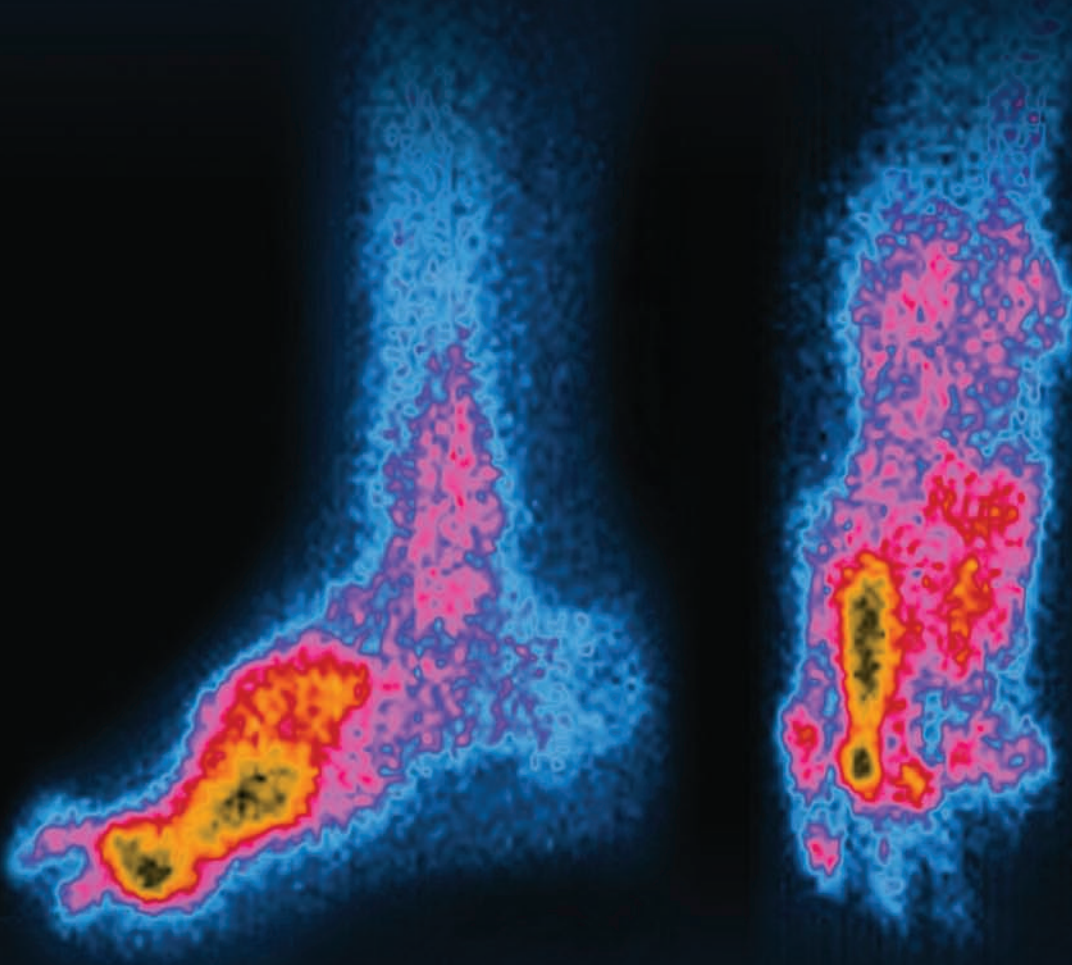


# Comorbid Depression and DIABETIC FOOT ULCERS



© BSIP SA / Alamy

*In the United States, 9.3% of the population, or 29.1 million people have diabetes, and depression affects 20% to 40% of these individuals. Diabetic foot ulcers are a common and serious complication of diabetes and one of the most costly. It is estimated that 2% to 3% of persons with diabetes will develop diabetic foot ulcers each year. There is an association between depression and the development of diabetic foot ulcers. The estimated costs associated with managing diabetes, depression, and diabetic foot ulcers place a substantial burden on the U.S. healthcare system and society. Patients should be screened and evaluated by professionals qualified in the diagnosis and management of depression and diabetic foot ulcers. To be effective, an interprofessional approach that includes the patient and significant others should be used.*

Diane R. Maydick, EdD, RN, ACNS-BC, CWOCN and Anna M. Acee, EdD, ANP-BC, PMHNP-BC

## Diabetes

Diabetes has become a worldwide epidemic. It is estimated that 9% of the world's adult population has Type 2 diabetes and by 2030, diabetes will be the seventh leading cause of death worldwide (World Health Organization, 2015). In the United States, 9.3% of the population, or 29.1 million people have diabetes; of these 21 million have already been diagnosed and 8.1 million are undiagnosed (National Diabetes Statistics Report, 2014). The estimated annual cost of care for diabetes is approximately \$245 billion, and of this amount, \$176 billion is for direct medical costs and \$69 billion is attributed to lost productivity (American Diabetes Association [ADA], 2013).

## Depression

The prevalence of depression increases with age and is the second leading cause of disability worldwide (Ferrari et al., 2013). Depression affects 20% to 40% of individuals with diabetes and is accompanied by an increased risk of myocardial infarction (Anderson et al., 2001; Bot et al., 2012; Scherrer et al., 2011). Depression is also a risk factor for poor diabetes control, complications related to macro- and micro-vascular complications, and mortality (Katon et al., 2010). Depression later in life also increases social isolation, caregiver burden, suicide, and nonsuicidal mortality (Alexopoulos, 2005). Management of depression is important from the perspective of the patient's quality of life as well as the patient's ability to meet diabetes self-care goals (Acee & Fahs, 2012).

## Comorbid Depression and Diabetes

Research suggests 20% to 40% of patients with Type 2 diabetes have comorbid depression (Anderson et al., 2001). Although there are separate and distinct direct and indirect costs associated with each diagnosis, the prognosis and costs to the individual and society are worse when they occur together, than if each entity was treated separately (Lloyd et al., 2010).

Diabetic foot ulcers (DFU) are a common and serious complication of diabetes and one of the most costly. A DFU is an infection, ulceration, or destruction of deep tissues associated with neurological abnormalities and various degrees of peripheral vascular diseases in the lower limb. Estimates for care range from \$3,096 for a Wagner Grade 1 ulcer to \$107, 900 for a DFU that results



© BSIP SA / Alamy

The estimated annual cost for care of diabetes is approximately \$245 billion, and of this amount, \$176 billion is for direct medical costs and \$69 billion is attributed to lost productivity.

in amputation (Hunt et al., 2011). The lifetime likelihood of a person with diabetes developing a DFU is as high as 25% due to neuropathy and vascular disease. It is anticipated that 2% to 3% of persons with diabetes will develop DFU each year (International Diabetes Federation, 2006). In 2010, a total of 73,000 nontraumatic amputations were performed on adults with diabetes who were older than 20 years of age (Centers for Disease Control and Prevention, 2014), of these most were preceded by a DFU.

Once a DFU develops, patients are often required to receive treatment for infection and may

even require long-term hospitalization for medical and surgical management of the ulcer. Costs include both direct and indirect costs. Examples of direct costs include prevention measures, medical devices, medications, labor, procedures, hospital bed days, nutrition support, and rehabilitation. Examples of indirect costs include absenteeism from work, loss of productivity, subsidies (workers compensation and welfare), litigation and insurance costs, as well as deconditioning, loss of independence, pain and suffering, and diminished quality of life (Hurd, 2013).

A recent international study suggests persons living in the community with chronic wounds had more mental health problems than those without wounds, and they are less able to cope with stressful events (Upton et al., 2014). Participants of the study reported that the experience of living with chronic wounds was stressful, isolating, debilitating, worrisome, and depressing (Upton et al.).

There is an association between depression and the development of a DFU. Williams et al. (2010) used the Patient Hospital Questionnaire-9 (PHQ-9), a validated instrument for screening, diagnosing, and monitoring the severity of depression in patients with diabetes. The researchers followed 4,839 patients with diabetes and found that those who suffered from major depressive disorders had a two-fold increased risk for developing a DFU over a span of 4 years (Williams et al.). Early detection and prevention are essential to improve healthcare for persons with diabetes and depression and to prevent the development of a DFU and the possible complications that might ensue.

### Screening for Depression

The American Psychiatric Association encourages screening, referral, and treatment for people with depression. The Centers for Medicare and Medicaid Services Outcome and Assessment Information Set (OASIS-C1) is required for patients who are receiving home healthcare services (2015). The OASIS-C1 provides a mechanism to collect baseline information in the home care environment and is completed for certification and subsequent recertification for home care services. Elements within the OASIS-C1 provide a mechanism to assess for depression and depressive symptoms (Acee, 2015). First the patient is screened with the 2-item Patient Health Questionnaire (PHQ-2); they are asked if they have little interest or pleasure in usual activities and if they are experiencing a

depressed mood. If the answer is yes to either question, it is suggested that the care provider administer the 9-item Patient Health Questionnaire (PHQ-9) although this is based on individual agency policy and procedure (Acee, 2015).

When a PHQ-9 score of <10 is assigned, (minimal depressive symptoms of short duration) offering support, education, and follow-up in 1 month is suggested. However, if the symptoms persist or worsen the patient should be referred to a mental health specialist. If a PHQ-9 score of 10 to 19 (mild-to-moderate depression) or >20 (major depression) is elicited, the patient should be seen by a professional who is qualified to assess and develop a treatment plan (Acee, 2010; Lichtman et al., 2008). If the patient responds “yes” when asked about suicide (question 9 on PHQ-9), they must be referred for immediate evaluation of suicide risk (Acee, 2010; Lichtman et al.).

Other indications for referral to a qualified mental health professional include: disregard for the medical regimen, overall stress related to finding balance in work and life, indication that the patient may harm themselves, severe anxiety, indication of an eating disorder, or impaired judgment related to cognitive functioning (Young-Hyman & Davis, 2010). A good relationship between clinician and patient may increase the patient’s acceptance of a referral for additional services. But more importantly, incorporating assessment and treatment into routine care is more desirable than waiting for a physiological or psychological crisis (ADA, 2015).

### Screening for Risk of Diabetic Foot Ulcers

Screening for risk of DFU includes asking about and assessing for: uncontrolled hyperglycemia, length of time of diabetes, trauma, improper footwear, 10-g monofilament testing for loss of protective sensation due to peripheral neuropathy, arterial insufficiency, foot deformity and calluses, history of prior ulcers/amputations, older age, blindness/impaired vision, chronic renal disease, poor nutrition, infection, and vitamin D deficiency.

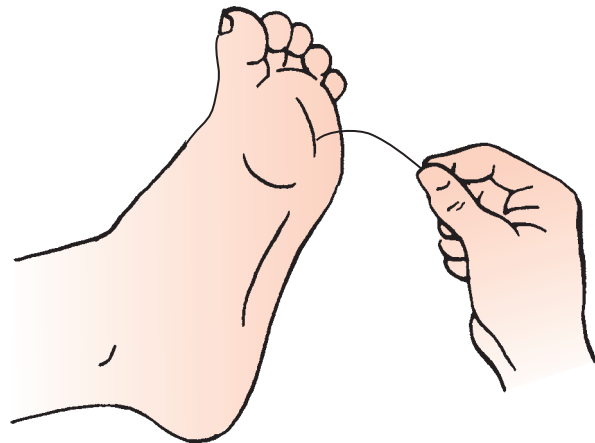
Physical assessment includes observing skin color, assessing temperature, and looking for any areas of callus formation. Assess for the presence of peripheral arterial disease by checking the dorsalis pedis, posterior tibial, popliteal, and femoral pulses. Check for cold feet, blanching on elevation, absence of hair on the legs, dry, and shiny

and atrophic skin. Observe for any unusual foot deformity (hammer toes, claw toes, bunions) and observe for appropriately fitted footwear.

Patients with diabetes may have sensory, autonomic, and/or motor neuropathy (Conway and Peltier, 2013). *Sensory neuropathy* is the loss of protective sensation, for example, no perception of shoes rubbing on feet and unawareness of temperature changes. *Autonomic neuropathy* involves changes related to the sympathetic nervous system: dysfunction leads to decreased vasomotor activity such as reduced sweating (anhidrosis) resulting in dry, cracked skin; increased blood flow (vasodilation) leading to a warm foot; increased atherosclerosis (plaque formation); and changes in the micro-vascular circulation to the tissue. *Motor neuropathy* affects the movement of the foot: dysfunction of the motor nerves results in limited mobility of the joints accompanied by increased pressure on the plantar surface of the foot (Conway & Peltier).

Monofilament testing (Figure 1) is used to evaluate for the presence, or absence, of protective sensation in patients with diabetes. The 10-g monofilament is used to touch the plantar surface of the bottom of the patient's foot at the 1st, 3rd, and 5th metatarsal heads and the plantar surface of the distal hallux. When the 10-g monofilament bends, the patient should be able to feel the pressure. Even one site with a negative response may indicate that the patient is at risk of developing a foot ulcer (Feng et al., 2009).

Use of a 128-Hz vibration tuning fork is another method of screening for diabetic neuropathy. The tuning fork vibration is initiated by striking the instrument against the palm of one's own hand hard enough to start vibrations that last approximately 40 seconds. Demonstrate how the instrument works and what the vibrations will feel like to the patient by holding the vibrating instrument to the forehead or sternum after having them close their eyes. Instruct the patient to respond yes each time they feel the vibration of the instrument. To perform the actual exam, have the patient remove their shoes and socks and assume a supine or sitting position with foot supported and the toes in an upright position. Have the patient close their eyes. Apply the tuning fork to the bony prominence on the dorsal aspect of the first toe immediately proximal to the nail bed. Have the patient report when the vibration stimulus stops and then still the tuning



**Figure 1.** Monofilament Testing.

Use of a monofilament in testing for impaired sensation in the foot of a person with diabetes. When the unsupported end of the monofilament is pressed against the skin until it buckles or bends slightly, it delivers 10 g of pressure at the point of contact. Usually between 4 and 10 sites are tested for impaired sensation.

Source: Porth, C. M. (2007). *Essentials of Pathophysiology Concepts of Altered Health States* (2nd ed.). Philadelphia, PA: Lippincott Williams & Wilkins.

fork with your other hand. For each vibration the patient feels or perceives it is considered “on” and for each time the patient feels or perceives that the tuning fork vibration has been stopped it is considered “off.” One point is assigned for each time the patient reports the tuning fork is “on” or “off.” The procedure is done in a randomized manner so that the patient cannot anticipate where the tuning fork will be applied. This test can be used to rule out neuropathy but threshold scores indicating risk of future neuropathy do not exist (Perkins et al., 2001).

### Implications for Practice

Once a thorough history and physical assessment have been completed, the clinician develops a comprehensive plan of care with the interprofessional team. Interprofessional team members might include: home healthcare nurse, psychiatric nurse practitioner, wound, ostomy and continence nurse, foot care nurse, diabetes educator, physician, endocrinologist, psychologist, psychiatrist, social worker, infectious disease specialist, podiatrist, rehabilitation team, vascular surgeon, neurologist, and dietitian). The literature suggests that to achieve progress in a patient's ability to

manage their diabetes, the plan of care must include a variety of psychological interventions such as social support, teaching skills for problem solving, cognitive-behavioral therapy, and setting achievable goals (Ministry of Health and Long-Term Care, 2007).

### Patient Education for Foot Care

- Inspect the feet regularly or teach a family member or other care provider to inspect the feet.
- Inspect for any areas of discolored skin or open lesions.
- Cleanse the feet gently with a mild soap and water—do not use “hot” water or place feet directly into a tub of water without checking to make sure the water is tepid.
- Do not use heating pads or hot water bottles on the feet.
- Prevent dry cracked skin by applying a moisturizer to keep the skin moist and supple.
- To prevent accidental traumatic injuries, always wear shoes when walking.
- Check shoes to make sure they fit properly and there are no areas where the shoe is rubbing against the skin.
- Check the inside of the shoe before wearing, feel for any objects that may have penetrated the sole or fallen into the shoe.
- Avoid tight, restrictive shoes and socks.
- Make sure that shoes fit properly, have a thick sole, and provide adequate support.
- Wear thick, padded socks such as “diabetic socks” that are designed to avoid constriction.
- If foot deformities exist, see a foot specialist (pedorthist) for shoes that are fitted to accommodate the shape of the foot.
- Report even minor foot injuries including cuts, scrapes, blisters, and tinea pedis (athlete’s foot).
- Seek healthcare immediately if you notice even a minor wound that does not heal.
- Avoid the use of home remedies including hydrogen peroxide, iodine, and astringents.

### Conclusion

The estimated costs associated with managing diabetes, depression, and DFU place a substantial burden on the U.S. healthcare system and on society. Patients should be screened and

evaluated by professionals qualified in the diagnosis and management of depression and DFU. The treatment plan must include screening for depression, diabetes, and neuropathy, followed by treatment. To be effective, an interprofessional approach that includes the patient and significant others is essential. A collaborative framework between home care mental health services and home healthcare providers is important to effectively implement the plan of care (Acee, 2015). ■

---

**Diane R. Maydick, EdD, RN, ACNS-BC, CWCN**, is an Assistant Professor, Long Island University, Harriet Rothkopf Heilbrunn School of Nursing, Brooklyn, New York.

**Anna M. Acee, EdD, ANP-BC, PMHNP-BC**, is an Associate Professor, Long Island University, Harriet Rothkopf Heilbrunn School of Nursing, Brooklyn, New York.

The authors declare no conflicts of interest.

Address for correspondence: Diane Maydick, EdD, RN, ACNS-BC, CWCN, Assistant Professor, Long Island University, Harriet Rothkopf Heilbrunn School of Nursing, 1 University Plaza, Brooklyn, NY 11203 (diane.maydick@liu.edu).

DOI:10.1097/NHH.0000000000000340

### REFERENCES

- Acee, A. (2010). Detecting and managing depression in Type II diabetes. PHQ-9 is the answer! *Medsurg Nursing*, 19(1), 32-38. doi:10.1097/NHH.0000000000000091
- Acee, A. (2015). Co-morbid depression and cardiovascular disease in the older adult homecare patient. *Home Healthcare Now*, 33(6), 333-336. doi:10.1097/NHH.0000000000000255
- Acee, A., & Fahs, M. (2012). Can treating depression improve diabetic management? *The Nurse Practitioner*, 37(1), 46-52. doi:10.1097/01.NPR.0000408509.34689.72
- Alexopoulos, G. S. (2005). Depression in the elderly. *Lancet*, 365(9475), 1961-1970.
- American Diabetes Association. (2013). Economic costs of diabetes in the U. S. in 2012. *Diabetes Care*, 36, 1033-1046. doi:10.2337/dc12-2625
- American Diabetes Association. (2015). Standards of medical care in diabetes-2015. *Diabetes Care*, 38(Suppl. 1), 1-94.
- Anderson, R. J., Freeland, K. E., Clouse, R., & Lustman, P. (2001). The prevalence of co-morbid depression in adults with diabetes: A meta-analysis. *Diabetes Care*, 24(6), 1069-1078. doi:10.2337/diacare.24.6.1069
- Bot, M., Pouwer, F., Zuidersma, M., van Melle, J. P., & de Jonge, P. (2012). Association of coexisting diabetes and depression with mortality after myocardial infarction. *Diabetes Care*, 35, 503-509.
- Centers for Disease Control and Prevention. (2014). *National Diabetes Statistics Report: Estimates of Diabetes and Its Burden in the United States, 2014*. Atlanta, GA: US Department of Health and Human Services.
- Centers for Medicare and Medicaid Services. Center for Health Services and Policy Research. (2015). *The Outcome and Assessment Information Set*. Retrieved from <https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HomeHealthQualityInits/OASIS-C1-DataSets.html>
- Conway, B., & Peltier, A. (2013). *Diabetic neuropathy*. Retrieved from <http://cdn.intechopen.com/pdfs-wm/43301.pdf>
- Feng, Y., Schlosser, F. J., & Sumpio, B. E. (2009). The Semmes Weinstein monofilament examination as a screening tool for diabetic peripheral neuropathy. *Journal of Vascular Surgery*, 50(3), 675-682.

- Ferrari, A. J., Charlson, F. J., Norman, R. E., Patten, S. B., Freedman, G., Murray, C. J., ..., Whiteford, H. A. (2013). Burden of depressive disorders by country, sex, age, and year: Findings from the global burden of disease study 2010. *PLoS Medicine*, 10(11), e1001547.
- Hunt, N. A., Liu, G. T., & Lavery, L. A. (2011). The economics of limb salvage in diabetes. *Plastic and Reconstructive Surgery*, 127(Suppl. 1), 289S-295S. doi:10.1097/PRS.0b013e3181f8e2a6
- Hurd, T. (2013). Evaluating the costs and benefits of innovations in chronic wound care products and practices. *Ostomy/Wound Management*, June Supple, 1-15.
- International Diabetes Federation. (2006). *Diabetes Atlas* (3rd ed.). Brussels, Belgium: Author.
- Katon, W., Maj, M., & Sartorius, N. (Eds.). (2010). *Depression and Diabetes*. UK: Wiley-Blackwell.
- Lichtman, J., Bigger, J., Blumenthal, J., Frasure-Smith, N., Kaufmann, P., & Lesperance, F. (2008). Depression and coronary heart disease: Recommendations for screening, referral, and treatment: A science advisory from the American Heart Association Prevention Committee of the Council on Cardiovascular Nursing, Council on Clinical Cardiology, Council of Epidemiology and Prevention, and Interdisciplinary Council on Quality of Care and Outcomes Research: Endorsed by the American Psychiatric Association. *Circulation*, 118(17), 1768-1775. doi:10.1161/CIRCULATIONAHA.108.190769
- Lloyd, C. E., Hermanns, N., Nouwen, A., Pouwer, F., Underwood, L., & Winkley, K. (2010). The epidemiology of depression and diabetes. In W. Katon, M. Maj, & N. Sartorius (Eds.), *Depression and Diabetes* (pp. 1-28). UK: Wiley-Blackwell.
- Ministry of Health and Long-Term Care. (2007). Preventing and Managing Chronic Disease. *Ontario's Framework*. Retrieved from [http://www.health.gov.on.ca/en/pro/programs/cdpm/pdf/framework\\_full.pdf](http://www.health.gov.on.ca/en/pro/programs/cdpm/pdf/framework_full.pdf)
- National Diabetes Statistics Report. (2014). *Statistics about diabetes*. Retrieved from <http://www.diabetes.org/diabetes-basics/statistics/>
- Perkins, B.A., Olaleye, D., Zinman, B., & Bril, V. (2001). Simple screening tests for peripheral neuropathy in the diabetes clinic. *Diabetes Care*, 24(2), 250-256. doi:10.2337/diacare.24.2.250
- Scherrer, J. F., Garfield, L. D., Chrusciel, T., et al. (2011). Increased risk of myocardial infarction in depressed patients with type 2 diabetes. *Diabetes Care*, 34, 1729-1734.
- Upton, D., Solowiej, K. L., & Woo, K. Y. (2014). A multinational health professional perspective of the prevalence of mood disorders in patients with acute and chronic wounds. *International Wound Journal*, 11(6), 625-635. doi:10.1111/iwj.12018
- Williams, L. H., Rutter, C. M., Katon, W. J., Reiber, G. E., Ciechanowski, P., Heckbert, S. R., ..., Von Korff, M. (2010). Depression and incident diabetic foot ulcers: A prospective cohort study. *American Journal of Medicine*, 123(8), 748-754. doi:10.1016/j.amjmed.2010.01.023
- World Health Organization. (2015). *Diabetes Fact Sheet*. Retrieved from <http://www.who.int/mediacentre/factsheets/fs312/en/>
- Young-Hyman, D. L., & Davis, C. L. (2010). Disordered eating behavior in individuals with diabetes: Importance of context, evaluation, and classification. *Diabetes Care*, 33, 683-689.

For 33 additional continuing nursing education activities related to diabetes and 16 related to depression, go to [nursingcenter.com/ce](http://nursingcenter.com/ce).



## Instructions for Taking the **CE Test Online** Comorbid Depression and Diabetic Foot Ulcers

- Read the article. The test for this CE activity can be taken online at [www.nursingcenter.com/ce/HHN](http://www.nursingcenter.com/ce/HHN). Tests can no longer be mailed or faxed.
- You will need to create a free login to your personal CE Planner account before taking online tests. Your planner will keep track of all your Lippincott Williams & Wilkins online CE activities for you.
- There is only one correct answer for each question. A passing score for this test is 12 correct answers. If you pass, you can print your certificate of earned contact hours and the answer key. If you fail, you have the option of taking the test again at no additional cost.
- For questions, contact Lippincott Williams & Wilkins: 1-800-787-8985.

Registration Deadline: February 28, 2018

Disclosure Statement:

The authors and planners have disclosed no potential conflicts of interest, financial or otherwise.

Provider Accreditation:

Lippincott Williams & Wilkins, publisher of Home Healthcare Now, will award 1.5 contact hours for this continuing nursing education activity.

Lippincott Williams & Wilkins is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation.

This activity is also provider approved by the California Board of Registered Nursing, Provider Number CEP 11749 for 1.5 contact hours. Lippincott Williams & Wilkins is also an approved provider of continuing nursing education by the District of Columbia, Georgia, and Florida CE Broker #50-1223. Your certificate is valid in all states.

Payment:

- The registration fee for this test is \$17.95.