# ICD-10-AM codes for cirrhosis and related complications: key performance considerations for population and healthcare studies: Supplementary material

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## Additional Methods: Data Linkage and Study Cohort

The Queensland Hospital Admitted Patient Data Collection (QHAPDC) registry contains clinical and socio-demographic information on all hospital episodes of care for patients admitted to hospital in Queensland, Australia. The state of Queensland adopted ICD-10-AM from ICD-9-AM in the year 1999. Data relating to admitted episodes of care are coded using the current version of ICD-10-AM; Australian Classification of Health Interventions; and Australian Coding Standards, "as a means by which admitted patient activity can be reported, monitored, evaluated, planned for and researched, thereby allowing improved and objective decision-making" (Statistical Services Branch, 2020). Assignment of ICD-10-AM diagnosis codes is impacted by the Australian Coding Standards, which stipulates the condition be either the chief reason for admission, or required commencement, alteration or adjustment of therapeutic treatment; diagnostic procedures; or increased clinical care and/or monitoring during the encounter.

As previously described (Powell et al, 2019), all public and private hospital admissions were ascertained from the Queensland Hospital Admitted Patient Data Collection registry (QHAPDC) between 1st July 2007 and 31st December 2016 for every patient that had *at least one* encounter during this timeframe which contained an ICD-10-AM code for cirrhosis or related complications; and/or death with a Principal or Other code of interest as a cause of death ('parent cohort'). This 'parent cohort' included a total of 344,100 hospital admissions, of which 30,716 admissions occurred at the Princess Alexandra Hospital between 1st January 2009 and 31st December 2016. For each ICD-10-AM code examined in the current study, a random sample of admissions from the Princess Alexandra Hospital cohort were ascertained, totaling 542 encounters.



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## Additional Methods: Data Collection and Analysis

Four clinicians (EP, AJ, NB, BM) blinded to QHAPDC coding conducted a comprehensive review of patients' medical records and extracted data for each audited encounter. The presence of cirrhosis, HCC, ascites, varices, SBP, and HE was collected. The presence of cirrhosis was determined by documentation of cirrhosis in clinical notes, evidence of cirrhosis on imaging, or a liver biopsy specimen with validated report describing cirrhosis during or prior to the audited encounter. Cirrhosis-related complications were confirmed by documentation in the clinical notes or visualization (i.e. on imaging or endoscopy) during the audited encounter. The relevance of each complication to the audited encounter was also categorized as either pertinent (requiring active management or monitoring) or not a current issue, in line with the Australian Coding Standards.

## References

Statistical Services Branch, Queensland Health. QHAPDC standard: Clinical coding. Brisbane, 2020.

Powell EE, Skoien R, Rahman T, Clark PJ, O'Beirne J, Hartel G, et al. Increasing hospitalization rates for cirrhosis: verrepresentation of disadvantaged australians. EClinicalMedicine 2019;11:44-53.

**Supplementary Table 1A. Measures of accuracy between ICD-10-AM codes and the medical record**

| Measure | Calculation |
|---|---|
| **Sensitivity**<br>*Proportion of patients who have cirrhosis (or a complication) correctly identified by ICD-10-AM codes* | True positive / (true positive + false negative) |
| **PPV**<br>*Proportion of encounters with ICD-10-AM code(s) that correctly identify patients with cirrhosis (or a complication)* | True positive / (true positive + false positive) |
| **NPV**<br>*Proportion of encounters without ICD-10-AM code(s) that correctly identify patients without cirrhosis (or a complication)* | True negative / (true negative + false negative) |

**Supplementary Table 1B. Classification table cells and definitions**

| | | **Disease / condition (on medical record review)** | |
|---|---|---|---|
| | | Present (+) | Absent (-) |
| **Test (ICD-10-AM code)** | Code present (+) | True Positive | False Positive |
| | Code absent (-) | False Negative | True Negative |

**Supplementary Table 2. Accuracy of select ICD-10-AM codes to identify the presence of cirrhosis**

| ICD-10-AM code | n with code | PPV (95% CI) | NPV (95% CI) |
|---|---|---|---|
| **Cirrhosis** | | | |
| K70.1 *Alcoholic hepatitis* | 45 | 0.62 (0.48-0.75) | 0.22 (0.19-0.26) |
| K70.2 *Alcoholic fibrosis and sclerosis of liver* | 10 | 0.30 (0.09-0.61) | 0.22 (0.19-0.26) |
| K70.3 *Alcoholic cirrhosis of liver* | 193 | 0.97 (0.95-0.99) | 0.35 (0.30-0.40) |
| K70.4 *Alcoholic hepatic failure* | 102 | 0.90 (0.83-0.95) | 0.27 (0.23-0.31) |
| K72.1 *Chronic hepatic failure* | 41 | 0.78 (0.64-0.89) | 0.24 (0.20-0.28) |
| K72.9 *Hepatic failure, unspecified* | 61 | 0.90 (0.81-0.96) | 0.25 (0.22-0.29) |
| K74.0 *Hepatic fibrosis* | 30 | 0.27 (0.13-0.44) | 0.21 (0.17-0.24) |
| K74.3 *Primary biliary cirrhosis* | 21 | 0.62 (0.41-0.80) | 0.23 (0.20-0.27) |
| K74.4 *Secondary biliary cirrhosis* | 12 | 1.00 | 0.24 (0.21-0.28) |
| K74.5 *Biliary cirrhosis, unspecified* | 6 | 0.67 (0.28-0.94) | 0.23 (0.20-0.27) |
| K74.6 *Other and unspecified cirrhosis of liver* | 169 | 0.96 (0.93-0.99) | 0.33 (0.28-0.38) |
| K76.6 *Portal hypertension* | 170 | 0.84 (0.78-0.89) | 0.27 (0.22-0.31) |
| K76.7 *Hepatorenal syndrome* | 39 | 0.80 (0.65-0.90) | 0.24 (0.20-0.28) |
| C22.0 *Liver cell carcinoma* | 74 | 0.99 (0.94-1.00) | 0.27 (0.23-0.31) |
| *Grouped varices (I85.0, I85.9, I86.4, I98.2, I98.3)* | 157 | 0.80 (0.73-0.85) | 0.25 (0.21-0.29) |