Integration of Smartphones into Clinical Pharmacy Practice: An Evaluation of the Impact on Pharmacists' Efficiency

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Introduction

- Personal smartphones are commonly used by healthcare practitioners.
- A comprehensive literature search failed to reveal an evaluation of the impact of smartphones on clinical pharmacy practice.
- VIHA is one of the first health authorities in Canada to endorse the iPhone as a potentially valuable tool for clinical practice.
- Proposed efficiency benefits include:
  1) Rapid communication between pharmacists and physicians, nurses, and other pharmacists.
  2) Increased access to:
     - patient information off-site through encrypted access methods.
     - drug information in the patient care area.
     - decision-support tool to resolve drug therapy problems (DTPs).
- To the best of our knowledge this is the first study of its kind in North America.

Objectives

- To measure smartphones effect on pharmacists' efficiency, to assess pharmacist acceptance of corporate smartphones, and to investigate how these devices are being used.

Methods

Design

- Multi-center (9 VIHA facilities on Vancouver Island, B.C., Canada), time-trial, survey and observational prospective study.

Inclusion Criteria Front Line Staff:

- Permanent full or part time pharmacist AND provides unit-based clinical service greater than 50% of the time OR routinely takes on-call shifts.

Inclusion Criteria Leaders/Project Staff:

- Holds a position as pharmacy leader OR job requires travel to multiple sites.

Exclusion Criteria

- Project Research Team.

Figure 1: Research Protocol

Figure 2: Technology Support

Table 1: Outcome Measures

Method	Measures
Time Trial	Time to answer 22 situational drug information questions
Survey	1) Demographic 2) Satisfaction 3) Narrative feedback
Direct Observation	To determine if there is a statistically significant difference before vs. four months after pharmacists receive a smartphone in occurrences and time related to: 1) Walking to/from technology 2) Answering clinical questions 3) Using a smartphone 4) Using a computer
Phone Usage	Determine the uptake of smartphones into clinical practice through the trend in calls and texts sent/received per month

Statistical Methods

- Descriptive statistics were used for the demographic variables, staff surveys and data usage. Outcomes for the time trial and direct observation were expressed as medians and analyzed using the non-parametric Wilcoxon Signed Ranks Test.

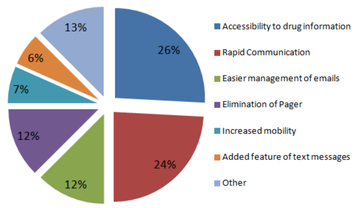
Results of Time Trial

Table 2: Time to Answer 22 Situational Drug Information Questions

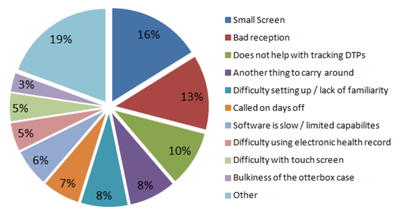
Type of Drug Information Question	n	Standard references*	iPhone only*	p-value
Faster with Smartphone				
Side effects	59	400	50	≤0.001
Overdoses or poisoning	63	265	96	≤0.001
Precautions and contraindications of a drug	62	229	142	≤0.001
Pharmacokinetic information about a drug	62	187	102	≤0.001
Compatibility/Stability of a drug product	61	128	65	≤0.001
Drug use in breastfeeding	63	88	46	≤0.05
No Difference				
Drug dosage adjustment recommendations for renal or hepatic impairment	62	109	59	0.15
Alternative names for a drug (e.g. brand name, generic, or different brand)	63	30	20	0.15
Drug interactions	63	50	45	0.31
Drug cost	55	122	88	0.37
Drug dosing and schedule of administration	63	60	60	0.52
Adverse drug events	62	62	76	0.89
Compounding or drug product formulation	48	156	222	0.71
Herbal products and remedies	53	76	89	0.42
Risks during pregnancy	63	78	109	0.11
Patient counselling considerations with a medication	63	75	78	0.09
Slower with Smartphone				
Mechanism of action	63	32	50	≤0.05
Drug of choice and therapy alternatives for a condition or disease	60	60	130	≤0.01
Schedule of a drug product	52	94	120	≤0.01
Available dosage forms of a drug	60	56	108	≤0.001
Therapeutic Indication for a drug	63	35	180	≤0.001
Identification of a drug by description of the product	52	92	300	≤0.001
Median time to answer all questions combined		**2895**	**2538**	**0.039**

*median seconds per questions for all valid responses

Results of Survey



Figures 3: Positive aspects of Smartphone Use (n=120 comments)



Figures 4: Negative aspects of Smartphone Use (n=62 comments)

Percentage of Pharmacists:

98% (60/61) agree or strongly agree that they find Smartphones to be useful.
87% (53/61) agree or strongly agree that the Smartphone aids their job performance.
68% (41/61) agree or strongly agree that they require further training on use of the Smartphone.
63% (54/86) had never owned an iPhone before.
46% (28/61) agree or strongly agree that the Smartphone has increased their confidence and competence in resolving DTPs.

Results of Direct Observation

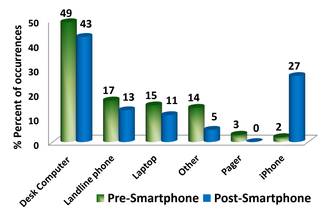


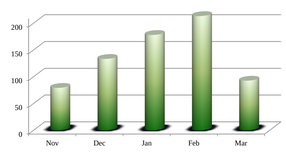
Figure 5: Types of Technology used by Pharmacist Pre- vs. Post-Smartphone implementation (n=502 Pre-Smartphone occurrences, n=644 Post-Smartphone occurrences.)

Table 3: Outcomes

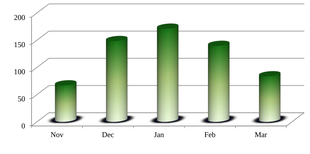
Direct Observation Outcome Measures	Pre-iPhone*	Post-iPhone*	p-value
Number of occurrences using smartphone	7	11	≤0.001
Total time spent using smartphone (min)	7	19	≤0.05
Number of occurrences using technology	30	43	≤0.01
Total time spent using technology (min)	206	225	0.22
Number of occurrences using computer	17	21	0.09
Total time spent using computer (min)	179	189	0.78
Number of clinical questions answered	6	4	0.55
Total time spent answering clinical questions (min)	13	13	0.81
Average time spent answering clinical questions (min)	4	4	0.78
Number of occurrences walking to obtain a resource/ use technology	3	3	0.80
Total time spent walking to obtain a resource/ use technology (min)	4	5	0.58

* median per person per 8 hour shift (n = 14)

Results of Phone Usage



Figures 6: Average Outgoing Weekday Minutes per Pharmacist per Month



Figures 7: Average Number of Texts Sent and Received per Pharmacist per Month

Discussion

- Technology is increasingly being used to improve efficiency of health services. We have observed that the use of smartphones are replacing the use of pagers, landlines and other non-computer devices.
- Smartphones are being used as a convenient and expanded source of drug information that may allow pharmacists to spend more time in patient care areas.
- Smartphone use decreased the time to answer 22 situational drug information questions but did not significantly affect time spent walking to obtain a resource or use technology. This suggests that either more time is needed for pharmacists to integrate smartphones into their daily practices or that smartphones themselves require further development to facilitate more functions such as printing documents and tracking drug-therapy problems.
- The decline in usage minutes and texts in March may have been due to more pharmacists taking vacation around school children's spring break.
- Overall, pharmacists report that smartphones increase their job performance despite not demonstrating increased efficiencies during direct observation.

Limitations

Time Trial:

- Rounding /estimation of times by participants.
- Some dissimilar questions between the two time-trials.

Direct Observation:

- Small sample size (n=14).
- Inability to observe and capture every occurrence.
- Didn't capture time pharmacists spent at the bedside.
- Difference in interpretation of how to collect data between observers.

General:

- Uptake in the use of smartphones and incorporation into clinical practice is still in progress. Four months was probably an insufficient time-frame to determine the full impact of these devices on pharmacists efficiency, especially since 68% of pharmacist had not owned an iPhone before.
- The lack of familiarity with the device, small sample size, and varied collection methods limits the reliability of our direct observation results.

Conclusions

- Pharmacists readily accepted smartphones into their practice but were still becoming familiar with the potential uses and benefits during the first four months post-implementation.
- Impacts on most measures of workflow were not changed by smartphone introduction during the first four months following implementation.
- Variable effects on time to answer simulated clinical questions were observed, but smartphone use faciliated a faster response time overall.
- Almost half of pharmacists reported that the smartphone increased their confidence and competence to resolve DTPs.
- The full effects of smartphones on pharmacists clinical activities will require longer observation timeframes.

Application to Practice

- This research provides sufficient evidence to continue to support the use of smartphones within VIHA's pharmacy department.
- Future quality-focused research would aid other health departments and organizations in deciding whether to endorse smartphone technology in their own departments.