Translating Mobile Technology from the Classroom and Laboratory to the Real World

Claire DeCristofaro, MD
Ashford University, San Diego, CA
claire.decrisofaro@ashford.edu

Tracy P. George, DNP, APRN-BC, CNE
Francis Marion University, Florence, SC
tgeorge@fmarion.edu

Tuesday, February 21, 2017
Objectives

1. Discussion of teaching innovation with mobile technology in an online graduate nursing advanced pharmacology course and a graduate nursing advanced health assessment course that incorporated point-of-care mobile technology into the simulation laboratory.

2. Discussion of teaching innovation with mobile technology in an undergraduate (pre-licensure BSN) nursing health promotion course that incorporated point-of-care mobile technology into a service learning activity.

3. Describe the methods used to implement these innovations that translate to real-world clinical settings.

4. Discuss how smartphone apps can be utilized in community nursing practice.

This use of smartphone apps was implemented across three universities, two states, and different program levels.
Clinical Nursing and Digital Reference Materials

• Both undergraduate and graduate nursing students need to access up-to-date reference materials and clinical practice guidelines in order to provide safe, high-quality care to patients (Institute of Medicine, 2001).

• Almost 80% of nurse practitioners use smartphones to obtain information about drug therapies (Grabowsky, 2015).
Introduction:
Smartphones in the Clinical and Classroom Settings
Interactive Question for Participants:
What are the mobile technology apps that are regularly used in your discipline?

*Please Type in Chat Box
Mobile Point of Care Technology

• Earlier research looked at personal digital assistants (PDAs), however smartphones are becoming more prevalent in American society.

• It is important for nursing students to become comfortable with accessing point of care (POC) technology.

• Many clinical smartphone applications (apps) are widely used by health professionals and patients as useful tools in evidence-based practice at the point of care, for patient education, disease self-management, and remote monitoring of patients (Mosa, Yoo & Sheets, 2012).
Selected Uses of Smartphones in Nursing Education

- Students can remotely communicate with a nursing instructor from the clinical setting.
- Students may access internet resources, including videos, podcasts, practice guidelines, and pharmacology resources to enhance safe care (Phillippi & Wyatt, 2011).
- Smartphone apps and internet access can support application of health promotion knowledge in the field, including recommended patient screenings (Phillippi & Wyatt, 2011).
Mobile Technology in the Clinical Setting

- The use of mobile technology has been studied more in the clinical setting (Raman, 2015); used for drug references, clinical logs, faculty-student communication, and peer support (Doyle, Garrett, & Currie, 2014).

- Use of smartphones improved undergraduate nursing student performance in the clinical setting (Wittmann-Price, Kennedy, & Godwin, 2012).
Many Compendiums of Clinical Apps

- Mobile clinical apps are available as free downloads, web based, and for purchase

Enter keyword to search for apps
Need for Mobile Technology in the Classroom

• There is a need for greater integration of mobile technology into the classroom (Raman, 2015).
• Case studies and group projects that require the use apps will provide students with familiarity with the capabilities of mobile technology (Raman, 2015).
• Regular use in the classroom will provide facility with the apps and promote regular use of the apps in the clinical setting.
Potential Barriers to Mobile Technology

• Cost of device and software (Raman, 2015):
  – Many students already own smartphones.
  – However, devices may be different platforms/OS.

• Lack of technology literacy, issues with internet connections, and small screen size (Martyn, Larkin, Sander, Yuginovich, & Jamieson-Proctor, 2014).

• Faculty resistance (Raman, 2015):
  – Faculty should role-model the use of mobile technology
  – Faculty training and access to the software is essential.
A theory model for such a teaching innovation has been described in the context of using simulation as a teaching and learning tool.

This theoretical framework emphasizes three themes (Humphreys, 2013): preparedness, activation & reflection.
Graduate Nursing Curriculum in Nurse Practitioner (MSN/DNP) Programs
In a laboratory setting with nurse practitioner students, high-fidelity simulation and personal digital assistants (PDAs) with app software (Lexicomp®) were used to complete unfolding clinical case scenarios.

Prior to use in the laboratory, focused classroom case studies provided students with experience using the devices and software.

Faculty training with the software enabled successful role-modeling in laboratory sessions with students (Elliott, DeCristofaro, & Carpenter, 2012).
Include drug-drug interactions, clinical practice guidelines, pharmacology & diagnostics databases
• Unfolding case studies and a Clinical Decision-making Worksheet (Spain et al., 2004) were used to guide the standardized patient encounter in the simulation laboratory.

• This same tool is used by the student when beginning clinical work during actual patient encounters to create a chart note using the SOAP (Subjective, Objective, Assessment, Problem) format and supporting Problem-oriented Medical Records (POMR).

• In formulating their diagnosis and evaluation plan, students are expected to consult pharmacology databases for appropriate patient selection (prescribing indications, contraindications, dosing, life span considerations).
The simulated environment is a safe place to practice communication and physical assessment skills, where mistakes can be made without clinical consequences & where mistakes are viewed as golden opportunities for teaching and learning.
• Rotating roles of patient, family member, consulting specialist, medical office assistant, nurse practitioner preceptor, and nurse practitioner student provided an appreciation of the stresses and obligations of each role in the team-based clinical setting.

• In the unfolding case scenarios all program functions of the POC app were used in the standardized patient encounter, increasing comfort levels regarding the transition to clinical site activities.
Using Pharmacology Case Studies

Interactive Question for Participants:
Are you using case studies in the classroom or laboratory setting, or do you prepare students for real world application of your discipline in other ways?

* Please Type Your Answer in the Chat Box
Smartphone/Tablet Apps in the Online Advanced Pharmacology Classroom

• In a fully-online advanced pharmacology class for MSN/DNP nurse practitioner students a clinical database app is used to complete unfolding pharmacology case studies (LexiComplete®)
• Students then use the app in clinical practicums
• Some apps are also free online and are also used to complete the case studies
• Student acceptance is high – most renew their subscription annually after the course is ended and continue to use it in clinical settings
Learning Objectives of Case Studies

The students learn:

1) Basics such as dosing and how to calculate
2) Higher-order decision-making based on clinical considerations
3) Real-world aspects such as length of time to take the drug
4) Real-world considerations such as herbal therapies
5) How to manipulate the software using a standardized patient encounter
Examples of Free Online Pharmacology Apps

EMPR: http://www.empr.com/

Medscape: http://www.empr.com/

Drugs.com: https://www.drugs.com/
Tom is a 76 year old male who is being discharged from the hospital after knee replacement surgery yesterday. You are responsible for medication reconciliation. The attending orthopedic surgeon’s discharge note states the patient should receive rivaroxaban (Xarelto) for post-operative DVT prophylaxis. Weight 175 lb Height 5’10” SCr 2 mg/dL

HINT for all questions below: LexiComplete “Dosing: Adult (postoperative thromboprophylaxis)”

a) **What is the dose of rivaroxaban (Xarelto) for this patient in this clinical setting?**  
   Answer:

b) **For how long should Tom take the rivaroxaban (Xarelto)?**  
   HINT: use LexiComplete or EMPR website [http://www.empr.com/browseby/brand/x/](http://www.empr.com/browseby/brand/x/)  
   Answer:

c) **This drug needs to have the dose modified for renal impairment. Does Tom’s dose need to be changed?**  
   Answer:

d) **Tom gets his prescription filled and comes back to the clinic that afternoon because he is concerned that he received the wrong medication at the pharmacy. You check the pill ID – is it correct? It is a round, red tablet with logo XA 10**  
   HINT: Check LexiComplete Pill ID or [https://www.drugs.com/imprints.php](https://www.drugs.com/imprints.php)  
   Answer:

e) **During medication reconciliation, you note that he takes OTC St. John’s wort. Is this a concern?**  
   HINT: use LexiComplete Interact or online drug interaction checker such as [https://www.drugs.com/drug_interactions.html](https://www.drugs.com/drug_interactions.html)  
   Answer:
Undergraduate (Pre-licensure) Nursing Curriculum in BSN Programs
• Two health promotion smartphone apps were used to prepare students for a service learning community screening activity – Body Mass Index (BMI) & Electronic Preventive Services Selector (ePSS)

• In the lab, student partners role modeled the nurse/patient role to complete several case studies for diverse patient types
Two Free Cross-platform Smartphone Apps Selected

• Both apps were free and available for Android and Apple/iOS platforms.
• These apps work on tablets and smartphones and have a web-based option.
• All students used smartphones in order to use cell phone signals for internet availability at sites.
Learning to Use the Apps

• Both weekly classroom and laboratory sessions (first semester, traditional BSN program).

• **Week 1:** Students received information on how to download the required smartphone/tablet apps.

• **Weeks 2 & 3:**
  – Practice data entry using mock cases in the laboratory
  – Students switched roles from student to patient
  – Instructor support facilitated learning how to obtain patient histories and integrate the apps into this process

• **Week 4:** Students used the apps in community screenings at a variety of settings.
Electronic Preventive Services Selector (ePSS) app uses patient information, such as age, sex, and smoking status, to display recommended screenings based on the United States Preventive Services Task Force (Agency for Healthcare Research & Quality [AHRQ], 2013):
http://epss.ahrq.gov/PDA/index.jsp
The USPSTF and the AHRQ

• The US Public Services Task Force (USPSTF) is an independent, voluntary group of experts in prevention and evidence-based medicine.
• They assign ratings to screenings based on how strong the evidence is and the risk/harm benefit for patients.
• The ratings include A (strongly recommends), B (recommends), C (no recommendation for or against), D (recommends against), or I (insufficient evidence to recommend for or against):
  http://www.ahrq.gov/professionals/clinicians-providers/guidelines-recommendations/uspstf/index.html
• The Agency for Healthcare Research and Quality (AHRQ) provides administrative, research, technical, and communication support to the Task Force
Second Free App Selected for Project: BMI

**Second App:** Body Mass Index (BMI) for adults:


Interactive Question for Participants:
Are you using case studies in the classroom or laboratory setting, or do you prepare students for real world application of your discipline in other ways?

*Please type in Chat Box*
• Each student in the course completed three hours of community screenings as a service learning activity.
• The students provide free blood pressure, glucose, and cholesterol screenings at various community sites.
• Smartphone apps for health promotion recommendations and body mass index (BMI) were used as part of the screening process.
• Sites included community screenings at senior centers, retirement communities, festivals, diabetes fairs, and occupational health sites.
Service Learning Community Screenings (2 of 2)

• Students from the lab were assigned to groups of 8-10 for community screenings
• Groups created trifold posters to bring to screening sites.
• At the conclusion of the screening, the students submitted a reflective journal on their activities.
• Students completed a confidential survey on the learning activity (requirement for the institutional grant funding for service learning activities).
Patient Counseling Based on App and Biomarker Results

• The students utilized the ePSS and BMI apps, did finger stick screening for blood glucose & total blood cholesterol, & took at least one blood pressure reading for each patient.

• Students used evidence-based charts with interpretation of results to counsel patients.

• Patients received individualized printed information regarding results and were encouraged to follow up with his/her provider.
Sources of Evidence-Base for Counseling

- Blood pressure (Centers for Disease Control): [http://www.cdc.gov/bloodpressure/measure.htm](http://www.cdc.gov/bloodpressure/measure.htm)
Patient Counseling Based on ePSS Results

- ePSS app provides personalized sex-specific recommendations on health promotion screenings based on AHRQ guidelines (2014a, 2014b)
Documenting Screening Results

A documentation packet was created for use with each patient:

• Letter to the patient’s provider with spaces for results of blood glucose, height/weight, BMI, blood pressure, and cholesterol, directing patient to bring these results to provider at next visit

• Evidence-based charts with interpretation of values for blood glucose, BMI, blood pressure, and cholesterol

• For male adults (blue paper) and female adults (pink paper) sex-specific screening recommendations from the ePSS app (individual recommendations could be circled based on the individual patient demographics)
Screening Packet (1 of 2)

Provider Letter

Biomarkers Charts
Male ePSS Screening

Screening Tools for Preventive Health – Men

Body Mass Index (BMI): Your body mass index, or BMI, is a measure of your body fat based on your height and weight. It is used to screen for obesity. You can find your BMI by visiting http://www.nhlbisupport.com/bmi/

Cholesterol: Once you turn 35 (or once you turn 20 if you have risk factors like diabetes, history of heart disease, tobacco use, high blood pressure, or BMI at 20 or over), have your cholesterol checked regularly. High blood cholesterol is one of the major risk factors for heart disease. See http://www.nhlbisupport.com/cholesterol/

Blood Pressure: Having your blood pressure checked every 2 years. High blood pressure increases your chance of getting heart or kidney disease and for having a stroke. If you have high blood pressure, you may need medication to control it. See http://www.nhlbisupport.com/bloodpressure/

Cardiovascular Disease: Having your blood pressure checked every 2 years. High blood pressure increases your chance of getting heart or kidney disease and for having a stroke. If you have high blood pressure, you may need medication to control it. See http://www.nhlbisupport.com/bloodpressure/

Colorectal Cancer: Starting at age 50 and through age 75, ask your doctor if you should take aspirin every day to lower your risk of a heart attack. How much aspirin you should take depends on your age, your health, and your lifestyle.

Cardiovascular Disease: Having your blood pressure checked every 2 years. High blood pressure increases your chance of getting heart or kidney disease and for having a stroke. If you have high blood pressure, you may need medication to control it. See http://www.nhlbisupport.com/bloodpressure/

Sexually Transmitted Diseases: Talk to your doctor to see whether you should be tested for gonorrhea, syphilis, chlamydia, or other sexually transmitted diseases.

HIV: Your doctor may recommend screening for HIV if you:
- Have sex with men
- Have unprotected sex with multiple partners
- Have used injected drugs
- Have sex with a sex partner who does
- Have paid for sexual acts with someone who has had sex with people who have sex with men
- Have been treated for sexually transmitted infections
- Have a blood transfusion between 1978 and 1995

Depression: If you have felt “down” or “depressed” for 2 weeks, you may want to talk to your doctor about depression. Depression is a treatable illness.

Abdominal Aortic Aneurysm: If you are between the ages of 65 and 75 and have smoked 100 or more cigarettes in your lifetime, ask your doctor to screen for an abdominal aortic aneurysm. This is an abnormal, large or saccular blood vessel in your abdomen that can burst without warning.

Diabetes: If your blood pressure is higher than 135/80, ask your doctor to test you for diabetes. Diabetes, or high blood sugar, can cause problems with your heart, eyes, feet, kidneys, nerves, and other body parts.

Tobacco Use: If you smoke or use tobacco, talk to your doctor about quitting. For tips on how to quit, go to http://www.nhlbissupport.com/tobacco/ or call the National Quitline at 1-800-QUIT/NOW.

Female ePSS Screening

Overweight and Obesity: Your body mass index, or BMI, is a measure of your body fat based on your height and weight. It is used to screen for obesity. You can find your BMI by visiting http://www.nhlbisupport.com/bmi/

Obstetricians (Gynecologists): Having a screening test at age 55 to make sure your bones are strong. If you are less than 50, or over 65, consult your doctor. If you are 50-64 and at risk for bone fractures, you should also be screened. Talk with your health care provider about your risk for bone fractures.

Sexually Transmitted Infections: Sexually transmitted infections can make it hard to get pregnant, may affect your ability to get pregnant, and can cause off or on health problems. Get screened for chlamydia and gonorrhea if you are 25 years of age or sexually active. If you are older than 26, talk to your doctor about whether you should be screened. Ask your provider whether you should have an annual sexually transmitted infection screening.

HIV: Your total cholesterol and a validated lipoprotein profile (LDL, HDL, or both) are tested at age 50 or if you have a family history of heart disease. You may have your cholesterol checked every 2 years. High blood cholesterol is one of the major risk factors for heart disease. See http://www.nhlbisupport.com/cholesterol/
Course & Program Outcome Alignments

• Implementing the mobile technology in the service learning setting actually helped meet several course and program objectives

• **Course Objectives:**
  – Knowledge integration from the sciences to conduct a thorough health history
  – Advocating for health promotion and disease prevention using risk assessments
  – Analysis of data and use of evidence-based knowledge

• **Program Objectives:**
  – Incorporate information management, client care technologies, and communication devices in providing safe and effective client care.
  – Provide safe, effective, and compassionate care to all individuals and groups across the lifespan based upon the principles and models of evidence-based practice
  – Be able to retrieve, evaluate, and synthesize evidence
  – Integrate knowledge and skill in the provision of holistic care to individuals, families, groups, communities, and populations with a focus on health promotion, disease and injury prevention.
Translation of Experiential Learning and Skills Enhancement

• ePSS app required students to ask about the patient’s smoking status, if they were sexually active, etc.

• Students felt that it became easier to ask these questions once they had screened several patients.

• Helped to apply history-taking skills from the classroom setting to “real life” setting.
Student Feedback

• Students thought it was “fun” to use the apps in the lab and community.
• “Less bulky” than using a textbook.
• Students felt that the apps made the content from the text more “interesting.”
• Said they had “better recall” of didactic health promotion subject content.
• Students stated that while taking objective assessments (exams) they realized they were recalling what they had learned in the case study activities.
University Library Integration of the Innovation

Wider university integration of teaching innovation via library services to create a library page with smartphone/tablet apps for use in undergraduate/graduate nursing.
Nursing Leading Change & Advancing Health

• Supports the validity of nursing practice in independent health promotion activities.

• Additional screenings for the university campus were held in the Nursing building lobby.

• Many students began looking for additional clinical apps for continued use in nursing application.

• Students shared their positive experience with practicing nurses in the community who also began using these and other apps in their own practice.

Institute of Medicine (2015), Assessing Progress on the Institute of Medicine Report The Future of Nursing:

Centers for Disease Control (CDC, 2015), Health Equity:
http://www.cdc.gov/chronicdisease/healthequity/
Impact on Community Health Equity

• The literature stresses that insufficient integration of digital health resources has a negative impact on senior citizens: “future innovations should ...improve the reach and effectiveness of digital health for seniors” (Levine, Lipsitz & Linder, 2016)

• We found that our senior citizen patients were very accepting of the use of apps in the screening process

• In fact, the retirement community site has scheduled additional screenings that will be community-wide and also will be used as part of their marketing strategy (Facebook).

• Centers for Disease Control (CDC, 2015), Health Equity: http://www.cdc.gov/chronicdisease/healthequity/
Published Conclusions
Publications Based on These Innovations


Case Studies – Active Learning

• In active learning learners and faculty construct knowledge, attitudes, and skills collaboratively (Cheng et al., 2015).

• Using apps in solving case studies and applying these to actual patients in service learning community screenings reinforced health promotion content including concepts of primary, secondary, and tertiary prevention and enhancing clinical reasoning skills.

• Using POC apps in simulated patient encounters involving unfolding case studies and role modeling improves nurse practitioner student’s critical thinking skills and comfort levels with complex patient encounters in multidisciplinary team settings.
Mobile Technology Translates Classroom and Lab Learning to the Real World

• Smartphone apps are already familiar to most students and are more convenient than textbooks.
• Translational learning allows students to apply content from class and lab to community and clinical settings.
• Many free reference apps are available.
• Engages students in active learning and promotes long-term retention of content.
• This innovation supports nursing practice leadership for health promotion, disease prevention, and achieving health equity in the community.
Demonstration Using ePSS App

- ePSS app is also web-based: [http://epss.ahrq.gov/PDA/index.jsp](http://epss.ahrq.gov/PDA/index.jsp)
  - iPhone go to App Store
  - Android go to Google Play Store
  - Search for “AHRQ ePSS”
- Input personal demographic information for screening recommendations from USPSF (AHRQ) levels “A” & “B”
- Interactive demonstration of case studies – see next slide for actual case studies used by students in lab
ePSS Website
Actual Case Studies Used in Lab for ePSS App

**STUDENT A**

1) Age 65, male, tobacco user, sexually active
2) Age 65, female, tobacco user, sexually active
3) Age 85, female, no tobacco, not sexually active
4) Age 85, male, no tobacco, not sexually active
5) Age 18, male, tobacco user, sexually active
6) Age 18, female, tobacco user, sexually active
7) Age 25, female, pregnant, no tobacco, sexually active

**STUDENT B**

1) Age 45, male, tobacco user, sexually active
2) Age 45, female, tobacco user, sexually active
3) Age 35, male, no tobacco, not sexually active
4) Age 35, female, no tobacco, not sexually active
5) Age 25, male, tobacco user, sexually active
6) Age 25, female, tobacco user, sexually active
7) Age 39, pregnant, female, tobacco user, sexually active
ePSS Website – Web Version Launched
ePSS Website – Case Study Results

![Search for Recommendations](image)

**Search for Recommendations**

Search results for a male, 65 years old, actively active, a tobacco user.

* Indicates an old grade denotation

<table>
<thead>
<tr>
<th>Grade</th>
<th>Title</th>
<th>Risk Info.</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Colorectal Cancer: Screening—Adults aged 50 to 75 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>HIV: Screening - Adolescents and Adults</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>High Blood Pressure: Screening — Adults 18 and Over</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>High Blood Pressure: Screening and Home Monitoring — Adults</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Syphilis: Screening — Asymptomatic, nonpregnant adults and adolescents who are at increased risk for syphilis infection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Tobacco Smoking Cessation, Behavioral and Pharmacotherapy Interventions — Adults who are not pregnant</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Thank You!

Any Questions?
References (1 of 4)


References (3 of 4)


