Digital Health Innovation for Consumers, Clinicians, Connectivity and Community
A. Georgiou et al. (Eds.)

doi:10.3233/978-1-61499-666-8-80

Little Things Matter: A Time and Motion Study of Pharmacists' Activities in a Paediatric Hospital

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Abstract. How healthcare providers distribute their time can impact on the quality and safety of care delivered, and this has been widely studied in hospitals providing care to adult patients. Children are different to adults and the workflow of healthcare providers in paediatric settings is largely unknown. The aim of this study was to quantify how clinical pharmacists working in a paediatric hospital spend their time. A direct observational time and motion study was conducted where two independent observers shadowed seven pharmacists covering eight wards for over 60 hours. Pharmacists spent the majority of time performing medication review (32.6%), followed by communication, non-clinical tasks, supply, medication discussion and in-transit. They were interrupted 3.5 times per hour and spent 4.4% of observed time multi-tasking. This is the first study to quantify how pharmacists in a paediatric hospital distribute their time. These results could act as useful baseline data against which to measure the impact of innovations, such as electronic medication management systems, on pharmacists' workflow.

Keywords. Time and motion, observation study, paediatric, pharmacist, hospital

Introduction

Understanding how healthcare providers distribute their time between different work tasks, who they interact with, and how often they are interrupted is important for a number of reasons. It may help identify inefficiencies and safety hazards, and highlight where workflow redesign is needed to improve care coordination. Measuring changes in task time distribution before and after the implementation of specific interventions, such as electronic health record systems, can demonstrate how workflow has been impacted.

A number of studies investigating how Australian doctors, nurses and pharmacists distribute their time has been published in recent years.[1-5] For example, a direct observational study of doctors' and nurses' workflow before and after the

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implementation of an electronic medication management system (eMMS) found that eMMS was associated with both doctors and nurses spending significantly more time reviewing medications, but no more time on medication-related tasks overall compared to their colleagues on the control wards with no eMMS.[6]

Pharmacists are medication experts whose job it is to ensure that patients receive appropriate medications based on their diagnosis and clinical status. There have been two recent studies exploring how pharmacists spend their time prior to the implementation of eMMS[7] and the difference in workflow between pharmacists using paper medication charts and eMMS.[2] However, a limitation with observational studies is that results cannot be compared between studies if the same work task definitions have not been applied. For example, deClifford *et al*, recorded conversations and communication, as well as writing notes in the medical record, as 'professional communication'.[7] Lo *et al.* on the other hand, recorded communication based on the type of conversation (medication discussions, work-related discussions and clarifying medication issues).[2] Writing in medical notes was recorded as 'documentation'. To overcome this challenge, Schofield *et al,* have drawn on previous research to develop task definitions and propose the use of the same task definitions in a direct observational study of clinical pharmacists in Australia and the UK.[8] This will allow for robust comparisons of pharmacists' workflow in different adult hospitals and countries.

However, of the previous work in this area, there is very little literature on how clinical pharmacists working in a paediatric hospital spend their time. Children differ from adults and require special consideration when it comes to medicines. The dose must be adjusted to their age, size and conditions, and they may require different strengths and routes of administration.[9] The aim of this study was to quantify how clinical pharmacists working in a paediatric hospital spend their time prior to eMMS implementation.

1. Methods

1.1. Study Design

A direct observational time and motion study of ward pharmacists working in a large teaching paediatric hospital in Sydney, Australia. Ethics approval was obtained and each participant gave written consent to participate in this study.

1.2. Study Setting

The study was carried out in a paediatric hospital which uses paper charts to document medical notes, medication orders and administrations, whereas pathology results can be viewed electronically.

1.3. Data Collection Tool

Google Nexus 9 tablets running the Work Observation Method By Activity Timing (WOMBAT) software were used to collect data. WOMBAT is a multidimensional electronic data collection tool that allows observers to record the nature of health professionals' work tasks in real time.[10] For this study, the definitions developed by Schofield *et al*, were used.[8] The WOMBAT data collection was structured under four task dimensions of: (1) What (the task being observed); (2) Where (the location where the observed task is being undertaken); (3) With (the person/people with the pharmacist at the time the observed task is being undertaken); and (4) How (how the task is being completed, eg, using a computer) (Figure 1). Interruptions, defined as stopping the current task to respond to an external stimulus such as a pager, and multitasking, defined as performing two tasks simultaneously, were also recorded.

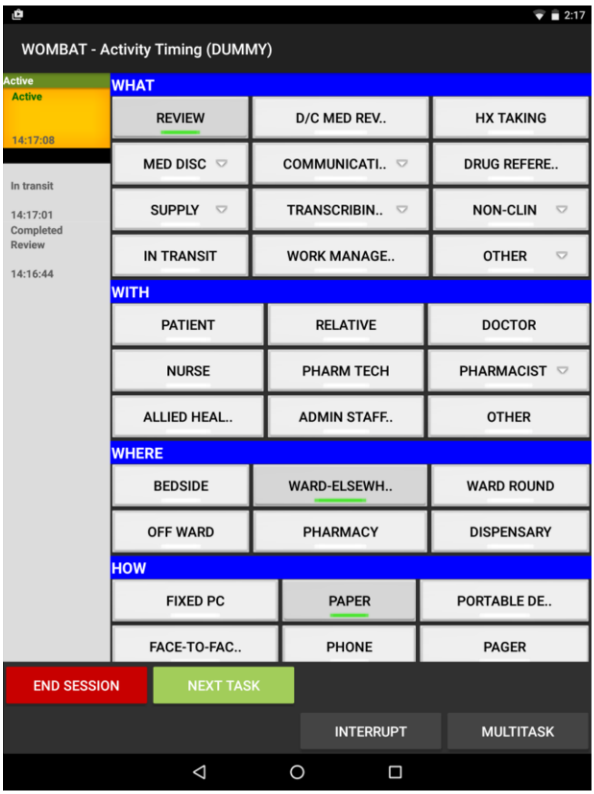

Figure 1. Screenshot of four task dimensions in WOMBAT

1.4. Data Collection

Two observers (ECL and WYL) familiarised themselves with the data collection tool and definitions. The two observers then shadowed the same pharmacist and independently recorded data for a number of training sessions until close agreement between the two observers was reached based on kappa statistics calculated using the method for time and motion studies.[11] The final average kappa score for task category, number of multitasking fragments, and number of interruptions was 0.87, indicating strong observer agreement in task classification.

Pharmacists were shadowed from October 2015 to February 2016, for a maximum of two consecutive hours followed by a break. No more than three observation sessions were conducted per day. This was intended to minimise participant and observer fatigue.

1.5. Data Analysis

To describe the work patterns of pharmacists, we calculated: task time for each task; proportion of total observation time on different tasks; proportion of multitasking time; rate of multitasking; and rate of interruptions. 95% confidence intervals (CIs) for the proportion of total time and the proportion of time on multitasking were obtained using the large sample normal approximation. The interruption rates, including their 95% CIs, were calculated using Poisson regression. Other descriptive statistics including number of tasks, average length of tasks, and frequency of tasks over observation time were also calculated. Data were analysed using SAS, Version 9.4.

2. Results

A total of seven pharmacists (all female) covering eight wards were observed for 62.1 hours while performing 4,578 individual tasks.

2.1. Task and Time Distribution

The most frequently performed task was medication review (n=1,394, 30.4%), followed by in-transit (n=935, 20.4%) and communication (n=794, 17.3%) (Table 1). On average, 22 review tasks occurred per hour. Pharmacists spent one third of their time on medication review (32.6%), followed by communication, non-clinical tasks, supply, medication discussion and in-transit. The majority of medication review tasks were performed while the pharmacist was on the ward (91.7%) but only 5.9% of all reviews were conducted by the bedside.

Pharmacists performed the majority of tasks alone (73.6%). Tasks undertaken with someone most often involved nurses (8.7%), doctors (6.2%) and other pharmacists (6.1%). Only 0.3% and 1.4% of tasks performed by pharmacists involved input from patients or relatives, respectively.

2.2. Interruptions

Pharmacists were interrupted 227 times, a rate of 3.5 interruptions per hour with 95% CI of 3.0 to 3.9. Interruptions occurred frequently when pharmacists were working on work management tasks (6.9 interruptions per hour), followed by discharge medication review (6.4), and medication review (5.6) (Table 1).

2.3. Multitasking

The total task time was 66.5 hours, which is greater than the 62.1 hours pharmacists were observed due to multitasking, i.e. pharmacists conducting two or more task concurrently. Overall, pharmacists spent 4.4% of their time multitasking (2.8 hours).

Pharmacists were more likely to multitask when they were in medication discussion, followed by communication, using a drug reference and history taking.

Table 1. Distribution of task time, multitasking time and interruption rate

Task type	No. of tasks	Total task time (hours)	Average time on task (seconds)	Frequency of tasks	Percentage of total observation time# (%, 95% CI*)	Percentage on multitasking of specific task time (95% CI*)	Interruption rate per hour (95% CI*)
Review	1,394	20	52	22	32.6(30.5-34.8)	8.6(4.9-12.3)	5.6(4.7-6.8)
Communication	794	8	38	13	13.6(11.4-15.7)	16.1(8.4-23.7)	1.7(1.0-2.9)
Non-clinical tasks	211	8	141	3	13.3(8.1-18.5)	0.2^	0.5(0.2-1.3)
Supply	310	8	94	5	13.0(7.5-18.5)	4.4(2.6-6.3)	3.9(2.7-5.5)
Medication discussion	355	7	71	6	11.3(9.1-13.5)	16.7(11.6-21.7)	1.2(0.6-2.4)
In transit	935	7	26	15	10.9(10.2-11.7)	3.1(1.5-4.8)	3.4(2.3-5.1)
Drug reference	288	3	37	5	4.8(4.1-5.5)	14.6(8.9-20.3)	4.4(2.5-7.5)
Work management	223	2	35	4	3.5(2.8-4.2)	3(0.6-5.3)	6.9(4.2-11.5)
Other	24	1	205	<1	2.2(0-4.8)	4.6^	0
History taking	32	1	72	1	1(0.7-1.4)	12.9^	0
Discharge medication review	12	<1	142	<1	0.8(0.2-1.3)	4.6^	6.4(2.1-19.7)

*CI=Confidence interval ^Number of multitasks is too small (n<5) to calculate the confidence interval.

3. Discussion

Clinical pharmacists working in a paediatric hospital spent the majority of their time reviewing charts and medical notes. A third of their time was divided between communicating with others, performing non-clinical tasks and managing ward-stock.

A large proportion of tasks (20.4%) was spent in-transit however, this equated to only 10.9% of total time, indicating that although pharmacists frequently change location, i.e. from the nurses' station to the bedside, these walks are fairly quick. The reverse is true for non-clinical tasks. Less than 5% all tasks pharmacists performed were defined as a non-clinical tasks, however, this task category accounted for over 13% of their total time. This is not surprising giving that attending a meeting is recorded as one task however long the meeting.

Only 1% of paediatric pharmacists' time was spent taking medication histories. Comparing these results to the published literature on how clinical pharmacists in adult hospitals spend their time is difficult due to different definitions applied. Nevertheless, de Clifford *et al,* reported that pharmacists spent 9.5% taking medication histories, a significantly greater proportion than we found.[7] Young children are often incapable of providing a medication history. Instead, pharmacists have to rely on carers to provide an accurate medication history or use other sources such as contacting the patient's general practitioner or community pharmacist to obtain an accurate medication history. As different task definitions were used in our studies, we are unable to determine the extent to which this result is a real difference in practice or a reflection of differences in task definitions. However, the number of interruptions to pharmacists' in our paediatric setting was similar to that reported in an adult hospital (3.5 and 3.8 interruptions per hour, respectively).[2] A limitation of this study is that it was performed in one hospital only, thus potentially reducing the generalisability of these results.

4. Conclusion

This is the first study to quantify how clinical pharmacists working in a paediatric hospital spend their time. How pharmacists in a paediatric hospital spend their time appears to be different compared to pharmacists in adult hospital. However, due to the limited research in this area and inconsistency in definitions used, whether these differences reflect true variations in work practices remains unknown. This highlights the importance of future use of standardised definitions and data collection tools.

A strength of this study is that well-defined definitions were used, which are also being used to collect data in an adult hospital setting. This standardisation will allow for comparison of workflow between pharmacists in paediatric and adult hospitals in Australia and internationally, and in hospitals with or without eMMS.

5. Acknowledgements

This research was supported by NHMRC Program grant [1054146]. The authors would like to thank the Director of Pharmacy and all pharmacists who participated in this study.

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ISSN 0926-9630 (print)
ISSN 1879-8365 (online)

Digital Health Innovation for Consumers, Clinicians, Connectivity and Community

Selected Papers from the 24th Australian National Health Informatics Conference (HIC 2016)

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IOS Press

Amsterdam • Berlin • Washington, DC

ISBN 978-1-61499-665-1 (print)
ISBN 978-1-61499-666-8 (online)
Library of Congress Control Number: 2016946388

Publisher
IOS Press BV
Nieuwe Hemweg 6B
1013 BG Amsterdam
Netherlands
fax: +31 20 687 0019
e-mail: order@iospress.nl

Distributor in the USA and Canada
IOS Press, Inc.
4502 Rachael Manor Drive
Fairfax, VA 22032
USA
fax: +1 703 323 3668
e-mail: iosbooks@iospress.com

PRINTED IN THE NETHERLANDS

Preface

There's never been a more exciting time to be involved with health informatics. In the last few decades, health informaticians have established the knowledge base and practical expertise to facilitate the development of ever-more capable technical systems, increasing connectivity, expanding access and greater mobility of e-health and information management systems. We have seen the evolution from simple computer based records to systems that allow intra-organisational, national, even international communication and information exchange. We have also seen progress in e-health and most recently m-health, facilitating access to information and advice almost anytime, anywhere. The health informatics community is now building on this strong foundation, taking a central role in the digital transformation of the healthcare sector. The Australian National Health Informatics Conference (HIC), Australia's premier health informatics event, is a key avenue for facilitating this transformation. This Conference, organised by the Health Informatics Society of Australia (HISA), with the support of the Australasian College of Health Informatics (ACHI), provides the ideal professional and social environment for clinicians, researchers, health IT professionals, industry and consumers to integrate, educate and share their knowledge to drive innovative thinking, to enhance services and allow greater consumer involvement. This is emphasised in the primary theme of the 2016 Conference: Digital Health Innovation for Consumers, Clinicians, Connectivity, Community.

The papers in this volume reflect this theme, highlighting the cutting edge research evidence, technology updates and innovations that are seeing the digital transformation of the healthcare sector. The papers are indicative of the wide spectrum of work encompassing major theoretical concepts, examples of key applications of new technologies and important new developments in the field of health informatics. They emphasise the central role that health informatics and e-health play in connecting information systems, being smart with data, and enhancing both practitioner and consumer experience in healthcare interactions. Welcome to the innovation boom.

This year's program maintains the high standard of papers for which the conference is well-known. All papers were blind-peer reviewed by three experts in the field of health informatics. These reviewers are widely considered to be prominent academics and industry specialists. The contribution of the Australasian College of Health Informatics, particularly the voluntary participation of Fellows, in supporting this review process is gratefully acknowledged. Similar contributions made by many senior and experienced members of the Health Informatics Society of Australia is also acknowledged. Forty papers underwent the initial review and feedback process. Resubmitted papers were then validated by the Scientific Program Committee to ensure that reviewers' recommendations were appropriately addressed or rebutted. In total 20 papers were selected for inclusion in this volume. Congratulations to all the authors.

Andrew Georgiou
Louise K. Schaper
Sue Whetton

Acknowledgements

The Editors wish to thank the following people for their efforts in reviewing the papers submitted for HIC 2016.

A/Prof Andrew Georgiou, Macquarie University
Dr Sue Whetton, University of Tasmania
Dr Michael Bainbridge, ASE Health
Dr Melissa Baysari, Macquarie University
Vicki Bennett, Vicki Bennett Consulting
Dr Jen Bichel-Findlay, University of Technology, Sydney
Heidi Bjering, University of Western Sydney
Neville Board, Australian Commission on Safety and Quality in Health Care
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