULATED AND WHAT FEATURES WERE USED

The Patient Economic Well-Being Score™ machine learning model uses artificial intelligence and data from the Sikka Platform™, an API platform that connects to over 97% of practice management systems and contains over 35,000 practices and 120 million patients, to predict the probability that the patient will pay their bill within 60 days. PEWS is calculated based on a patient’s demographics, insurance information, payment history, procedure history and patient behavior data, including the features listed below.

The features include:
- age
- gender
- marital status
- geographic location
- guardian information
- cash to insurance ratio
- claim settlement ratio
- how many different insurance companies sent claims for the patients
- how many procedures in each procedure type
- dollar amount spent in each procedure type
- number of visits
- how long they have been going to a certain practice
- broken appointment ratio.
We used these features to establish tree-based models to predict the probability of the patient’s ability to pay the bill. We used Information Value, one of the most useful techniques for selecting important variables in a predictive model, to determine which variables to incorporate into the final model.

**GINI**

Another metric used to evaluate the model's performance, Gini index, which indicates the model’s discriminatory power, namely, the effectiveness of the model in differentiating between “good” patients, who will not default in the future, and “improvement” patients, who may default in the future, is good at 0.87. The model also passed the K-S statistic test, which similarly measures the discriminatory power of a model.

**AUROC**

AUROC, the area under the receiver operating characteristic, was used to evaluate the classification model and is good at 0.93. After we established the model, we converted the probability to a score for use. The higher the score is, the higher the probability of paying the bill is.

**PSI**

In the score development process, we used PSI (Population Stability Index) to validate that the score was stable in both the development dataset and validation dataset.

The plot below shows how actual ‘good’ and actual ‘improvement’ patients are distributed vs the PEWS distribution. The blue bars represent actual ‘good’ patients and the orange bars represent actual ‘improvement’ patients. The x-axis represents the PEWS that was calculated from predicted probability and the y-axis represents what percentage of patients fall in each bin. Most ‘good’ patients have a score greater than 50 while most ‘improvement’ patients have a score smaller than 50.
Based on the score distribution, we can segment the patients into different segments based on the bill paying risk: ‘high propensity to pay’ (score greater than 55), ‘medium-to-high propensity to pay’ (score between 40-55), ‘medium-to-low propensity to pay’ (score between 20-40) and ‘low propensity to pay’ (score below 20). Practices can make different payment strategies for different patient segments. Let’s take a look at two examples.

Example A

Patient A, age 30, has been in the practice for more than 20 years and has visited the practice 4 times. She did a great job in the history of payment and reached a cash-to-insurance ratio of 10, which means that she has good cash payment ability. Most of the procedures done on her were diagnostic and preventative procedures, which are not very expensive and lower the risk of missed payments. As for her appointment behavior, she hasn’t missed any appointments with the practice. Once she gives consent to evaluate her PEWS score, the score value is 87.

Example B

Patient B, age 38, has been in the practice for 13 years and has just visited the practice twice. In those two visits, he underwent 5 restorative procedures, 2 oral maxillofacial procedures and 1 orthodontic procedure, which are more expensive than diagnostic and preventative procedures, therefore increasing the risk of missed payments. Based on data in the Sikka database, we found that the patient has a high broken appointment ratio at 0.6, which means that he tends to miss or cancel his appointments. We also found that he did not show much cash payment ability in the past. Some of the claims he sent to insurance companies were not paid so he had to pay by cash. This increases the paying risk. In addition, he is also a guardian for a patient, which increases the paying burden. Thus, he was given a PEWS score of 37, showing a medium default risk. To check the accuracy of PEWS, we checked the real data and found that Patient B did not, in fact, pay off all the bills within the expected 60 days time frame.
Payment companies, buy now pay later companies, membership clubs and receiveable companies can benefit from using PEWS score from Sikka.

These days many patients will delay paying their bills. Payment and receivable companies are experiencing risks of not being able to receive payments on bills from patients on time. PEWS can be used to optimize revenue cycle management strategies. Costs of some expensive dental procedures such as implant services or orthodontics procedures have reached $4,500 and $7,000 per treatment. Some patients may not have the financial ability to immediately start the treatment plans. Loan companies will help and even provide them the option to first get the procedure done and then pay the bill within a certain number of days. To lower the risk, the ‘Buy Now Pay Later’ companies need to evaluate the bill paying ability of a patient before they provide the loan to them. PEWS is a great evaluation tool, checking the patient propensity to pay.

Reference: