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# JOURNAL of Pharmacy

New Jersey Pharmacists Association
Spring 2016 • Volume LXXXX • Number 2

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The New Jersey Journal of Pharmacy (ISSN0028-5773 USPS #380-360) is published seasonally by the NJ Pharmacists Association
760 Alexander Road, PO Box 1
Princeton, NJ 08543-0001
609-275-4246 Fax 609-275-4066
www.njpharmacists.org

Periodicals Postage Paid at Princeton, NJ and additional mailing offices. Subscriptions paid for through allocation of membership dues. US Subscription **$50 per year;** Foreign Rate **$100 per year.**

POSTMASTER: Send address changes to The New Jersey Journal of Pharmacy, 760 Alexander Rd., PO Box 1, Princeton, NJ 08543-0001. 609-275-4246. www.njpharmacists.org



# *Table of Contents*

**2** President's Letter

**3** Message from the BOT Chair

**3** From The Editor's Desk

**4** Gradual Dose Reduction of Psychotropics in the Long-Term-Care Setting

**8** The Pharmacists Role in Wound Care with a Focus on Dressing Selection

**10** Resources to Optimize Medication Adherence

**15** A Systematic Review of Current eHealth Technologies that Foster Medication Adherence

**22** Practice Spotlight: Advanced Pharmacy Practice Experience Near and Far

**24** Member Momentum

**25** Continuing Education: Post-Lumbar Puncture Headache: A Mini- Review for Pharmacists


***Mission Statement:***

*To advance the profession of pharmacy, enabling our members to provide optimal care to those they serve.*

# *President's Letter*

Pharmacy Students and Graduates, You Can Make a Difference!

Welcome to the spring journal. This journal's focus is on the social aspects of pharmacy and I have to admit, it took some thought with regard to our profession. What will I write about? Societal issues in pharmacy, social life of a pharmacist or socializing in our profession? Do we even have time for this?

My friends, as busy as we all are, it's all about finding family, social and professional balance with your time. I'm sure the recent pharmacy graduates appreciate this as they begin their careers in pharmacy. As thrilled as they are at this memorable time, I am equally thrilled about 70 plus students and graduates from Rutgers who have recently gotten involved with NJPhA!! And boy do they want to make a difference! From pursuing a strong interest in becoming student immunizers, they are encouraging others to become involved in the future stake of the pharmacy profession. Students from FDU have also lent a hand at March Madness this year and continue to volunteer in other areas in the association. In addition, our student chapters at St. John's, PCP, Temple, and LIU undertake community projects and patient programs under the NJPhA umbrella. Yes, they are making a difference!

Recent graduates, I congratulate and applaud all of you! You are our future and your efforts to advance our profession WILL make a difference in society. I want to share some excerpts from a very moving commencement speech our NJPhA first vice president, Ron Mannino gave at the Rutgers Pharmacy commencement in May. Being a Rutgers graduate 42 years ago, Ron gave a 'back to the future' journey recalling when he passed out while mixing chemicals in Dr. Tom Medwick's medicinal chemistry class to becoming a savvy business owner in the pharmaceutical industry. Ron shares, "Always be mindful, it is Ok and human to question a potential change in your endeavors but the education you received here at Rutgers has afforded you the ability to flourish within all the practice settings that our profession has to offer. "

In addition, Dean Alvatroni's FDU commencement speech relayed a similar back to the future theme where he spoke of his journey, themed about purpose. "Be proud of what you've accomplished, but stay humble and know that just because they call you Doctor, your ability to give back and live life with purpose has nothing to do with the degree you've earned, but rather the degree in which you use your skills, your talents and your passion to inspire, love and serve others."

Whether a student, graduate or seasoned professional, I look forward to hearing your back to the future stories and hope you share the same with others as we embrace our professional endeavors!

Professionally yours,
Ruth Marietta, RPh, CCP
President 2015-2016

# *Message from the BOT Chairman*

Dear NJPhA Members,

I hope you all enjoyed this year's Spring Fling – unfortunately I was unable to attend but heard I really missed out! There have been a number of very successful events throughout the state over the last few months, including educational and social – I do hope you have been keeping abreast with everything going on and have been able to take advantage of the activities!

In this issue of the Journal, examining the Social Aspects of Pharmacy, we are covering a number of very important topics related to our role as pharmacists. Social aspect is the relationship that is developed by individuals through interactions with other people in the society. This is a very powerful sentiment as it relates to our profession. As you all know, pharmacists continue to be among the most trusted health care providers in the system, and we take this role very seriously. I believe it is our societal duty to understand our relationship to our patients but also the relationship those patients have with their other health care providers. In doing this, we are able to support the proper, multidisciplinary and effective use of therapies which are so critical to patient care!

Whether you work in the community, industry, hospital, academia, long term care, or other; keep doing what you're doing! Keep advocating for our patients! And don't forget to keep smiling!

Professionally yours,
Moriah Weissman, PharmD, CCP

# *From The Editor's Desk...*

Dear Colleagues,

Summer is here! We can begin to enjoy the warm sun, create vacation memories, and spend days at the beach and/or pool. I hope you the best this summer and congratulations to the new graduates! The NJ Journal of Pharmacy – the official peer-reviewed journal of the NJ Pharmacists Association is pleased to provide this issue that is dedicated to social health and pharmacist role in medication management. This issue will focus on optimizing medication adherence, ehealth technology, medication dosage reduction, and wound care.

You can earn continuing education by completing and submitting the fee-based Ohio CE concerning pneumococcal disease or our free CE which reviews post lumbar puncture headache. Our pharmacy spotlight is on a recent graduate and her pharmacy rotations.

Thank you for continuing to support the NJ Journal of Pharmacy and as always, please consider becoming active in the development of the NJ Journal of Pharmacy, through either submission of an article, or becoming a peer-reviewer. If interested please reach out to me, Elise Barry, or one of the NJPhA officers. You may email ideas and submissions or concerns to marcella.r.brown@gmail.com. I can help you with a topic consideration for the journal.

Happy summer!

Marcella R. Brown BSPharm, MS, PharmD, MPH, CGP, PharmD
Editor, NJPhA Journal Of Pharmacy

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# Gradual Dose Reduction of Psychotropics in the Long-Term-Care Setting

By: Ayse Elif Özdener, PharmD, BCACP, Michallene Betti, PharmD, BCACP, CGP
Jennifer Miller, PharmD, BCPP and Jillian Snyder, PharmD, BCACP

**Disclaimer**
Ayse Elif Özdener, Michallene Betti, Jennifer Miller, and Jillian Snyder have nothing to disclose concerning possible financial or personal relationship with commercial entities that may have direct or indirect interest in the subject matter of this manuscript. The contents of this manuscript do not represent the views of the U.S. Department of Veterans Affairs or the United States Government.

**Acknowledgement**
This work was supported by the United States (U.S) Department of Veterans Affairs.
*Dr. Ayse Elif Özdener was a Post Graduate Year (PGY)-1 Pharmacy Practice Resident at Wilkes-BarreVeterans Affairs Medical Center at the time this manuscript was written.
**Dr. Michallene Betti was a Clinical Pharmacist at the Wilkes-Barre Veterans Affairs Medical Center during the time this manuscript was written.

**Abstract**
*Objective:* The objective of this project was to implement a process for gradual dose reduction (GDR) of psychotropic medications in patients residing in the Wilkes-Barre Veterans Affairs Medical Center (WBVAMC) long-term-care (LTC) facility as per Centers for Medicare & Medicaid Services (CMS) and The Joint Commission guidelines.

*Methods:* The appropriateness of GDR was assessed in patients residing at the Community Living Center (CLC) who have been initiated or admitted on a psychotropic medication within the past year and/or have been on a sedative/hypnotic past the manufacturer's recommendations. Clinical pharmacists educated providers about GDR and initiated the process by establishing a biweekly GDR meeting. Patients were assessed for GDR during biweekly meetings and documentation was made of the assessment and interventions. If GDR was not tolerated, future dose reductions were deemed contraindicated by the physician.

*Results:* A GDR process was established and implemented referencing CMS guidelines. CLC residents were assessed for GDR and documentation was made in patients' charts as referenced in the CMS guidelines. Monitoring and additional psychotropic interventions were made during weekly-interdisciplinary CLC meetings.

*Conclusion:* The implementation of the GDR process has ensured that the WBVAMC is in compliance with CMS and The Joint Commission guidelines for GDR of psychotropic medications.

**Introduction**
In 2012, CMS announced the Partnership to Improve Dementia Care, an initiative to ensure appropriate care and use of psychotropic medications for nursing home patients.[1] CMS mandates LTC facilities establish a GDR protocol for antipsychotics, sedative hypnotics, and psychopharmacological medications (ex. antidepressants).[2] Before the development of the process described below, a GDR protocol in the CLC at the WBVAMC, as mandated by CMS guidance, was nonexistent.

**Background**
Psychotropic medications is an umbrella term for a variety of medication classes that alter mental function and include anxiolytics, hypnotics, antidepressants, and antipsychotics. While these medications alter mental function in all recipients, geriatric patients are at an increased risk of adverse events due to age-related changes in the absorption, distribution, metabolism, and excretion of the drug. The enhancement of adverse effects such as sedation, memory impairment and psychomotor impairment in geriatric patients taking anxiolytics and hypnotics increase their risk of falls.[3] A meta-analysis done by Ballard and colleagues showed that patients treated with atypical antipsychotics for behavioral disorders caused by dementia had an increased risk of cerebrovascular events and extrapyramidal symptoms compared to the placebo arm.[4] Atypical antipsychotics do not have a Food and Drug Administration (FDA)-approved indication for dementia-related psychosis but continue to be widely used for this reason.[5] Federal regulation of psychotropic medication usage in the LTC setting started with the implementation of the Omnibus Budget Reconciliation Act of 1987 (OBRA-87). This legislature put restrictions on the use of these medications in patients residing in nursing homes and set minimum standards of healthcare within these facilities. Before the implementation of this law, the rate of antipsychotic use in geriatric patients residing in nursing homes was 20-50%.[6] One study showed that there was a 26.7% reduction in antipsychotic prescribing within Medicaid recipients living in nursing homes in the state of Tennessee after the implementation of OBRA-87.[7]

In April 2005, the FDA announced that it would require all manufacturers of atypical antipsychotics to include a boxed warning in its labeling outlining the risk of increased mortality in patients using these medications for behavioral disorders secondary to dementia. In addition, the boxed warning is required to state that the atypical antipsychotic is not approved for the treatment of dementia-related psychosis. This decision came after the publication of several studies that compared the use of an atypical antipsychotic to placebo in elderly patients with dementia and behavioral problems. The majority of these studies demonstrated an increased mortality rate in patients taking an atypical antipsychotic in comparison to the control arm.[8]

Later, in 2012, CMS published guidelines outlining four categories in which GDR should be considered in LTC patients. These four categories include the use of antipsychotics in dementia patients with behavioral problems, use of antipsychotics in psychiatric disorders (ex. schizophrenia, bipolar disorder), use of sedative/hypnotics, and the use of other psychopharmacologic agents. CMS mandates that within the first year in which a patient is admitted on or has been prescribed an antipsychotic/psychopharmacologic

medication, the facility must attempt a GDR in two separate quarters with at least one month in between the attempts. After the first year, a GDR must be attempted annually.[1]
GDR of antipsychotics for behavioral symptoms related to dementia can be considered clinically contraindicated if the previous GDR within the facility caused instability of the target symptoms. The physician must document the rationale for why any additional attempts at GDR might cause instability in the resident's behavior.[1]

Contraindications for patients receiving antipsychotics for psychiatric disorders, sedative/hypnotics, and psychopharmacologic agents are identical. GDR may be considered contraindicated if the use of the medication is within current standards of practice and the physician documents the clinical rationale for psychiatric instability with dose reduction. GDR may also be considered contraindicated if a previous dose reduction caused psychiatric instability in the resident and the physician documents the clinical rationale for symptom exacerbation with future GDR.1 The flow charts below (Figures 1-4) explain the contraindications defined by CMS guidance for each of the four categories.

**Methodology**

*Objective*

The objective of this project was to establish a GDR protocol for psychotropic medications in patients residing in the CLC as per CMS guidelines.

*Project design*

This project was a prospective, quality-improvement project that began October 2013. The process that was developed continues to be used at the WBVAMC.

*Interventions*

Education was provided to CLC physicians and nurses, psychiatrists, and psychologists to inform them of CMS guidelines pertaining to GDR. The clinical pharmacists were responsible for monthly chart reviews to identify eligible patients for GDR. The schedule of patients to be discussed was made to coincide with weekly CLC interdisciplinary meetings. This process ensured that each patient would be discussed at the GDR meeting every 3 months. A templated note was created in the Computerized Patient Record System (CPRS) to facilitate GDR documentation for CLC physicians (Figures 5-6). A biweekly GDR meeting was established consisting of members from the psychology department, pharmacy department, psychiatry department, and CLC physicians. Five to ten patients were assessed for GDR at each meeting and documentation of assessment and interventions were made using the templated note. The dose of the psychotropic medication was decreased incrementally as tolerated. Intolerance to dose reduction was documented in the patient's chart as a contraindication due to psychiatric instability. Patients discussed at the biweekly GDR meeting were followed up in the weekly CLC interdisciplinary meeting.

*Endpoints*

The goal of this project was to design and implement a GDR protocol that physicians could follow to meet the standard of care set by CMS and The Joint Commission. Success or failure of dose reduction was not an outcome of this project.

*Analysis*

The process of implementation of a GDR protocol was summarized. Provider feedback was captured using a pre-and post-GDR survey and an applicable feedback was used to amend the protocol. The pre-and-post survey questions were as follows:

1. Do you understand what GDR is?
2. Do you feel comfortable initiating a GDR of the psychopharmacologic agent used by your patients?
3. Do you think the implementation of this new protocol will be a burden in your daily work routine?

An excel spreadsheet was maintained to track all the patients in the CLC who have been assessed for GDR in the GDR meetings.

**Results**

A total of seventy-five patients resided in the CLC in years 2013-2014. By May 2014, approximately 40 patients had been assessed for GDR and documentation of the assessment was made in all patients' charts. Five providers filled out the pre-and-post survey. The results to these surveys are described in the charts below (Figures 7-8).

**Limitations**

Initially, there were delays in getting all of the providers to agree with the new GDR process and the workload. This delayed the education and implementation process. More patients could have been assessed and documented if our original process was approved.

**Conclusion**

The implementation of the GDR process has ensured that the WBVAMC is in compliance with CMS and The Joint Commission's guidelines on gradual dose reduction of psychotropics in the long-term-care setting. Pharmacists can play a vital role in the development and implementation of such processes to ensure the efficacy and safety of psychotropic medication usage in the elderly.

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## References

1. Centers for Medicare and Medicaid Services. CMS Announces Partnership to Improve Dementia Care in Nursing Homes. 2012 May 30. Available from: http://www.cms.gov/Newsroom/MediaReleaseDatabase/Press-Releases/2012-Press-Releases-Items/2012-05-30.html
2. Centers for Medicare & Medicaid Manual System. Department of Health and Human Services. 2006 Dec 15.
3. Lindsey PL. Psychotropic medication use among older adults: What all nurses need to know. J Gerontol Nurs. 2009 Sep; 35(9): 28-38.
4. Ballard CG, Waite J, Birks J. Atypical antipsychotics for aggression and psychosis in Alzheimer's disease. Cochrane Database of Systematic Reviews. 2006 Jan 25; 1: DOI: 10.1002/14651858.CD003476.pub2
5. Beier MT, Martin CM. Gradual dose reduction and medication tapering: a clinical perspective. Consult Pharm. 2007 Aug; 22(8): 628-44.
6. Snowden M, Roy-Byrne P. Mental illness and nursing home reform: OBRA-87 ten years later. Psychiatric Services. 1998 Feb; 49(2): 229-233.
7. Shorr RI, Fought RL, Ray WA. Changes in antipsychotic drug use in nursing homes during implementation of the OBRA-87 regulations. JAMA. 1994 Feb 2; 271(5): 358-62.
8. Public health advisory: deaths with antipsychotics in elderly patients with behavioral disturbances. United States Food and Drug Administration. 2005 Apr 11. Available from http://www.fda.gov/Drugs/DrugSafety/PostmarketDrugSafetyInformationforPatientsandProviders/ucm053171.htm

*Figure 1*

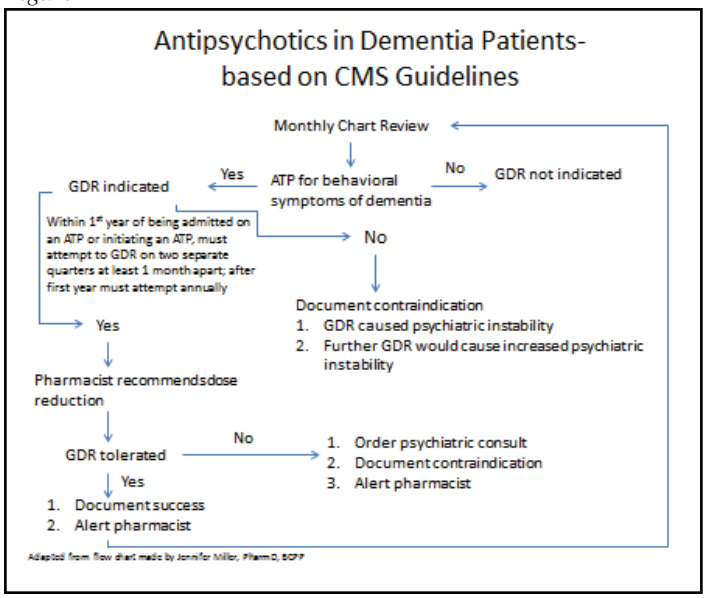
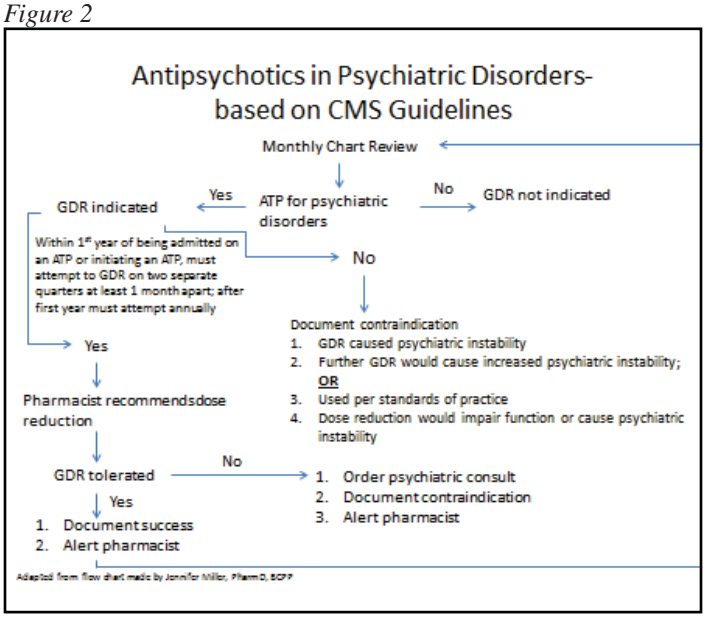



*Figure 2*

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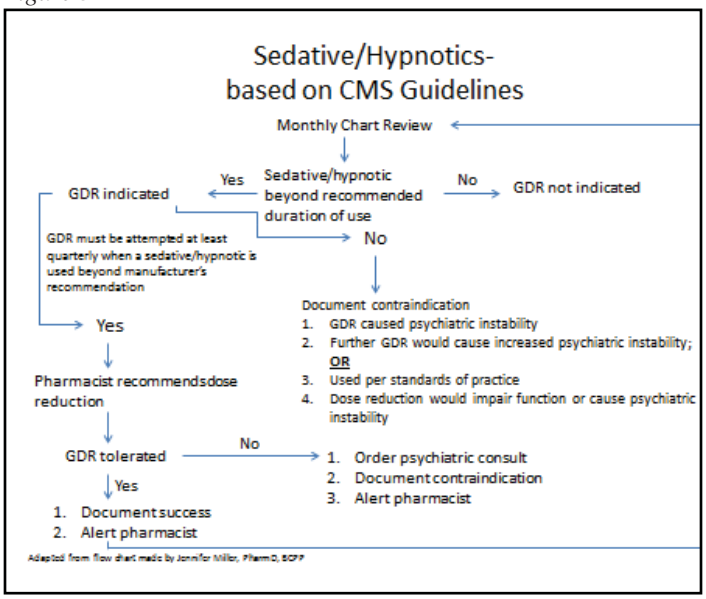


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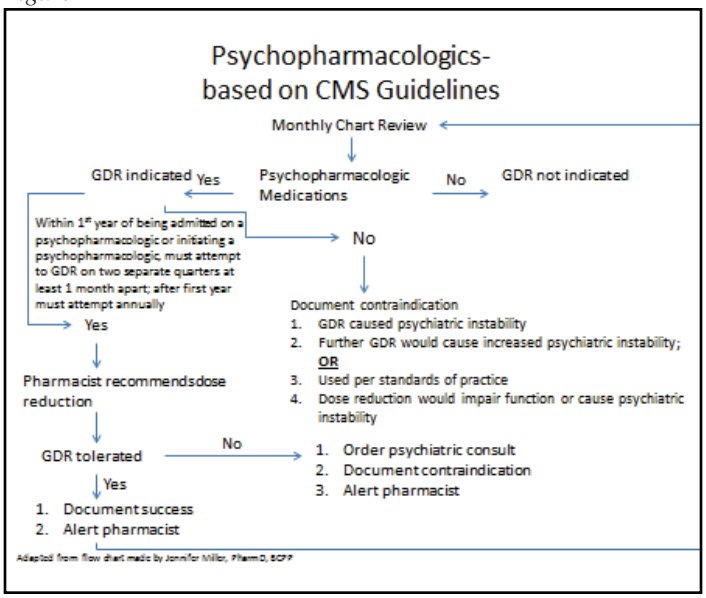

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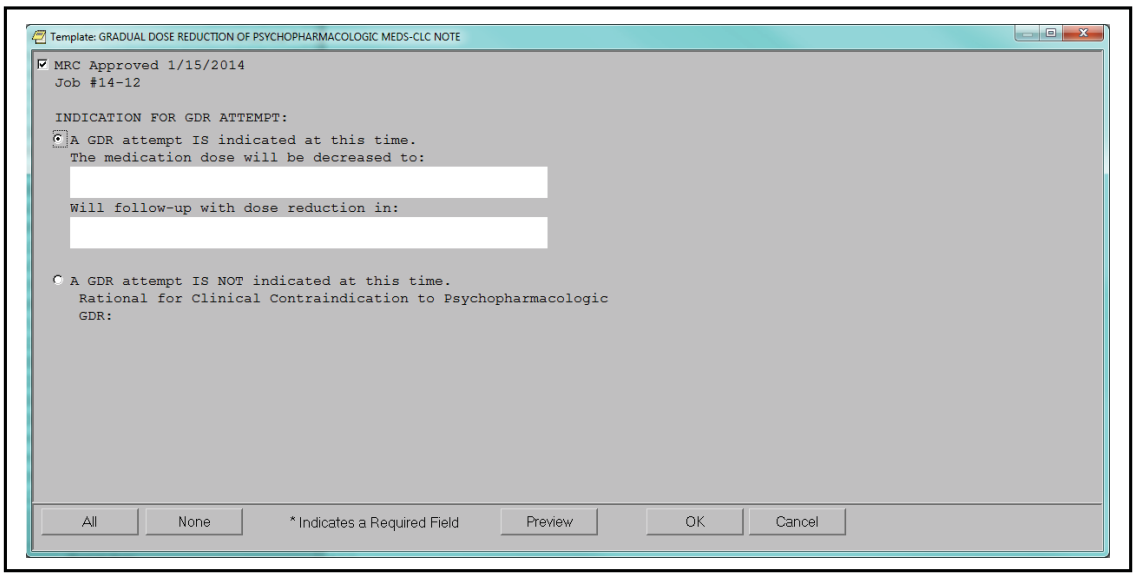


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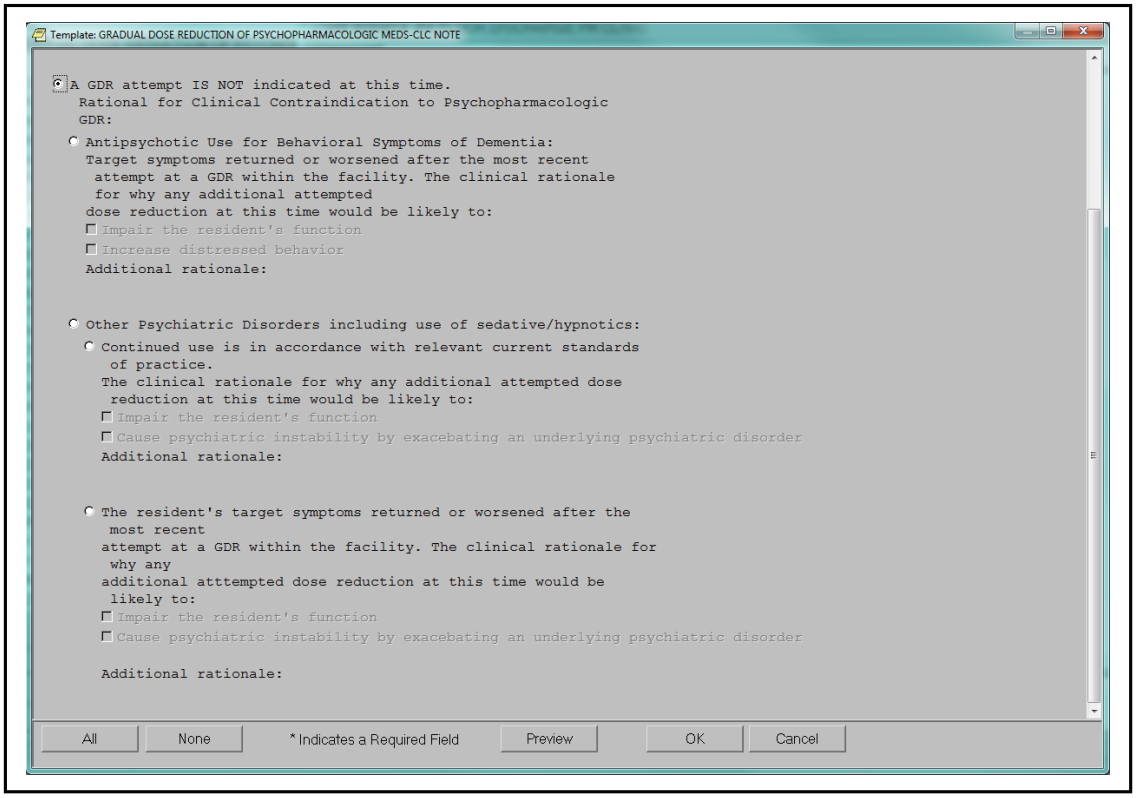



*Figure 7*

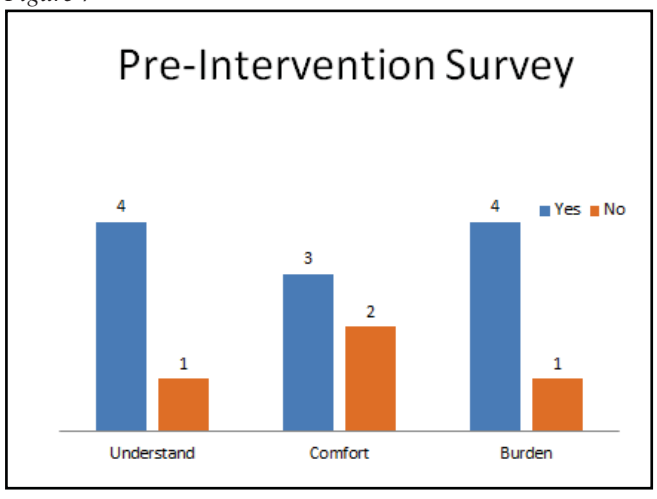
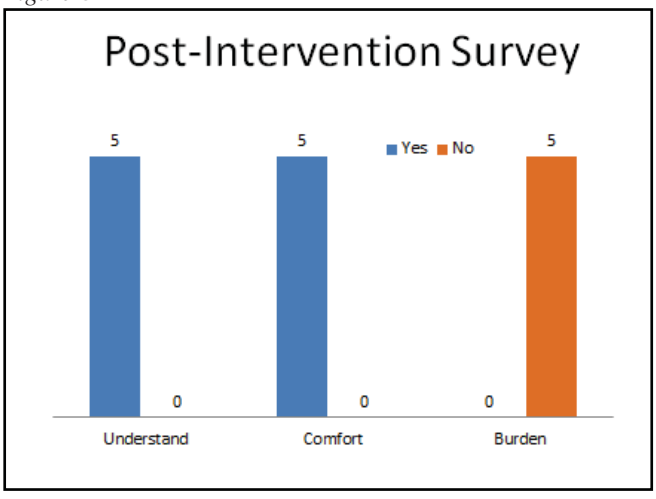



*Figure 8*



# The Pharmacists Role in Wound Care with a focus on Dressing Selection

By: Sean LaFlamme CWCA, CGP, BCPS

Current statistics show that chronic wounds affect 6.5 million patients in the United States[1]. The implications of this statement are far reaching. Monetary costs are said to reach 25 billion dollars annually in the United States.[1] The human costs associated with chronic wounds include pain, prolonged hospital stays, anxiety, increased morbidity, and even death. There are an increasing number of patients suffering from conditions that predispose them to chronic wounds. These diseases' include but are not limited to diabetes and obesity. These trends indicate that these current human and monetary costs are likely to increase in the future.

These staggering statistics indicate that a multidisciplinary team of health professionals is essential to reducing these costs. One may wonder why the pharmacist, an expert on medication therapy management, has not branched out to become an expert on wound dressings as well. A pharmacist is a valuable part of an interdisciplinary wound care team as an expert on both the selection of wound care products and their labeled use. The wound care pharmacist is able to assess a patient's medication regimen and optimize medication therapy while taking into account the patient's current wound status. Pharmacists can assess diabetic patients for proper glycemic control to encourage wound healing and also target medications known to inhibit wound healing such as corticosteroids and recommend dose reductions or discontinuation where appropriate. The wound care pharmacist is also able to assess the ever changing wound environment and proactively recommend treatment alternatives for a chronic wound that is not healing.

The American Board of Wound Management, recognized by the National Commission for Certifying Agencies, as well as other organizations, can provide essential information on preparation for becoming board certified in wound care as well as access to experts in the field, and competency testing for the pharmacist. A certified wound care pharmacist can potentially reduce wound care costs in an organization, improve patient care, and enhances career satisfaction for the individual pharmacist.
The following is a general overview of wound dressing selection and their role in proper wound care.

**What's in a Dressing Selection?**
A dressing should be selected that will maintain a moist, but not overly wet wound bed environment. The dressing should be able to absorb excess exudates if the wound bed is too wet. Conversely, if the wound is too dry the dressing should promote a moist environment. Another function of the wound dressing includes thermal insulation which keeps the wound tissue as close as possible to normal body temperature. Dressings act to provide a barrier to protect the wound from bacterial infection. They will also protect wounds that have exposed nerve endings, decreasing experienced pain. Lightly packing wounds with selected dressings can eliminate dead space, this will prevent premature closure of a non-healed wound and abscess formation. Certain dressings can be used to help remove wound debris, thus assisting the body with debridement. Finally, dressings provide for adequate gas exchange, allowing the wound to breath.
There are an incredibly large number of wound care products on the market today. With so many choices, it can be hard to choose the best product for your patient. Dividing wound care products 8 essential categories can improve understanding of the products.

**Gauze Products**
Gauze products are considered non-occlusive, highly permeable, and are designed for single-use. They can be used as a primary dressing to pack a wound or can be used as a secondary dressing, lending to the versatility and advantage of gauze dressings. Gauze products can be used on both infected and non infected wounds. They are considered the dressing of choice for wounds with frequent dressing changes to decrease cost. This is especially true with infected wounds or wounds that are being treated with enzyme debriding agents. Roll gauze can be especially useful for patients with fragile skin where adhesive products may cause further skin damage.

**Impregnated Gauze Products**
Impregnated mesh gauze can be impregnated with a number of different substances including petroleum, zinc, or bismuth. These dressings will always be a primary contact layer and always require a secondary dressing to secure. They are non-adherent and commonly used for a wound with a granulating wound bed. One noted precaution with the use of gauze impregnated with bismuth is that it may cause irritation, dermatitis, or inflammation in some patients.

**Transparent Films**
Transparent films are thin polyurethane sheets coated with a hypoallergenic adhesive that is inactivated by moisture allowing the film to stick to dry, periwound skin, skin located around the wound, instead of the wound bed. Transparent films are impermeable to bacteria but allow for gas exchange. They have no absorptive capability and are elastic and easily conformable to the wound. They enhance moisture by acting as a "blister roof." This dressing will act as the roof on that blister locking in moisture. This is important to note as brownish tan fluid may appear under the dressing that can sometimes be mistaken to be an infectious process. This, however, is actually the normal function of the dressing and it is important to advise patients and caregivers of this. Transparent films are not indicated for infected or heavily draining wounds.

**Hydrogels**
Hydrogels are used to donate moisture to dry wounds. They consist of 80% to 99% water or glycerin. They absorb minimal amounts of exudate and always require a secondary dressing. Hydrogels enhance hydration and are effective at softening eschar especially in combination with occlusive dressings such as a transparent film. Hydrogel sheets are particularly useful for skin tears. Hydrogels should not be used on infected or gangrenous tissue, and should not be used on heavily draining wounds. The use of hydrogels may cause maceration to the periwound skin.

**Hydrocellular Foams**

Hydrocellular foams are really the work horse in wound care. They are the most versatile of all the wound dressings. They have a polyurethane backing and hydrophilic side ready to absorb moisture from the wound. They are permeable to gas but not bacteria and provides thermal insulation. The adhesive is not overly sticky so they are less likely to cause periwound damage upon removal. These dressings are ideal for pressure ulcers, wounds with minimal to moderate drainage, and granulating or slough covered wounds. Foams are not indicated for dry or eschar covered wounds or arterial ulcers. They are also not ideal for areas of high friction because of the reduced stickiness of the adhesive.

**Hydrocolloids**

Hydrocolloid dressings were once considered the workhorses in wound care before hydrocellular foams were introduced to the market. They contain hydrophillic colloid particles with a film or foam backing and a strong adhesive. They absorb fluid slowly with the colloid particles becoming a gel-like mass, providing thermal insulation, and are an effective barrier to outside microbes, reducing the risk of infection. They enhance moisture retention and are useful for many types of wounds including but not limited to granulating wounds, dry necrotic eschar, minor burns, pressure ulcers and venous insufficiency ulcers. They should not be used on wounds with heavy drainage, and are contraindicated on infected wounds due to their occlusive nature. They should be used with caution in immuno-compromised patients and should only be used on patients with good periwound skin integrity as they may damage intact skin upon removal because of their strong adhesive properties.

**Alginates**

Alginates are a product derived from brown seaweed. They form a gel like mass when in contact with exudates. They are non occlusive, therefore they can be used on infected wounds and are easily conformable. A moist, but not overly wet environment is maintained in a heavily draining wound to promote healing and prevent maceration of the surrounding skin. Alginates are only to be used on moderate to heavily draining wounds to avoid desiccation, or over drying of a wound.

**Composites**

Composites are combinations of different classes of dressings. The easiest way to think of composites is to imagine a band-aid. They have an inner contact area to prevent sticking and prevent trauma, a middle layer used to absorb exudates, and an outer layer which is usually a semi-permeable plastic type material to keep debris out of the wound.

Advancing the practice of pharmacy means stepping into realms pharmacists are not traditionally involved. It makes sense for a pharmacist to become an expert on dressing selection and prescription drugs that focus on the promotion of wound healing. New wound dressings are being introduced to the market, thus there is an ever evolving practice in wound care. Having pharmacists as part of the wound care team can enhance patient care and lower healthcare spending through utilization of their knowledge and expertise and being at the forefront of these changes.

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**References**

1. Sen, Chandan K., et al. "Human skin wounds: a major and snowballing threat to public health and the economy." *Wound Repair and Regeneration* 17.6 (2009): 763-771.
2. Baranoski S, Ayello E. Wound Care Essentials. Lippincott, Williams & Wilkins, 2004.
3. Bryant RA, Nix DP, eds. *Acute and Chronic Wounds: Current Management Concepts. 4th ed*. St Louis, MO:Elsevier/Mosby.

# Resources to Optimize Medication Adherence

By: Sibyl M. Cherian, PharmD; Christine Lam, PharmD, BCPS; Rupal Mansukhani, PharmD

**Introduction to Medication Adherence**

Former US Surgeon, C. Everett Coop, best summarizes medication non-adherence in the following quote: "drugs don't work in patients who don't take them."[1] Unfortunately, this is the painful truth in healthcare worldwide. The World Health Organization (WHO) reports that "adherence to long-term therapy for chronic illnesses in developed countries average 50%."[2] In the United States, the rate of medication adherence drops after the first six months.[3]

Patients face many barriers when taking medications. The breakdown of medication adherence can begin in a provider's office. Patients can decide not to fill a prescription, take their medication incorrectly, or even discontinue medications.[4] Some examples of common barriers to medication adherence that are under the patients' control. These include forgetfulness, conflicting priorities, deciding to omit doses, emotional factors, and lack of information.[5] Healthcare providers can contribute to patients' non-adherence in various ways. They may inadequately explain the risks and benefits of the medications. Healthcare providers may also prescribe a complex regimen, fail to consider their patients' lifestyles, or even the cost of the medications. In order to improve the patient's ability to follow a medication regimen, all potential barriers must be addressed.

Healthcare professionals can help improve adherence (Table 1) by optimizing dose schedule, educating patients, and enhancing communication with their patients.[1,6] Optimizing patients' dosing schedule includes switching to once daily dosing if possible, and encouraging adherence aid use (Table 2). Furthermore, healthcare professionals should take into consideration patients' schedules when recommending a medication regimen.[7] Patient education about their disease state and medication therapy can further enhance medication adherence.[6,7] After communicating healthcare information, clinicians can utilize the teach-back method to check patient understanding by asking them to reiterate the information in their own words.[8]

Medication adherence may also be affected by other factors including medication access, transportation, and health literacy. These factors will be outlined in further detail throughout this article.

**Table 1. Methods to improve medication adherence**

| | |
|---|---|
| **Optimize dosing regimen** | • Switch to once daily dosing<br>• Adjust timing, dosage, and frequency<br>• Adherence aids |
| **Patient education** | • Provide clear instructions<br>• Reinforce discussion (teach-back method) |
| **Patient and healthcare professional relationship** | • Assess patients' priorities and needs<br>• Address perceived barriers of taking medications |

**Table 2. Adherence aids**

| | |
|---|---|
| **Medication manager apps (free and available for iOS and Android)** | Dosecast<br>My Pillbox<br>Medisafe |
| **Cellphone reminders** | |
| **Pillboxes** | |

**MEDICATION ACCESS**

One of the many reasons patients may have trouble with medication adherence is due to the cost of prescription medications.[9] This may have massive adverse consequences on public health and total healthcare cost.[10] In this section, we will outline some of the current medication access programs that are available for patients who have problems with the affordability of prescription medications.

**Pharmacy Savings Programs**

Most community pharmacies offer some form of a prescription savings program or generic medication lists for patients who are unable to afford their medications.[10] This is often a quick way to save on prescriptions because most pharmacies do not require membership fees or a waiting period. Table 3 lists the various types of programs that are currently available at community retail pharmacies. This list is not all-inclusive and it is important to contact the particular pharmacy to find out about any prescription savings plans. It is important to bear in mind these savings are subject to change at the discretion of the participating retail pharmacy. Furthermore, the online available lists for qualifying medications may not be current and up to date. It is important for patients to speak to a retail pharmacist for the most accurate information.

**Pharmacy Coupons**

In addition to pharmacy savings programs, there are numerous drug coupons that are available. Drug coupons, from either manufacturers or non-profit organizations, can make expensive brand-name prescription medications more affordable. These coupons are not considered insurance, can vary in their average savings and are frequently changing. Some available savings coupons include National Association of Counties (NACo) Prescription Discount Program, RxSavingsPlus, and AAA Prescription Savings. Many drug coupons are available through drug online searches. Other websites, such as www.goodrx.com and www.wellrx.com, offer prescription discount cards and prescription drug price comparisons at local pharmacies

| Table 3: Pharmacy Savings Programs* | |
|---|---|
| **WALMART**† **KROGER WEGMANS** | ✓ $4 generic list/30 days |
| **RITE AID** | ✓ 15% savings on select brand name prescriptions<br>✓ $9.99 for 30 day supply and $15.99 for 90 day supply<br>✓ Select generic oral contraceptives for $19.99<br>✓ A 50-count of Rite Aid TRUEtest diabetic test strips for $29.99 |
| **CVS** | ✓ NLC Prescription Discount Card & Easy Drug Card<br>✓ Discounts only available at participating pharmacies<br>✓ Average savings of 24% off the full retail cost of prescription medication |
| **WALGREENS** | ✓ Membership fee required ($20 individual and $35 family per year)<br>✓ Tiered savings/90 days: Tier 1 ($10); Tier 2 ($20); Tier 3 ($20)<br>✓ Medicare, Medicaid and other federal or state healthcare programs are ineligible |
| **STOP AND SHOP ACME**‡ | ✓ $3.99 for a 30-day supply and $9.99 for a 90-day supply of select generics |
| **COSTCO** | ✓ Must be Costco member<br>✓ Estimated between 2% to 40% savings and determined at time of sale |
| **SHOPRITE** | ✓ Free diabetes medications (metformin and sulfonylureas)<br>✓ "4Dollar Drugs": $3.99 for a 30-day supply and $9.99 for a 90-day supply |
| **SAM'S CLUB** | ✓ Must be Sam's club member<br>✓ Free 30 day supply of donepezil, escitalopram, pioglitazone, vitamin D 50,000 units (4 capsules), finasteride<br>✓ 200 generic prescriptions for $4/30 days<br>✓ 400 generic prescriptions for $10/30 days<br>✓ 10-30% on select name-brand prescriptions |

.* All information obtained through respective pharmacy websites and may be subject to change

† Prices may be higher in CA, HI, MT, PA, TN and WI

‡Target is now operating under CVS/Caremark and does not honor previous savings program

§ Requires annual fee of $11.99

**Patient Assistant Programs**

Patient assistance programs (PAPs), or medication assistance programs, are pharmaceutical company plans that provide brand name medications to low-income, uninsured, or underinsured patients at a reduced cost or for free.[11]

Every program may differ in specific eligibility requirements but typically patients must meet these requirements:[11]

1. United States residency (some may require that the patient is a legal resident or U.S. citizen)
2. Prescription issued by a healthcare provider
3. Health insurance without prescription coverage provisions – patients must not have any public or private insurance (Medicare, Medicaid, Veteran's benefits, or any state-supported prescription assistance program)
4. Limited income - each company has specific income eligibility
5. Chronic medication needs – the process of PAP may take weeks so it may be inappropriate for patients with acute conditions

While the application process can be complex, it can be broken down into five steps:[11,12]

1. Find PAP form – most application forms are located on the pharmaceutical company's website.
2. Fill out PAP form – it is also important to keep a copy of the completed form before sending it out.
3. Send out PAP form – check on the company's website to see how the manufacturer accepts form.
4. Obtain PAP drug – if approved, medications are usually sent to the provider's office or local pharmacy for distribution. Patients may receive 30-180 day supply.
5. Drug is dispensed from the patients' pharmacy or sent directly to patient via mail
6. Refills – new application may need to be submitted

PAPs are a great resource for medication access but present some challenges. Many programs may require patients to have a social security number, which may be a barrier to non-citizens/resident. Requirements for PAPs change frequently due to company merges, state and federal regulations, or expired patents; therefore, it is important to check the website for the most up to date form. Filling out the form may be time consuming due to its complicated instructions, detailed documentation requirements, and prolonged waiting period to receive medications (about 4-6 weeks).[11] This is why PAPs should generally be used for prescribing chronic medications. Despite all of these challenges, PAPs may still have numerous benefits to the patients that qualify for the programs. Similar to the pharmacy saving programs, these PAPs are subject to change at the discretion of the manufacturer.

Table 4 identifies several databases to search for PAPs. These online lists can be used to help identify the manufacturer company of a specific drug. It is important to look on the manufacturer's website because these online available lists may be subject to change.

| Table 4. Comprehensive database to search for patient assistance programs |
|---|
| NeedyMeds (www.needymeds.org) |
| Partnership for Prescription Assistance (www.pparx.org) |
| Patient Assistance Program Center (www.rxassist.org) |
| RxHope (www.rxhope.com) |

**340B Drug Pricing Program**

The 340B program, created under Section 602 of the Veterans Health Care Act of 1992, requires drug manufacturers to provide discounts on expensive outpatient drugs to healthcare providers.[13] The only products that are not covered under the 340B program are drugs without a National Drug Code (NDC) number, inpatient drugs and vaccines, and drugs not directly reimbursed by a payer.[14] These healthcare providers, also known as Covered Entities (CEs), are then able to provide these medications to vulnerable patient populations.[15] Typically hospitals or non-hospital centers that qualify for this program provide care and service to low-income individuals who do not qualify for Medicaid or Medicare.[15] Some examples of non-hospital centers include Ryan White Act Part A, Part B, and Part C programs.[16] A list of these covered entities can be found on the HRSA Office of Pharmacy Affairs 340B database. Once the Office of Pharmacy Affairs (OPA) approves these facilities as covered entities, they can start to receive discounts on all covered outpatient drugs.[15]

Not all patients can receive medications through this program. In August 2015, eligibility requirements were changed for 340B purchased drugs. Patients need to meet three criteria:[17]
1) Covered entity has an established relationship and maintains records of care
2) Patient receives healthcare services from healthcare professional employed/contracted with covered entity
3) Patient receives healthcare consistent with range of services from the covered entity
Patients have to meet all three criteria in order to be eligible for this program. [17] This is one way that hospitals and non-hospital facilities can help patients with obtain expensive medications.

**HEALTH LITERACY**

Functional health literacy is "the ability to read, understand and act on health information," which includes prescription labels, appointment slips, health insurance paperwork, and diagnostic test instructions.[18] According to the Program for the International Assessment of Adult Competencies (PIAAC), 67% of patients between 66 to 74 years old were at level three or below health literacy proficiency. At a level three or below, patients could not understand information that may be complex or in unfamiliar contexts. Patients also could not perform tasks that involved understanding of arguments or communicating rationalized explanations to answers.[19]

Poor health literacy can lead to negative health outcomes. Patients with lower-level reading are three times more likely to experience adverse outcomes than those who read at higher levels.[20] Furthermore, patients with poor health literacy may be hospitalized more frequently.[21,22] In a study conducted in an urban public hospital, patients with inadequate health literacy, as defined by the short version of the Test of Functional Health Literacy in Adults, had double the number of hospitalizations when compared to patients with adequate literacy.[21,22]

Healthcare practitioners can improve educating patients with poor health literacy by asking open-ended questions, using simple language, and providing written information (Table 5). Health literacy can also be improved by ensuring patients and caregivers are given easy-to-read materials. There are several tools, highlighted in Table 6, which are available to improve the readability of medical materials.

| Table 5. Strategies for Improving Patient Education[18] |
|---|
| **Communication** |
| Introduce yourself clearly and greet patient by name |
| Create an environment open to learning |
| Obtain consent from patient and ask if family member or caregiver would like to listen |
| Ask open-ended questions |
| Use simple, easy-to-understand language |
| Connect new information to previously learned knowledge |
| Specify information to specific patient by using examples and giving reasoning |
| Repeat important information and ask the patient to repeat the same information back |
| If applicable, demonstrate what is being taught |
| **Written Materials** |
| Prepare written materials at a 5th grade reading level |
| Tailor material to patient by including the patient's name |
| Use one or two syllable words and short sentences |
| Use large-font print |
| Use uppercase letters, bold, highlight or underline to emphasize certain points |
| Try to use bullets instead of paragraphs |
| Avoid a cramped look by spacing appropriately |
| Focus on writing only important points |
| Avoid too much unnecessary details |
| Use illustrations relevant to text |
| Use verbal education to highlight written material |
| Give importance to the patient's motivation to succeed |

| Table 6. Resources to Improve Health Literacy[18] | |
|---|---|
| **Resource** | Purpose |
| **Maine Area Health Education Center (AHEC) Literacy Center** | • Checklist available to ensure patient education pamphlets are easy-to-read |
| **Readability Calculations** | • Computer program to assess reading level of written material |
| **Vocabulary Assessor** | • Available for purchase with Readability Calculations<br>• Identifies text words that may be confusing for patients |
| **Microsoft Word: Flesch Reading Ease score, Flesch-Kincaid Grade Level score** | • Check readability of document |

**TRANSPORTATION**

Lack of transportation is a main challenge faced by patients as they transition back from the hospital to home. Patients may depend on unpredictable or limited options for transportation.[23] Studies involving patients with chronic diseases have demonstrated that issues with transportation can have a considerable effect on adherence to medications and medical care.[23,25]

Patients living in the state of New Jersey have several options to access to find transportation to a clinic appointment or to the pharmacy. An online search database, www.NJfindaride.org, will match specific transportation needs to available public and accessible transportation options. Eldercare.gov allows patients to search for available transportation areas through zip code or city and then provides contact information for available services. Many Eldercare services will link to the Union County Paratransit System (phone number: 908-241-8300) for patients 60 and older. There is a $4 roundtrip fee, but waivers are available for low income riders. Table 7 lists several options available for patients in need of transportation.

| Table 7. Transportation Resources | |
|---|---|
| **Area Agency on Aging** | Identify local agency through eldercare.gov |
| **NJ Ease** | (877)-222-3737, toll-free number with available transportation options for disabled and older adults |
| **New Jersey Council on Special Transportation** | (973)-251-2242, information on available transportation services for people with disabilities |
| **New Jersey Transit** | 1-800-955-2321, Access Link services for people with disabilities |

**CONCLUSION**

Some factors leading to poor adherence include poor health literacy, lack of transportation, and medication expense. Pharmacists are in a unique position to develop a trusting, professional relationship with their patients. They can help identify potential barriers and create solutions by using available tools to improve medication adherence. Better patient education, adherence aids, transportation considerations, and medication costs are techniques that can further increase patient adherence and improve outcomes for patients and the overall healthcare system.

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**References**

**1.**Osterberg L, Blaschke T. Adherence to medication. *N Engl J Med*. 2005;353:487–497.
2. Sabate E. Adherence to long term therapies: evidence for action. *World Health Organization*. 2003. http://www.who.int/chp/knowledge/publications/adherence_introduction.pdf. Accessed March 2, 2016.
3.Choudhry NK, et al. Trends in adherence to secondary prevention medications in elderly post-myocardial infarction patients. *Pharmacoepidemiol Drug Saf*. 2008;17:1189-1196.
4. Kocurek B. Promoting medication adherence in older adults…and the rest of us. *Diabetes Spectr.* 2009;22(2):80-84. doi: 10.2337/diaspect.22.2.80.
5. Cramer J. Identifying and improving compliance patterns. In: Cramer JA, Spilker B, eds. *Patient compliance in medical practice and clinical trials.* New York, NY: Raven Press; 1991:387-392.
6. Atreja A, Bellam N, Levy SR. Strategies to enhance patient adherence: making it simple. *MedGenMed.* 2005;7(1):4.
7. American College of Preventive Medicine. Medication Adherence Time Tool: Improving Health Outcomes. American College of Preventive Medicine Website. http://www.acpm.org/?MedAdherTT_ClinRef. 2011. Published 2011. Accessed March 5, 2016.

8. Use the Teach-Back Method: Tool #5 | Agency for Healthcare Research & Quality. *Ahrqgov*. 2015. Available at: http://www.ahrq.gov/professionals/quality-patient-safety/quality-resources/tools/literacy-toolkit/healthlittoolkit2-tool5.html. Accessed May 18, 2016.
9. The Public on Prescription Drugs and Pharmaceutical Companies. *Kaiser Family Foundation*. 2008. Available at: https://kaiserfamilyfoundation.files.wordpress.com/2013/01/7748.pdf. Accessed May 15, 2016.
10. Choudhry NK, Shrank WH. Four-dollar generics-increased accessibility, impaired quality assurance. *N Engl J Med* 2010;363:1885-1887.
11. Richardson K and Geller S. *Using Pharmaceutical Company Patient Assistance Programs: A Volunteers in Health Care Guide* 2004, Pawtucket, RI: Volunteers in Health Care
12. Klein B. Patient Assistance Programs: Getting Free Drug from the Drug Makers. *ACRIA* 2004;13(4):15-17. Available at: http://img.thebody.com/legacyAssets/45/36/fall04.pdf
13. Section 602 of the Veterans Health Care Act of 1992 (P.L. 102-585) confided as section 340B of the Public Heath Act. Initial federal regulations, 57. Reg. 27289. Available at: http://www.hrsa.gov/opa/programrequirements/publiclaw102585.html#602. Accessed May 15, 2016.
14. Eligibility & Registration. *Hrsa.gov*. Available at: http://www.hrsa.gov/opa/eligibilityandregistration/index.html. Accessed May 14, 2016.
15. Avalere Health. The 340B drug discount program: a review and analysis of the 340B program. *Winter 2013*. Available at : http://340breform.org/userfiles/340b%20white%20paper%20final.pdf. Accessed May 14, 2016.
16.Winter A. Zabinski C. The 340B Drug Pricing Program. MedPAC. November 6, 2014. Available at: http://www.medpac.gov/documents/november-2014-meeting-presentation-the-340b-drug-pricing-program.pdf?sfvrsn=0. Accessed May 14, 2016.
17. Patient Definition - 340B PVP. *340bpvp.com*. 2014. Available at: https://www.340bpvp.com/resource-center/faqs/patient-definition/. Accessed May 14, 2016.
18. Andrus, M. R., Roth, M. T. Health literacy: A review. *Pharmacotherapy.* 2002;22(3);282-302
19. Skills of U.S. Unemployed,Young, and Older Adults in Sharper Focus. *Nces.ed.gov*. 2016. Available at: http://nces.ed.gov/pubs2016/2016039.pdf. Accessed May 15, 2016.
20. Dennison CR, McEntee ML, Samuel L., et al. Adequate health literacy is associated with higher heart failure knowledge and self care confidence in hospitalized patients. *J Cardiovasc Nurs.* 2011 Sep-Oct; 26(5): 359–367.
21. Baker DW, Parker RM, Williams MV, Clark S. Health literacy and the risk of hospital admission. *J Gen Intern Med.* 1998;13:791–8.
22. Baker DW, Gazmararian JA, Williams MV, et al. Functional health literacy and the risk of hospital admission among managed care enrollees. *Am J Public Health.* 2002;92(8):1278-1283.
23. Welty TE, Willis SL, Welty EA. Effect of limited transportation on medication adherence in patients with epilepsy. *J Am Pharm Assoc*. 2010;50:698–703.
24. Strauss K, Maclean C, Troy A, Littenberg B. Driving distance as a barrier to glycemic control. *J Gen Intern Med.* 2006;21:378-380.
25. Santos Pde M, D'oliveira A Jr, Noblat Lde A, et al. Predictors of adherence to treatment in patients with severe asthma treated at a referral center in Bahia, Brazil. *J Bras Pneumol.* 2008;34:995-1002.

# A Systematic Review of Current eHealth Technologies that Foster Medication Adherence

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**ABSTRACT**

**Objective:** To systematically review the literature to identify emerging eHealth technologies.

**Methods:** A PubMed search identified articles between January 2011- January 2015 using these terms: medication adherence/ methods, chronic disease. A total of 477 unique abstracts were screened for inclusion based on the following: described or evaluated a health information technology; reported on patient usability; or reported on outcomes affecting medication adherence.

**Results:** A total of 477 abstracts were screened and 23 abstracts met the inclusion criteria. Two additional full-text articles were included. A total of 25 full-text articles described innovations using these eHealth tools: automated messaging and interactive voice response systems using telephone calls, internet portals, software applications for mobile devices or computers, messaging using smart phones, electronic dose monitoring, and predictive analytics.

**Conclusion:** eHealth technology is an emerging tool to promote adherence to medications, achieving healthy targets, and adopting self-care behaviors. Pharmacists should be aware of the available eHealth tools in order to recommend them as a medication adherence aid. eHealth reminders using automated phones calls or text messaging, and electronic-medication monitoring are simple and modestly effective tools to improve adherence. Predictive analytic software for use by a community pharmacy is also an effective tool to identify at-risk patients.

Patients lose interest with text-messaging reminders after several months to a year.

Health information technology, or eHealth, is being integrated into patient care to support and foster medication adherence. eHealth is a tool that offers the convenience of supporting the patient in their home, work or recreational setting. However, the impact of these tools are unclear. The synopsis from a Cochrane Systematic Review (2008) explained that adherence interventions were effective in the short-term but studies did not consistently demonstrate a statistically significant effect.[1]

A desired target for medication adherence is 80% or higher.[2] In some disease states, such as HIV, optimal adherence rates are set at >95% to reduce viral load.[2] Poor adherence occurs when an individual takes less than 50% of prescribed doses.[2] Medication nonadherence is quite prevalent and average adherence rates for chronic diseases are reported to be 43-78%.[2] The rates of nonadherence in patients with asthma range from 30-70%.[3] For example, some patients with intermittent asthma symptoms stop using their inhaler when their symptoms are controlled. Fifty-one percent of patients diagnosed with hypertension were reported to remain adherent to drug therapy regimens.

eHealth technology offers opportunities for one-way and two-way communication using telephones, mobile devices, or computer. A description of these eHealth terms are listed in Table 1. The momentum behind implementation of eHealth stems from legislation and national campaigns to reform health care delivery and improve quality.[4] The Department of Health and Human Services "National Action Plan to Improve Health Literacy" recommends automated telephone messaging for supporting patient self-management. The aim of the paper is to inform pharmacists on innovations affecting health information technology designed to improve medication adherence.

## Methods

A systematic review was conducted in order to describe emerging research on eHealth technologies to improve medication adherence in patients diagnosed with chronic disease. A literature search was performed using PubMed between dates January 1, 2011 and dates January 15, 2015. The following terms were used to conduct a broad search using All Fields: medication adherence/ methods, medication adherence behaviors, self-management behavior, and chronic disease. The search was limited to English. A total of 477 unique abstracts were reviewed and screened for inclusion. Abstracts were included if they described or evaluated an innovative health information technology; reported on patient usability; or reported on outcomes affecting medication adherence. Key study details were extracted from the abstracts and full-text articles then entered into an Excel worksheet.

## Results

A total of 477 abstracts from PubMed were screened. Twenty-three full-text articles that were entirely focused on eHealth were included. Two additional full-text articles describing completed study results were located by searching PubMed using the author names. A total of 25 articles were included in this review, and are listed in Table 2. The populations described in the publications included these chronic disease states: cardiovascular, pulmonary, diabetes, infectious diseases (HIV), rheumatoid diseases, congenital disorders (Spina Bifida) and others.

## Telephone calls

A telephone call or telephone reminder is an inexpensive and commonly used eHealth tool to promote medication adherence.[3,5,6] Telephone calls are initiated manually or are automated to deliver a recorded voice message or video message.[6,7] Recorded messages provide motivating reminders to the patient on taking their medication dose. Health plans use a live person-to-person call, automated calls, and text messaging to contact patients when alerted to a pattern of nonadherence.[5] The database search identified a number of articles describing innovative research using interactive voice systems to foster self-monitoring and medication adherence.

Health information technology can overcome health access barriers as a bridge for patients with limited transportation, home-bound due to disabilities, and living in rural settings.[8,9,10] One-hundred sixty-five patients with diabetes and hypertension were enrolled in a 12-week pilot study evaluating a self-management program that used a weekly telephone monitoring using an interactive voice response system.[10] Patients used the telephone system to report their health status (excellent versus poor health), medication dose-supply counts, and home blood pressure readings at weekly intervals. The percentage of patients reporting good to excellent health increased from 64% to 88% by study end.[10] Plus, patients with improved health status were more likely to self-report adherence to medications ($p < 0.001$).[10]

eHealth supports the use of combined interventions

such as calling patients to deliver motivational support.[8,11,12] Motivational interviewing is a technique to facilitate patient self-recognition of adherence barriers and promotes changes in the patients' health behavior.[8] Evidence supporting this comes from 2 recent systematic reviews of telephone-based motivational interviewing in patients with chronic diseases that included studies published between 1991-2012.[8,11] Five of the 9 studies evaluated showed a statistically significant improvement in adherence.[8] Calls were made at weekly or monthly intervals by trained practitioners. One robust trial used random patient assignment (n = 2,087) and detected a significant difference in Medication Possession Ratio for older adults [48% in the intervention arm versus 31% control arm ($p< 0.05$)].[8] Despite design flaws affected by small sample size, short follow-up period (3-17 months), and subjective measures of adherence, the authors felt that these interventions merit further exploration.[8]

eHealth was evaluated as a tool to overcome language barriers and provide Culturally and Linguistically Sensitive Communication. SMARTSteps is "Self-Management Automated and Real-Time Telephonic Support Study" that provided 12 minute weekly calls in Cantonese or Spanish.[7] Patients with diabetes were enrolled in this 7-week study. Patients used an interactive telephone system to access self-care topics and to request follow-up calls from health coaches for assistance with goal-setting. The 6-month outcomes were not significantly different for medication adherence or clinical endpoints (Hemoglobin A1C).[13] Adherence was assessed using patient self-report and refill pharmacy claims. However, the intervention group was more likely to adopt self-care behaviors such as blood glucose monitoring than the control group ($p< 0.01$).[13] eHealth interventions can be tailored to individuals with all levels of health literacy or spoken languages.

**Text Messages**

Text messaging delivers standard or personalized messages to encourage medication adherence and self-management. Patients with psoriasis, a chronic disease prone to acute flares, were treated with high-risk medications such as methotrexate and biological agents. In a well-designed study by Balata N. et al., adult outpatients (n = 20) were sent frequent text-messages over 12 weeks versus a usual care arm (n = 20).[14] Patients reported on the number of days per week that medications were taken. The number improved significantly from 3.86 days per week at baseline to 6.46 days per week in the text messaging group ($p < 0.001$). There was no difference in the usual care arm.[14] Disease severity scores improved significantly in the text messaging arm versus control($p<0.05$).[14]

The "Medication Plan" smartphone mobile application (app) was evaluated for usability in a European study targeting patients with kidney disease.[15] The app was designed for quick input of prescription data and sent one-way text-messages to remind patients about their medication dosage, instructions, and timing of dose. Ads for the app were posted on a health-related website, and the app was distributed in Germany by Apple™. There were approximately 12,000 software downloads and demographic data was collected from 2,279 users. After 1 year, 1% of users were using it regularly. After 30 days, 29% of the users used the app once per week, and 27% had activity recorded for at least 84 days. The majority of the users were 50 years and older, male, and had cardiovascular disease. Thirteen-percent of users had kidney or liver transplants. Long-term usage rates declined during the "Medication Plan" study and with other studies.[15,16] The low response rate reflects "message fatigue" which reflects the patients lack of interest in responding to frequent messages.

Two meta-analyses evaluated interventions using a phone and pager text-messaging in patients with chronic diseases.[6,17] Fenerty SD et al concluded that there was a modest yet significant improvement in mean adherence rates with an eHealth reminder intervention versus control (66.6% vs. 54.7% [95% CI 0.8%-22.4%]).[6] The major barrier to estimating the true intervention effect stems from inclusion of studies using quasi-experimental design. Text-messaging is an appealing tool due to the capacity to automate the messages however the shortcoming is message fatigue.

**Internet and Web Portals**

The research evaluating the impact of web portals to promote medication adherence is in the early stages. There were 2 published pilot studies that included a small numbers of patients.[18,19] The web portal system is set-up for two-communication using mobile phone apps (and/or internet) for the patient and a clinical internet portal for the clinicians. The iMHere system is comprised of 9 mobile apps and a web portal for patients with Spina Bifida.[18] Spina bifida is a chronic disease prone to complications, and patients are susceptible to increased hospitalization due to skin wounds. An eHealth intervention was introduced to a cohort of 14 patients with Spina bifida. The apps supported the patient's self-care tasks, delivered medication reminders, and tracked adherence. Patients used the Medication Management app (MyMeds) to schedule daily alarm reminders. Eleven patients used the app consistently for the 6 month study period, often more than twice a day.

A nurse-led monitoring program, MasterYourBreath, encouraged self-directed use of web-based educational modules on smoking cessation, physical activity, and medication adherence.[19] The aim of the program was to motivate patients with pulmonary disease to use the modules in-between provider visits. Eleven patients were included and were given tailored feedback on lifestyle changes and adherence. Portal usage was highest during the first month, and then declined. Eleven patients used the adherence tool a total of 12 times. There were no differences in self-reported adherence using the Medication Adherence Rating Scale (MARS-5). This web-based tool was not used consistently, and reasons given for this were lack of variation in educational content.

**Mobile Software Applications and Electronic Dose Monitoring**

Mobile medication management app software has the advantage of delivering multiple functions to support patients taking complex medication regimens.[20,21] Older adults were introduced to 4 mobile apps using an iPAD® tablet and created a medication list, set a reminder alarm, and shared lists using email (Table 2).[20] The users (n = 35) had mixed opinions on daily usability and functionality of the apps. There was a learning curve to competently use the apps, however, users felt they would make an effort to practice if they believed apps could be of benefit to them. Those individuals with hearing loss could not hear the reminder alarms, and many would turn-off the devices when not in active use.

Electronic dose monitoring is a form of eHealth that supports dose-memory and dose-reminder functions.[22] Monitors are placed directly on the lid of a prescription bottle or other device (ex. insulin pen) to support continuous monitoring. When the bottle is opened or used, it records the data in a remote data storage device. One monitor uses a light alarm, sound alarm, and text messaging alert. A systematic review identified 4 studies which measured adherence as an outcome and used an observational (n = 2) or random assignment (n = 2) design.[22] The devices were associated with significantly improved adherence rates when age

(children) and memory impairment were a factor.[22] A different systematic review focused on studies including patients with HIV and identified 20 studies using active reminder devices.[23] The active reminder devices used some form of technology. Seventy-percent of the studies had at least one favorable outcome measure (pharmacy refill, clinical outcomes). [23]

Mobile software and electronic monitoring devices provides automated dose reminders and/or tracking. These tools can empower patients to support development of a daily habit of taking medications or to look up drug information. Pharmacists can review the adherence patterns together with the patient and discuss ways to overcome barriers to adherence. Electronic monitoring does not guarantee that the patient administered the dose.

**Predictive Analytic Software**

Predictive analytics describes the ability to use data to detect trends predictive of medication nonadherence. MeMO® is a program designed for community pharmacists in the Netherlands.[24,25] A software algorithm was used to search prescription refill database to detect refill patterns that predict nonadherence. Pharmacists use a structured approach to patient counseling, to assessing response to treatment, and to promoting adherence with the first and second fill of a prescription. A pharmacist offers an intervention if a gap in adherence or care is detected. The MeMO® program was instituted for osteoporosis, lipid-lowering therapy, and chronic obstructive pulmonary disease (COPD). Tailored interventions address inhalation technique, nonadherence, or other factors as deemed appropriate. Patients treated for osteoporosis or dyslipidemia had statistically significant higher adherence rates in the MeMO program versus a historical control. Medication discontinuation rates for osteoporosis decreased from 31.7% to 16.1% ($p<0.001$) after 1 year.[24] Similar findings were reported for patients receiving treatment for dyslipidemia (a decrease from 25.9% to 13.6% ($p<0.001$).[24] This tool is most effective if patients fill all prescriptions at one community pharmacy practice, or pharmacy using a shared database.

**Discussion**

Telephone calls, interactive messaging systems, and text-messaging are basic eHealth tools to provide behavioral support to patients to promote medication adherence. Medication management software apps and electronic monitors offer multiple functions to patients with serious chronic diseases. They provide many useful features that support adherence behaviors and patient autonomy including dose reminders, refill reminders, drug information, drug interaction checks, and tools to promote self-care strategies for the patient. Interactive systems and portals appeal to the patients' sense of autonomy by accessing information based on their preferences. These tools should be integrated into the pharmacists' patient care process to aid the patient in achieving the desired goals of therapy.[26]

There may be a small to moderate increase in medication adherence with eHealth interventions, however, the evidence comes from observational studies as well as randomized controlled studies. A Cochrane Review evaluating a variety of medication adherence interventions was recently updated in 2014.[27] A meaningful improvement in adherence was seen in 5 out of 182 randomized, controlled trials that were evaluated, and the authors concluded that adherence interventions were not very effective in a population with chronic diseases.[27]

eHealth has the potential to bridge the connection between the patient and healthcare provider over a distance and in-between face-to-face visits. eHealth can be combined with patient education and motivational counseling to empower patients to take their medications. The downside of eHealth occurs when the user has a lapse in use of the device. Furburg RD addressed the concept of message fatigue and found that less than 10% of users responded to tailored text messages.[16] An individual's satisfaction with the usefulness of the information could play a part in their decision to use a monitor or app on a long-term basis.[14]Apps are geared toward individuals that are technology-driven and are willing to make the effort to learn the devices for optimal use.

From the community pharmacy perspective, predictive analytics software was a highly effective tool for identifying at-risk patients which prompted a face-to-face intervention.[24] The MeMO program highlights an important principle that pharmacists in the community setting are accessible to patients and are in an optimal position for making an intervention to promote optimal medication use. We did not evaluate the cost of the technology which could be a burden for the community pharmacy owner (for example, the cost of purchasing an automatic calling system or predictive analytics software).

**Conclusion**

eHealth technology is an emerging tool to promote adherence to medications, achieving healthy targets, and adopting self-care behaviors. Pharmacists should be aware of the available eHealth tools in order to recommend them as a medication adherence aid. However, there is still much research to be done in exactly how effective eHealth tools are over time. eHealth reminders using automated phones calls or text messaging, and electronic-medication monitoring are simple and modestly effective tools to improve adherence. These methods also require little additional effort on either the patient or the pharmacist, as enrollment into a reminder program is sufficient. Well-designed research on eHealth technology is necessary to determine if the benefits to the patient lead to sustained improvements in health outcomes.

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**References**

1. Haynes RB, Ackloo E, Sahota N, McDonald HP, Yao X. Interventions for enhancing medication adherence. *Cochrane Database Syst Rev*. 2008;(2):CD000011. doi(2):CD000011.
2. Osterberg L, Blaschke T. Adherence to medication. *N Engl J Med*. 2005;353(5):487-497.
3. Sabate E. Adherence to long-term therapies: Evidence for action. Geneva, Switzerland. World Health Organization. 2003.
4. Institute of Medicine (US) Committee on Evaluating Clinical Applications of Telemedicine. Washington, DC. national Academy of Sciences. 1996.
5. Jones C. Medication adherence study looks at types of interventions. *Manag Care*. 2014;23(9):38-41.
6. Fenerty SD, West C, Davis SA, Kaplan SG, Feldman SR. The effect of reminder systems on patients' adherence to treatment. *Patient Prefer Adherence*. 2012;6:127-135.
7. Ratanawongsa N, Handley MA, Quan J, et al. Quasi-experimental trial of diabetes self-management automated and real-time telephonic support (SMARTSteps) in a medicaid managed care plan: Study protocol. *BMC Health Serv Res*. 2012;12:22-6963-12-22.
8. Teeter BS, Kavookjian J. Telephone-based motivational interviewing for medication adherence: A systematic review. *Transl Behav Med*. 2014;4(4):372-381.
9. Piette JD, Mendoza-Avelares MO, Ganser M, Mohamed M, Marinec N, Krishnan S. A preliminary study of a cloud-computing model for chronic illness self-care support in an underdeveloped country. *Am J Prev Med*. 2011;40(6):629-632.
10. Piette JD, Valverde H, Marinec N, et al. Establishing an independent mobile health program for chronic disease self-management support in bolivia. *Front Public Health*. 2014;2:95.
11. Moullec G, Gour-Provencal G, Bacon SL, Campbell TS, Lavoie KL. Efficacy of interventions to improve adherence to inhaled corticosteroids in adult asthmatics: Impact of using components of the chronic care model. *Respir Med*. 2012;106(9):1211-1225.
12. Williams A, Manias E, Walker R, Gorelik A. A multifactorial intervention to improve blood pressure control in co-existing diabetes and kidney disease: A feasibility randomized controlled trial. *J Adv Nurs*. 2012;68(11):2515-2525.
13. Quan J, Lee AK, Handley MA, et al. Automated telephone self-management support for diabetes in a low-income health plan: A health care utilization and cost analysis. *Popul Health Manag*. 2015;18(6):412-420.
14. Balato N, Megna M, Di Costanzo L, Balato A, Ayala F. Educational and motivational support service: A pilot study for mobile-phone-based interventions in patients with psoriasis. *Br J Dermatol*. 2013;168(1):201-205.
15. Becker S, Kribben A, Meister S, Diamantidis CJ, Unger N, Mitchell A. User profiles of a smartphone application to support drug adherence--experiences from the iNephro project. *PLoS One*. 2013;8(10):e78547.
16. Furberg RD, Uhrig JD, Bann CM, et al. Technical implementation of a multi-component, text message-based intervention for persons living with HIV. *JMIR Res Protoc*. 2012;1(2):e17.
17. Anglada-Martinez H, Riu-Viladoms G, Martin-Conde M, Rovira-Illamola M, Sotoca-Momblona JM, Codina-Jane C. Does mHealth increase adherence to medication? results of a systematic review. *Int J Clin Pract*. 2015;69(1):9-32.
18. Parmanto B, Pramana G, Yu DX, Fairman AD, Dicianno BE, McCue MP. iMHere: A novel mHealth system for supporting self-care in management of complex and chronic conditions. *JMIR Mhealth Uhealth*. 2013;1(2):e10.
19. Voncken-Brewster V, Tange H, Moser A, Nagykaldi Z, de Vries H, van der Weijden T. Integrating a tailored e-health self-management application for chronic obstructive pulmonary disease patients into primary care: A pilot study. *BMC Fam Pract*. 2014;15:4-2296-15-4.
20. Grindrod KA, Li M, Gates A. Evaluating user perceptions of mobile medication management applications with older adults: A usability study. *JMIR Mhealth Uhealth*. 2014;2(1):e11.
21. Brondi R, Banno F, Bendinelli S, et al. Drugs don't work in patients who don't take them: Dr. drin, the new ICT paradigm for chronic therapies. *Stud Health Technol Inform*. 2013;191:100-104.
22. Hall RL, Willgoss T, Humphrey LJ, Kongso JH. The effect of medical device dose-memory functions on patients' adherence to treatment, confidence, and disease self-management. *Patient Prefer Adherence*. 2014;8:775-788.
23. Chaiyachati KH, Ogbuoji O, Price M, Suthar AB, Negussie EK, Barnighausen T. Interventions to improve adherence to antiretroviral therapy: A rapid systematic review. *AIDS*. 2014;28 Suppl 2:S187-204.
24. van Boven JF, Stuurman-Bieze AG, Hiddink EG, Postma MJ, Vegter S. Medication monitoring and optimization: A targeted pharmacist program for effective and cost-effective improvement of chronic therapy adherence. *J Manag Care Spec Pharm*. 2014;20(8):786-792.
25. Vegter S, Oosterhof P, van Boven JF, Stuurman-Bieze AG, Hiddink EG, Postma MJ. Improving adherence to lipid-lowering therapy in a community pharmacy intervention program: A cost-effectiveness analysis. *J Manag Care Spec Pharm*. 2014;20(7):722-732.
26. Joint Commission of Pharmacy Practitioners. Pharmacists' patient care process. . 2014 May 29.
27. Nieuwlaat R, Wilczynski N, Navarro T, et al. Interventions for enhancing medication adherence. *Cochrane Database Syst Rev*. 2014;11:CD000011.
28. Moore JO, Hardy H, Skolnik PR, Moss FH. A collaborative awareness system for chronic disease medication adherence applied to HIV infection. *Conf Proc IEEE Eng Med Biol Soc* 2011:1523-1527

**Table 1. Definitions of eHealth terms**

| Term | Definition |
|---|---|
| Devices - Mobile phone, Smartphone | A portable phone that allows you to make a call and also offers advanced multimedia functions such as video, web browsing, and health-related software applications.[28] Example: iPhone, Android |
| Devices - Landline | A stationary landline telephone connection using hard-wired telephone lines[29] |
| Devices - Portal | Secure web-based system that allows patients to access their health record; can be accessed from a stationary or portable device.[30] |
| Devices - Personal computer | A computer that is designed for one person to use at work, home, or leisure that allows communication between the owner and other users.[29] |
| Email | Internet-based communication using written text between users and supported by a computer or mobile phone.[31] |
| Text messaging - Mobile messaging, Texting | Short message service (SMS) uses written text sent through a cell phone or smart phone for rapid and direct transfer of information between users. Messages can be accessed at user convenience and can be delivered to phones that are switched off. Limited to 160 characters per message.[32] |
| Voice messaging | Basic telephone services, with voice delivered over the network.[33] |
| Interactive systems | Enables two-way exchange of information using phones that engages patients more actively in the management of their health. Allows the user to select a range of choices using an interactive menu.[28] |
| Mobile applications (apps) | Software programs that run on smartphones and other mobile communication devices which allow access to information in an interactive manner that can enhance medication adherence.[34] |
| Telehealth | Use of electronic information technologies which support long-distance clinical health care, patient and professional health-related education, public health and health administration.[33] |
| Telemedicine, eHealth | The use of electronic information and communications technologies to provide and support health care when distance separates the participants.[4] |

**Table 2. Types of eHealth technologies promoting adherence**

| eHealth Technology | Types |
|---|---|
| Telephone contact | Automated and Live Telephone call[5,6,7,8,9]<br>Interactive Voice Response[6,7,9,10]<br>With Motivational Interviewing[7,8,11,12,14]<br>Messaging (text, SMS)[5,6,13,14,15,16,17] |
| Internet portal | Adherence and self-management support applications[18,19]<br>Monitoring patient activity[18]<br>Internet interface using a touch screen[28] |
| Software applications for mobile devices or computer | Medication Plan[15]<br>iMHere[19]<br>MyMedRec[20]<br>DrugHub[20]<br>Pillboxie[20]<br>PocketPharmacist[20]<br>MediSafe[20]<br>Dr. Drin[21] |
| Electronic dose monitoring | Dose memory[22,23]<br>Dose reminder[22] |
| Video | Video messages offering advice/encouragement[6,28] |
| Pictures or graphs | Plasma concentration graph[28]<br>Disease-state simulation[28] |
| Predictive analytic software | MeMO[24,25] |

We are grateful to the experts that review the submissions, for their recommendations greatly contribute to the quality of The New Jersey Journal of Pharmacy.

The Journal wishes to acknowledge the following clinicians who have participated in peer review:

Brian Catton, PharmD
Juliet Cobb, PharmD
Donna McGuffy, RPh, BCOP
A. Elif Özdener, PharmD
Ruth Kim, PharmD
Connie Garcia, PharmD, MS, CPh
Ealia Washington, PharmD, CGP, BCACP

## Practice Spotlight:

# Advanced Pharmacy Practice Experience Near and Far

By: Amanda Mastrogiovanni, PharmD
Candidate 2016, University of the Sciences

My journey to become a pharmacist included unique advanced pharmacy practice experiences (APPE) that not all students have the fortune of experiencing. Born and raised in New Jersey, educated at the University of the Sciences in Philadelphia, I was eager to learn about pharmacy practice in different areas of the United States. I had the privilege of living in Bethel, Alaska from October 24-December 5, 2015 and Crownpoint, New Mexico from February 14-March 16, 2016 to complete clinical rotations. These rotations, in addition to my New Jersey based experiences, provided life long memories that will guide the rest of my pharmacy career.

While in Bethel, Alaska I worked at the Yukon-Kuskokwim Health Corporation 400 miles west of Anchorage. This healthcare corporation serves the Alaskan residents of the Yukon-Kuskokwim Delta region, roughly an area the size of Nebraska. The hospital is a hub for about 60 surrounding villages that provides emergency, dental, mental health services, substance abuse counseling and treatment, health promotion and disease prevention programs. Since the villages can be miles away from Bethel, there is heavy dependence on air ambulances or Medevac. I took a trip to Kalskag, AK with the LifeMed Alaska Medevac team to transport a child who needed to be transported into Bethel for treatment. Due to the hospitals remote location the pharmacist takes on many roles in patient care. In addition to traditional pharmacist workflow, the pharmacists are a key component of the trauma room team, running the anticoagulation clinic, and managing the adherence of patients on antiepileptic medications. When serious cases come in to the trauma room, pharmacists are responsible for sedating and then paralyzing the patient prior to intubation. I was able to assist in the trauma room a few times during my rotation. This was an area I was not sure my previous experiences had prepared me for but with help from my preceptor, doctors and nurses I began to understand how they all worked together. With minimal resources, our job was to stabilize the patient and transport them to Anchorage for further care. I also had the opportunity to shadow a pediatrician and physician assistant in the ER which gave me insight to a providers prescribing thought process. Being in Alaska I had more to do than just improve my pharmacy skills, I had the chance to see the breathtaking Northern Lights or Aurora Borealis, go dog sledding, visit an ice museum where I went into an igloo, and swim in a hot spring surround by snow. The coldest day I experienced in the tundra was -27° F. School provided me the opportunity to not only visit Alaska but be immersed in their culture for 6 weeks and it was one of the most gratifying experiences of my education to date.

While in New Mexico, I worked at Crownpoint Healthcare Facility, Indian Health Service. This federal health facility is located 150 miles west of Albuquerque and serves a population of 20,000 Navajo people. The primary focus of this rotation was comprehensive patient counseling. Before patients entered the counseling room students had access to patient charts in order to review the patient's medication history, recent healthcare provider notes, and evaluate pertinent labs in order to prevent medication complications. Every patient who picked up a prescription had to come through the patient counseling room before being dispensed their medications. Since there was no monetary transaction the patient's sole task upon pick up was engaging with the pharmacist or pharmacy student to better understand their treatment regimen. Sometimes this was a challenge because patients did not speak English, but interpreters were available for assistance. The pharmacists are responsible for management of patients on anticoagulants and chronic pain management. I had the opportunity to sit in and contribute to patients' chronic pain evaluation with their health care team. It was excellent to see a multidisciplinary team come together to provide a comprehensive plan to best fit that specific patients needs. In addition to my rotation work, I had the opportunity to visit Santa Fe, Carlsbad Caverns National Park, White Sands National Monument, Antelope Canyon, Four Corners Monument, Horseshoe Bend, Bandelier National Monument, Kasha-Katuwe Tent Rocks National Monument and Mesa Verde National Park. Throughout this rotation I had the opportunity to learn about the Navajo culture from the perspective of a health care provider as well as a tourist.

With such stellar experiences in different states I also kept the excitement with my remaining rotations all around New Jersey. I completed rotations at Barnabas Health Behavioral Health Center, a 100-bed acute care psychiatric facility, Target Pharmacy for my community pharmacy experience, an infectious disease focused rotation at Hunterdon Medical Center, a government based pharmacy experience at 87th Medical Group, Joint Base McGuire-Dix-Lakehurst, an air force staffed pharmacy that served army, navy, air force, marine, and coast guard, and last but not least New Jersey Pharmacists Association, a professional organization whose mission is to advance the profession of pharmacy.

When previous graduates told me rotations were the best year of pharmacy school, I just assumed it was because we finally weren't taking exams every week. After completing seven 5-week rotations I can now say that this was the best year of pharmacy school. Not just because of the lack of exams and coursework but because I learned what it really means to be a pharmacist. This year allowed me to grow both personally and professionally and I am honored to be called a pharmacist in just a few short weeks!


## Member Momentum

NJPhA is pleased to bring our readers a new journal feature – an opportunity to recognize and congratulate good work, positive practice models, major accomplishments and other personal achievements that show positive momentum within pharmacy.

This inaugural column highlights the recent recognition received by Steve Zlotnick, PharmD. A long time NJPhA member, committee chair, trustee, and former president, Steve Zlotnick has been awarded the ELITE Master Educator distinction by Genentech. His role as an MSL for his company and as a professor at the Philadelphia College of Pharmacy provide ample opportunities for him to share information and teach—often using analogies to illustrate the point – all in an effort to help patients.

Congratulations, Steve!


**NJPhA**
**146th Annual Meeting & Convention**
**October 28-30, 2016**

**Preliminary Schedule**

| FRIDAY, OCTOBER 28th | |
|---|---|
| Registration Opens | 9:00 AM-4:00 PM |
| **Continuing Education programs** | 10:00 AM-12:00 PM |
| LUNCH | 12:00 PM-1:00 PM |
| **Continuing Education programs** | 1:00 PM-4:00 PM |
| NJPhA Annual Meeting | 4:00 PM-5:00 PM |
| Welcome Reception | 5:00 PM-6:30 PM |
| **Potential Dinner for Healthcare Providers- Separate Registration may be required** | |

| SATURDAY, OCTOBER 29th | | |
|---|---|---|
| Registration Open | 7:00 AM-4:00 PM | **Student Programming**<br>9:30 AM-3:00 PM<br>√ Roundtables<br>√ Student Challenge<br>√ Advocacy |
| Continental Breakfast in Exhibit Hall | 7:30 AM-9:00 AM | |
| Opening Session & Cont. Education | 9:00 AM-12:00 PM | |
| LUNCH in Exhibit Hall | 12:00 PM-1:30 PM | |
| Continuing Education programs & Poster presentations | 1:30 PM-5:00 PM | |
| +TONIC Rx & NPN Happy Hour | 6:00 PM-7:00 PM | |
| **Installation & Awards Banquet** | 7:00 PM-9:00 PM | |

| SUNDAY, OCTOBER 30th | |
|---|---|
| Registration & Exhibit Hall Open | 7:00 AM-10:30 AM |
| Continental Breakfast in Exhibit Hall | 7:00 AM-8:30 AM |
| Continuing Education programs | 8:30 AM-12:30 PM |
| LUNCH | 12:30 PM -1:30 |

As of May 2016; schedule subject to change

NJPhA Continuing Education Activity

Audience: Pharmacists & Pharmacy Technicians

# *Post-Lumbar Puncture Headache: A Mini-Review for Pharmacists*

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**Learning Objectives:**

**After participating in this activity, the participant shall be able to:**

**Pharmacist:**

1. define lumbar puncture (LP)
2. list common adverse effects from LP
3. discuss post-LP headache
4. describe treatment options for post-LP headache

**Pharmacy Technician: (if applicable to article)**

1. define lumbar puncture (LP)
2. list common adverse effects from LP
3. define post-LP headache
4. list treatment options for post-LP headache

**Authors' disclosures: none**

CEU Hours: .5 contact hour of continuing education credit (0.05CEU)

Activity Type: knowledge based.

UAN: 0136-0000-16-15-H04-P ; 0136-0000-16-15-H04-T

Release Date : 6/3/2016 Expiration Date : 6/3/19

## Introduction

Lumbar puncture (LP) is a diagnostic and therapeutic procedure that was first performed in the late 1800's by physician and surgeon Heinrich Quincke. Also known as a "spinal tap," a lumbar puncture is a minimally invasive procedure that involves the insertion of a needle between the L3-4 vertebrae in the lumbar spine to collect and examine the cerebral spinal fluid (CSF) or to administer medications directly into the central nervous system (CNS)[1,2].

Lumbar puncture is utilized in the evaluations of infections of the central nervous system (e.g.: meningitis, encephalitis or syphilis), subarachnoid hemorrhage (SAH), multiple sclerosis, Guillain-Barré syndrome, malignancies in the brain or spinal cord, and acute headache. A lumbar puncture may be also be used therapeutically for the administration of medications including spinal anesthesia, antibiotics, and chemotherapy.[1,2] Patients who undergo a lumbar puncture rarely develop serious complications such as infection, bleeding such as epidural hematoma or SAH. The most common complication of LP is headache, followed by soreness, bruising or bleeding at the site of puncture.[2]

**Epidemiology and Clinical Presentation**

Post-lumbar puncture headache (PLPH) can occur in up to 32% of patients receiving a lumbar puncture[2] and often presents as a pounding headache with pressure occurring in the front and back of the head, as well as bi-temporal headache. The headache occurs typically within the first twenty-four hours to five days following LP, is worsened in the upright position, and is relieved when lying down flat.[2,3] Patients may also experience blurred vision, vertigo, nausea, neck stiffness, tinnitus, and photophobia.[2,4] The headache is usually self-limiting, resolving within ten days.[2] Symptoms, however, may last anywhere from a few hours to several months.[5]

**Pathophysiology**

The pathophysiology of PLPH is not fully known, however, it is thought to be due to leakage of CSF from the subarachnoid space. This leads to decreased intracranial volume and pressure, a downward shift of CNS contents, and irritation of pain sensitive structures. In addition, activation of adenosine receptors can occur causing vasodilation and increased CNS blood flow. In the upright position, further down shifting of CNS structures occurs, causing increased pain.[6,7]

**Pharmacological Treatment**

Treatment of post-lumbar puncture headache may involve both pharmacological and non-pharmacological modalities and is based on the severity and duration of symptoms. For patients who experience a mild headache, conservative treatment such as hydration, antiemetics, and analgesics is often recommended. If conservative treatment fails, additional pharmacologic therapies and blood patching are options.[2] A review by the Cochrane Collaboration was published in 2015 evaluating pharmacological treatment in 13 randomized controlled trials.[3] Medications that have been utilized for the treatment of mild symptoms included caffeine, theophylline, gabapentin, and hydrocortisone.[3,7] A summary of these agents can be found in Table 1.

***Caffeine.*** Caffeine is a methylxanthine that inhibits phosphodiesterase leading to increased levels of cyclic AMP (cAMP), acts as an antagonist at adenosine receptors, and causes cerebral vasoconstriction.[8] Caffeine was studied at a dose of 300 mg by mouth for one dose and showed an improvement in headache severity in a greater percentage of caffeine patients when compared to placebo patients at fours hours (90% vs. 60% respectively) although there was no difference at 24 hours, and fewer blood patches were required in the caffeine group, although these results were not statistically significant (35% of caffeine group vs. 55% of placebo group).[9] Additionally, caffeine may be administered intravenously (IV) as caffeine and sodium benzoate at a dose of 500 mg/L over one hour followed by one liter of normal saline over one hour. A second dose may be administered one to two hours later. Intravenous administration of caffeine for this indication is controversial as supporting data is conflicting and a high headache recurrence rate of up to 60% has been reported.[7] Caution must be taken as IV caffeine is supplied as caffeine and sodium benzoate, or caffeine citrate and these forms are not interchangeable. Caffeine should be used with caution in patients with anxiety, cardiovascular disease, history of peptic ulcer disease, and seizures, as it may worsen these conditions.[8]

***Theophylline.*** Theophylline is a methylxanthine like caffeine that inhibits phosphodiesterase leading to increased levels of cAMP.[10] Theophylline at a dose of 250 mg by mouth every eight hours resulted in patients having pain severity scores statistically lower that patients that received acetaminophen twelve hours after dosing (2.67 vs. 4.24 respectively).[11] Theophylline 400 mg by mouth was compared to conservative treatment of resting in supine position, caffeine beverages, and analgesics. Improvement in visual analogue scales (VAS) occured in 100% of the theophylline patients and in 50% of

the conventional management group. The VAS scores were better in the theophylline group at all time intervals (9.3 vs. 56.7 respectively).[12] Theophylline should be used with caution in patients with a history of cardiovascular disease, hyperthyroidism, peptic ulcer disease, and seizures. Patients should be counseled on the signs and symptoms of theophylline toxicity such as persistent repetitive vomiting.[10,13]

***Gabapentin.*** Gabapentin is a GABA analog that binds to the alpha2-delta site of voltage-gated calcium channels in the CNS, however the result of this is not known.[14] In patients wtih PLPH, gabapentin was had lower pain severity scores at a dose of 300 mg by mouth every eight hours for four days when compared to placebo (4.1 vs. 5.7 respectively at day 1, and 0.1 vs. 1.7 respectively at day 4).[15] Gabapentinor ergotamine/caffeine.[15,16] Gabapentin must be dose adjusted in renal impairment and commonly causes dizziness, drowsiness, and ataxia. Additionally, patients should be counseled to report any signs or symptoms of angioedema and any changes in mood or behavior.[14]

***Hydrocortisone.*** Hydrocortisone is a short acting corticosteroid that reduces inflammation.[17] Hydrocortisone was added to conventional treatment at a dose of 100 mg/2 mL IV every eight hours for 48 hours, and was compared to conventional treatment alone, which included positioning, hydration, and caffeine. The conventional treatment with hydrocortisone showed reduced pain severity scores at six hours compared to conventional treatment alone (6.02 vs. 2.06 respectively).[18] Hydrocortisone should be used with caution in patients with a history of cardiovascular disease, diabetes, gastrointestinal disease, and myasthenia gravis.[17]

## Surgical Treatment

***Blood Patch.*** For patients with moderate, severe, or persistent headache, a highly effective treatment option is an epidural blood patch, with efficacy rates up to 98%.[7] As mentioned above, blood patching is also an option after failure of pharmacologic interventions.[2] The blood patch procedure involves the injection of 15 to 30 mL of the patient's own blood into the epidural space, ideally injected into the same site as the previous LP.[5,7] The injected blood will spread and the subarachnoid pressure will be restored.[7] The blood will also clot and seal the site of the CSF leak.[6,7] The procedure should be performed at least 24 hours after the lumbar puncture to ensure the highest chance of success, and usually results in immediate resolution of the PLPH.[7] Following the blood patch, the patient should remain lying down for 1-2 hours. The main adverse effect is back pain at the site of injection, which increases with larger volumes of injected blood. Additional risks include scarring in the epidural space, and cerebral venous thrombosis.[5] The blood patch may also be repeated in patients who do not get complete relief from the first patch.[7] Blood patches may incur additional costs as the procedure is to be performed by a physician.

## Conclusion

Headache is one of the most common complications following lumbar puncture and contributes to diminished physical activity and quality of life. Pharmacological options with evidence for treatment include caffeine, theophylline, gabapentin, and hydrocortisone. The most effective treatment, however, is the administration of an epidural blood patch. Although the headache is self-limiting, treatment is often required to improve symptoms and increase quality of life. The role of the pharmacist in the treatment of post-lumbar headache includes assessment of medication orders, preparation and dispensing, ensuring safe and effective medication use including proper dosing of medication and monitoring of efficacy and safety. Patient counselling regarding on onset of headache relief and nonpharmacologic measures are also important.

**Table 1: Summary of pharmacological agents used to treat PLPH[7-17]**

| Drug | MOA | Dosing | Precautions |
|---|---|---|---|
| Caffeine | Methylxanthine, Inhibits phosphodiesterase leading to increased levels of cyclic AMP (cAMP), acts as an antagonist at adenosine receptors, and causes cerebral vasoconstriction | 300 mg po one time or 500 mg/L IV over 1 hour followed by 1 L of normal saline over 1 hour. A second dose may be give 1-2 hours later. | Caffeine sodium benzoate and caffeine citrate are not interchangeable, use with caution in anxiety, cardiovascular disease, history of peptic ulcer disease, and seizures |
| Theophylline | Methylxanthine, Inhibits phosphodiesterase leading to increased levels of cAMP | 250 mg po every 8 hours or 400 mg po for one dose | Risk of theophylline toxicity, use with caution in cardiovascular disease, hyperthyroidism, peptic ulcer disease, and seizures |
| Gabapentin | GABA analog, Binds to the alpha2-delta site of voltage-gated calcium channels in the CNS | 300 mg po every 8 hours for 4 days | Must be dose adjusted in renal impairment and commonly causes dizziness, drowsiness, and ataxia |
| Hydrocortisone | Short acting corticosteroid that reduces inflammation | 100 mg/2 mL IV every eight hours for 48 hours | Use with caution in patients with a history of cardiovascular disease, diabetes, gastrointestinal disease, and myasthenia gravis |

**References**

1. Radiological Society of North America. "Lumbar Puncture." Available at www.radiologyinfo.org/en/info.cfm?pg=spinaltap#overview Published March 21, 2016. Accessed April 7, 2016.
2. Doherty CA, Forbes RB. Diagnostic lumbar puncture. *Ulster Med J*. 2014;83(2):93-102.
3. Basurto Ona X, Uriona Tuma SM, Martínez García L, Solà I, Bonfill Cosp X. Drug therapy for preventing post-dural puncture headache. Cochrane Database of Systematic Reviews 2013, Issue 2. Art. No.: CD001792. DOI:10.1002/14651858.CD001792.pub3.
4. Robbins E, Hauser SL. Technique of lumbar puncture. In: Kasper D, Fauci A, Hauser S, Longo D, Jameson J, Loscalzo J. eds. Harrison's principles of internal medicine. 19th ed. New York, NY: McGraw-Hill; 2015.
5. Post-dural puncture headache. DynaMed [online database]. Ipswich, MA:. EBSCO Industries (Available at www.dynamed.com/home/ Published October 2015. Accessed March 28, 2016).
6. Lee L, Sennett M, Erickson J. Prevention and management of post-lumbar puncture headache in pediatric oncology patients. *J Pediatric Oncol Nurs*. 2007; 24(4):200-207
7. Frank RL. Lumbar puncture and post-dural puncture headaches: implications for the emergency physician. *J Emerg Med*. 2008;35(2):149-57.
8. Caffeine and sodium benzoate package insert. Shirley, NY: American Regent; 2008 Sept.
9. Camann WR, Murray RS, Mushlin PS, Lambert DH. Effects of oral caffeine on postdural puncture headache a double-blind, placebo controlled trial. *Anesthesia and Analgesia.* 1990; 70(2):181-184.
10. Theo-24® (theophylline) package insert. Chesterbrook, PA: Actient Pharmaceuticals LLC; 2013 Oct.
11. Mahoori A, Hassani E, Noroozinia H et al. Theophylline versus acetaminophen in the treatment of post-dural puncture headache (PDPH). *Middle East J Anaesthesiol*. 2013; 22(3):289-292.
12. Sen J, Sen B. Non invasive management of post dural puncture headache - a comparison. *Bangladesh Journal of Medical Science*. 2014; 13(2):114-118.
13. Aminophylline injection package insert. Lake Forest, IL: Hospira, Inc; 2009 Nov.

14. Neurontin® (gabapentin) package insert. New York, NY: Pfizer Inc; 2015 Sept.
15. Erol DD. The effect of oral gabapentin on postdural puncture headache. *Acute Pain*. 2006; 8(4):168-173.
16. Erol DD. The analgesic and antiemetic efficacy of gabapentin or ergotamine/caffeine for the treatment of postdural puncture headache. *Advances In Medical Sciences*. 2011; 56(1):25-29.
17 Solu-Cortef® (hydrocortisone sodium succinate) package insert. New York, NY: Pfizer Inc; 2014 July.
18. Alam MR, Rahman MA, Ershad R. Role of very short-term intravenous hydrocortisone in reducing postdural puncture headache. *J Anaesthesiol Clin Pharmacol*. 2012; 28(2):190-193.

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# NJPhA 2016 ANNUAL CONVENTION POSTER CALL

## Join the fourth annual Poster Session on

## October 29,2016 @ Harrah's in Atlantic City, NJ

## Encores Welcome!

**Logistics:** Poster set up begins Friday, October 28th in the afternoon and must be completed by 11:30AM on Saturday, October 29th.* The formal poster session (required presentation) is scheduled for Saturday, October 29th. Posters are on display throughout the day and you are welcome to be available by your poster before the allotted time. Posters may be removed after the session or as late as 9:00 AM the following (Sunday) morning.

*Arrangements can be made for posters to be shipped to the venue at presenter's expense. A presenter is responsible for installation and removal of the poster. Please contact the NJPhA office [609-275-4246] for instructions on shipping materials directly to the venue.

**Submission Deadline & Details:** Poster applications are available online at www.njpharmacists.org/events/annual-convention . The submission deadline is September 16, 2016. Accepted Poster applicants will be notified approximately one month prior to the Convention. In addition, up to four poster submissions may be chosen for a live accredited CE session on Saturday.

**Fee:** Participation is included with a FULL or DAILY convention attendee purchase. All attendees who will be presenting the material are required to register for at least Saturday's day of programming.

**Journal Publication:** All accepted posters will be listed in the New Jersey Journal of Pharmacy. All accepted abstracts will be published in the New Jersey Journal of Pharmacy.

**See you there!**

Ron Mannino, RPh
NJPhA 1st Vice President & Convention Committee Chair

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**To submit, complete the attached form and email by September 16, 2016.**

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