

Introduction

Quality of life (QoL) is a critical factor in the care of patients with leukaemia, influencing treatment choices and well-being.

Data are lacking on how demographic, socioeconomic, and psychosocial factors are predictive of QoL. Understanding how to classify and predict QoL using a validated patient-reported outcome measure (HM-PRO) can provide insights to improve patient care and tailor interventions.

Aim

To provide evidence that can influence clinical practice and policy by identifying factors that can predict impact on QoL.

Methods

We performed an online cross-sectional study of a 100-item questionnaire conducted in 2023 by the Acute Leukaemia Advocates Network (ALAN), CLL Advocates Network, CML Advocates Network, and Picker to explore the experiences, perceptions, and QoL of adult patients with leukaemia.

The Haematological Malignancy Patient-Reported Outcome (HM-PRO) instrument assesses various dimensions of QoL and symptom burden. The HM-PRO Part-A measures general physical, emotional, and social well-being, and HM-PRO Part-B evaluates disease-specific symptoms and their impact on daily activities. Higher scores represent poorer QoL and more severe symptom experience.

The survey items included the HM-PRO, demographic, socioeconomic, and psychosocial factors, and used Gradient Boosting Decision Trees (GBDT) to predict QoL classifications of grouped HM-PRO scores. We used Python 3.11 to invoke *LightGBM* models, that were optimized using *HyperOpt* library.

Results (demography)

There were 2260 leukaemia patients responding across 64 countries. 1251 (55%) were female. Median age was 57 years (range 17-92). The most common leukaemia was Chronic Lymphocytic Leukaemia (Table 1).

A subset of these respondents provided HM-PRO scores:

- HM-PRO Part-A: 1993 respondents, 55% (n=1102) were female, median age 58 years (range 17-92).
- HM-PRO Part-B: 1951 respondents, 55% (n=1075) were female, median age 58 years (range 17-92).

Table 1: Study participants' reported Type of leukaemia

Leukaemia Type	n	%
Acute myeloid leukaemia (AML)	341	15.1
Acute lymphoblastic leukaemia (ALL)	271	12.0
Chronic lymphocytic leukaemia (CLL)	846	37.4
Chronic myeloid leukaemia (CML)	660	29.2
Other leukaemia	142	6.3
Total	2260	100

Investigating the key predictors of quality of life in leukaemia patients: analysis of global study data using gradient boosted decision trees

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Key messages

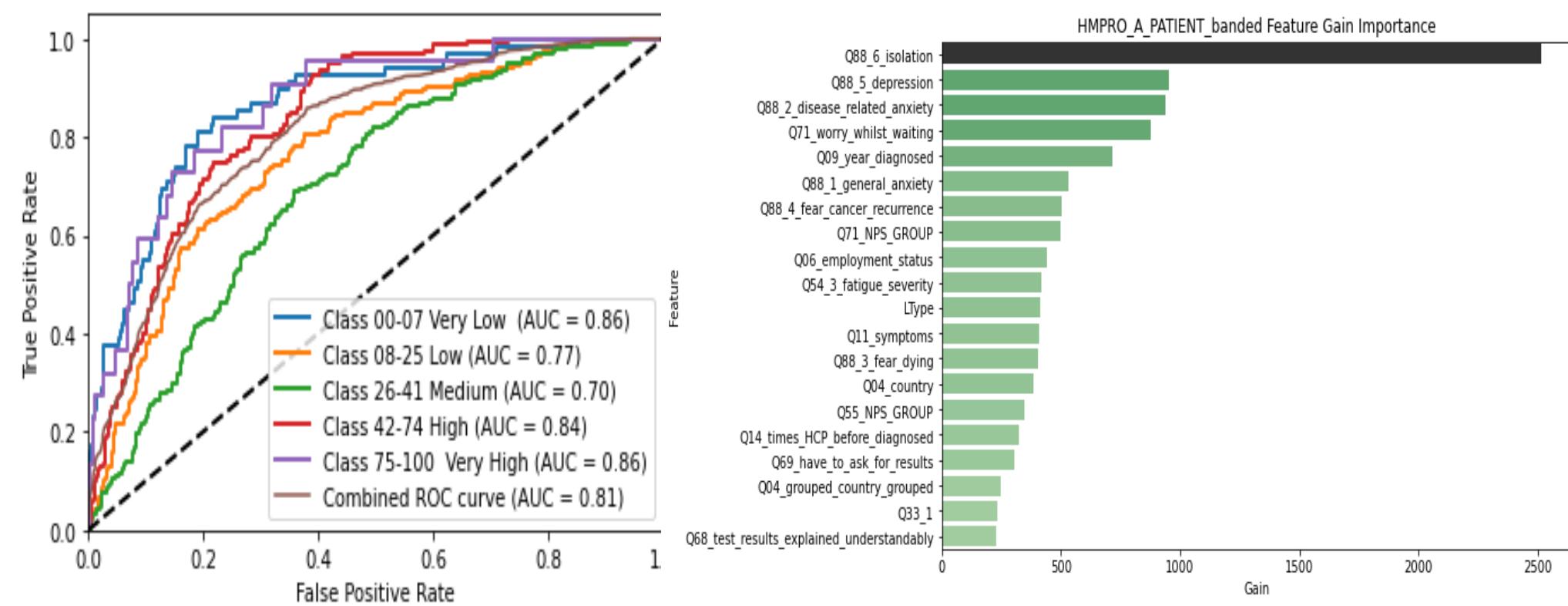
- Quality of life (HM-PRO Part-A scores) of patients with ALL (n=219) and AML (n=278) was more impaired than that for patients with CLL (n=771) and CML (n=601)
- Patients aged 18–25 reported worst quality of life (n=101; HM-PRO Part-A) and symptoms (n=97; HM-PRO Part-B)
- The five most important predictors were year diagnosed, symptoms, isolation, depression, and worry while waiting.
- The models for the HM-PRO Part-A and Part-B share similar predictors - this indicates psychological factors, such as isolation and depression, play a large role in QoL in patients with leukaemia, impacting general and disease-specific aspects of QoL
- Disease-related anxiety was more strongly associated with the HM-PRO Part-A, highlighting emotional strain related to disease symptoms, which as a predictor for HM-PRO Part-B underscores direct disease impact
- Increased patient engagement in treatment decisions, clarity of information on treatment side effects and transparent communication may serve as protective factors against the psychosocial burden of leukaemia, suggesting the important role of patient support groups.

Results (models)

The HM-PRO Part-A score was predicted with moderate accuracy (54.0%; F1-score 0.526), but the Area Under a Curve (AUC) for the Receiver Operating Characteristic (ROC) curve was relatively high (0.81), indicating good overall performance (Figure 1).

The five most important predictors were isolation, depression, disease-related anxiety, worry while waiting, and year diagnosed (Figure 2).

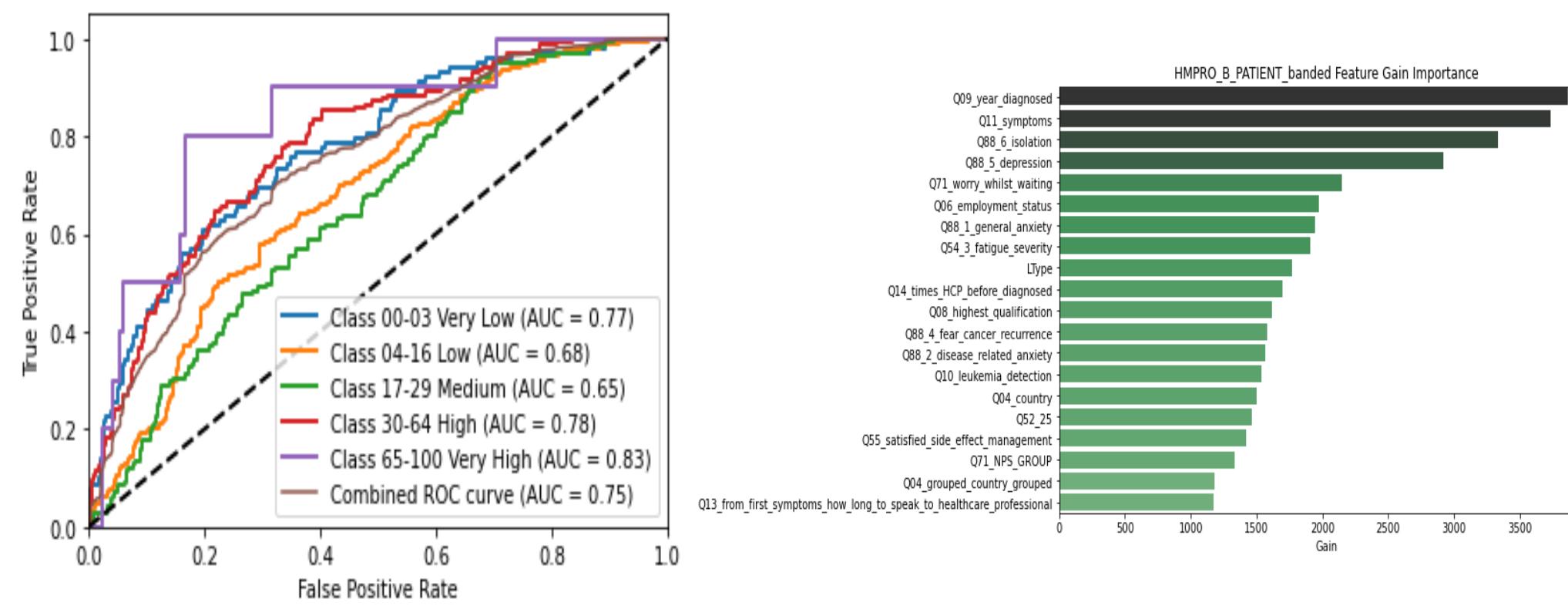
Figure 1: HM-PRO Part-A – ROC Plot. Figure 2: HM-PRO Part-A – Feature Importance



The HM-PRO Part-B score was predicted with low accuracy (47.5%; F1-score 0.448), yet the AUC was moderately high at 0.75 (Figure 3).

The five most important predictors were year diagnosed, symptoms, isolation, depression, and worry while waiting (Figure 4).

Figure 3: HM-PRO Part-B – ROC Plot. Figure 4: HM-PRO Part-B – Feature Importance



Next steps

The difference between accuracy and AUC shows a need for care when interpreting these models. Even if the exact predictions are not always correct (low accuracy), high AUC means the models can recognize whether a patient's QoL is relatively high or low. This makes these models more useful for exploring what affects QoL and identifying areas for improvement rather than making clinical decisions or exact predictions of the QoL score of a person.

Research could focus on using larger datasets and improving the model design to make predictions more reliable. This could help develop more personalized approaches to care.