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# Process Mining to Explore Variation in Chemotherapy Pathways for Breast Cancer Patients

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## Abstract

*Background*

There is concern that standard chemotherapy pathways of six cycles scheduled every two or four weeks reflect administrative and operational needs rather than patients' personal and biological needs. Process mining of routine data can help identify and explore common pathway variants.

*Methods*

We extracted anonymised records from routine data at Leeds Cancer Centre for breast cancer patients with a first diagnosis between 2004 and 2013 with an adjuvant chemotherapy pathway (n=738). This produced an event log data file (containing events, dates and times) which was analysed using the ProM process mining tool (www.promtools.org). We used the Inductive Miner plug-in and constructed statistical and visual models of the clinical pathways. The data covered a ten-year period and we created multiple splits of the event log to examined statistically significant variations over time.

*Results*

Most patients varied from the expected pathway (712 variants for 738 patients). We produced a pathway model which included these variants and checked conformance. Overall fitness of data to model was high (97.1%) but we noted significant changes to the fit in 2006 (a 5.1% change) and 2011 (8.9% change) which require further investigation. In total 51% (n=376) of patients did complete all six cycles, less than half (21% of total, n=158) completed the cycles without an adverse event while many (30%, n=218) experienced at least one adverse event including missed appointments, neutropenic sepsis and emergency admissions. Of the 49% (n=362) who did not complete six cycles, 28% (n=207) experienced adverse events with the remainder (21%, n=155) not completing for other reasons.

*Conclusions*

Process mining of routine data showed extensive variation from standard chemotherapy pathways including incomplete treatment and adverse events. Future work is needed to explore potential causal links and understand changes in the pathway over time.

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