

Socio-technical analysis and modeling of hazards related to test ordering and results management systems in primary care: impacts on safety and performance

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1. Introduction

The ordering of laboratory tests by clinicians for the purpose of screening, diagnosing and monitoring patients is a vital part of routine primary care worldwide (Callen et al, 2012). However, evidence indicates that 15% - 54% of all detected safety incidents in primary care are directly related to the systems management of testing results (Dovey et al., 2002). Existing support systems are complex, problematic, error prone and vary in terms of reliability and design quality (Elder et al., 2005). The impacts for patients include missed or delayed diagnosis and treatment causing unnecessary distress and continued ill-health (Bowie et al., 2005).

For clinicians there is the possibility of patient complaints, medico-legal action, breakdowns in patient relationships, and increases in workload and time commitments caused by repeating work tasks due to unreliable and inefficient systems (Bowie et al., 2015, The Health Foundation, 2011, Karsh et al., 2006). As part of the LINNEAUS Euro-PC collaboration (LINNEAUS Eurp-PC, 2015), the Medical Protection Society (MPS) provided data collected from their Clinical Risk Self-assessment (CRSA) process which involves visits to UK and Ireland member practices by a trained risk assessment facilitator to review system risks to the safe management and communication of laboratory test results.

Our aims were twofold: 1. To analyse the MPS organisational database to identify hazards related to systems for ordering laboratory tests, managing test results, and communicating test result outcomes to patients. 2. To integrate these data with other published evidence sources to inform design of a systems-based conceptual model of related hazards.

2. Methods

A retrospective database analysis was undertaken of MPS hazard data from Jan 2008 to Dec 2014. Data were analysed thematically and presented as the proportion of practices with system hazards; categorisation of identified hazards; and most frequently occurring hazards. Study data were integrated with other published evidence to develop a conceptual model of hazards and potential impacts on health, wellbeing and organisational performance, informed by the SEIPS socio-technical model (Carayon et al., 2006).

3. Results

Of 778 general practices visited, a range of systems hazards were recorded in 647 (83.2%). 45 discrete hazard categories were identified with a mean of 3.6 per practice (SD=1.94). The most frequently occurring hazard was the inadequate process for

matching test requests with results received (n=350, 54.1%). Other hazards included informing patients of results but failing to communicate that the results data set is incomplete (n=195, 30.1%), and system reliance on patients contacting the practice for test results (n=166, 25.7%). Of the 1604 instances where hazards were recorded, the most frequent was at the 'post-analytical test stage' (n=702, 43.8%), followed closely by 'communication outcomes issues' (n=628, 39.1%). A number of commonly occurring high-level organisational and culture risks were identified from both MPS data and published evidence sources - defined as those risks that relate to the organisation of the whole system. For example, limited practice leadership commitment to safety; limited opportunities for necessary staff training; an over reliance on patients to contact the practice for test results; and lack of a formal written system protocol that is shared and understood by the GP team. A socio-technical conceptual model of system hazards was designed based on these and other published data. It describes (and potentially predicts) how the hazards at the organisational and cultural levels and across the specific generic stages of the test results system may interact to impact on the well-being of people and on practice performance. The model has the potential to be utilised or adapted by GP teams to prompt reflection and discussion around specific hazards related to different aspects of the results handling system as a means to facilitate risk assessment, potential learning and improvement opportunities as part of the patient safety agenda.

4. Conclusions

Our study of the MPS's CRSA programme sheds new light on the scale and nature of hazards related to test results handling systems in primary care. Interventions to reduce patient harm are currently limited due to lack of research attention given to this high risk area. However, the study outcomes will be of relevance to primary care providers, researchers, safety leaders and policymakers internationally interested in improving the underlying safety and resilience of such systems.

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References

- Bowie P, Forrest E, Price J, et al. (2015) Good practice statements on safe laboratory testing. A mixed-methods study by the LINNEAUS collaboration on patient safety in primary care. *Eur J Gen Pract* Sep;21 Suppl:19-25. doi: 10.3109/13814788.2015.1043724.
- Callen JL, Westbrook JL, Georgiou A, Li J. (2012) Failure to follow-up test results for ambulatory patients: a systematic review. *J Gen Intern Med* Oct 2012 27(10): 1334–1348.
- Carayon, P., Schoofs Hundt, A., Karsh, B.-T., Gurses, A. P., Alvarado, C. J., Smith, M., & Flatley Brennan, P. (2006). Work system design for patient safety: the SEIPS model. *Quality and Safety in Health Care*, 15(suppl 1), i50–i58.
- Dovey SM, Meyers DS, Phillips RL Jr, et al. (2002) A preliminary taxonomy of medical errors in family practice. *Qual Saf Health Care*. 11(3):233-238.

- Elder NC, Graham D, Brandt E, Dovey S, Philips R, Ledwith J, Hicjner J. (2005) The testing process in family medicine: problems, solutions and barriers as seen by physicians and their staff. *J Patient Saf* 25-32
- Karsh BT, Holden RJ, et al. (2006) A human factors engineering paradigm for patient safety: designing to support the performance of the healthcare professional. *Qual Saf Health Care* 15(Suppl 1):i59–65.
- LINNEAUS Euro-PC. (2015) Learning from international networks about errors and understanding safety in primary care. Retrieved May 20 2015 from <http://www.linneaus-pc.eu/>
- The Health Foundation (2011) Evidence scan: Levels of harm in Primary Care. January 2011. London: Retrieved September 10, 2015, from <http://www.health.org.uk/publications/levels-of-harm-in-primary-care/>