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### Honey for the Diabetic Foot Ulcer: Alternatives in Wound Care

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Honey for the Diabetic Foot Ulcer: Alternatives in Wound Care

A Paper Submitted in Partial Fulfillment of the Requirements

For NURS 5382: Capstone

In the School of Nursing

The University of Texas at Tyler

by

Hannah Campbell

August 9, 2020

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### **Acknowledgments**

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### **Executive Summary**

Diabetes is a huge health burden in the United States. According to the 2020 Centers for Disease Control and Prevention (CDC) report, 34.2 million Americans, or about 1 in 10, have diabetes, and 88 million Americans have prediabetes. Diabetics face many associated complications and secondary effects that can be very costly. Foot ulcers in the diabetic are common complications and can be extremely serious and expensive. Lower extremity complications such as peripheral neuropathy, arterial disease, vascular problems, and ulcerations are common in the diabetic patient and contribute to the occurrence of diabetic foot infections (Alam, Islam, Gan, & Khalil, 2014). Diabetic foot wounds precede about 85% of lower-limb amputations (Asamoah, Ochieng, & Meetoo, 2014). The five-year mortality rate for diabetics with infected foot wounds is 43-55% (Dekker, Qin, Ho, & Kadakia, 2016). Chronic diabetic wounds are also associated with increased healthcare costs. One estimate for cost of healing an infected diabetic wound is \$17,500, while cost for a wound requiring lower-limb amputation can range from \$30,000 to \$33,500 (Alam et al., 2014). Since diabetic foot wounds are so costly in both quality of life and healthcare resources, finding efficient and effective treatments is extremely important. The use of honey in bandages for wound care has gained popularity because of many properties that promote wound healing. Many studies have been conducted to evaluate the effectiveness of honey as a viable alternative to traditional bandages in order to decrease wound healing time in the diabetic and prevent serious complications that can arise from chronic infected wounds. Honey bandages are a simple, easy to use and cost-efficient way to reduce wound healing time. By avoiding amputation or inpatient surgical intervention, patients

and hospital systems can benefit from significant health savings. The proposed change intervention has three main stages: preparation and staff education, implementation and monitoring, and evaluation of results. Staff education centers on the basic understanding of honey activity in wounds to allow for patient education during intervention, how to apply honey dressings, how often to change bandages, and how to consistently measure and document wound size and appearance for data analysis at the end of the intervention period. Intervention period will last 12 weeks, and patients will be assessed, and wound measurements taken twice a week for the duration of the treatment time. At the end of the twelve weeks. Data from all patients treated with honey will be combined and averaged to find the average healing rate of diabetic foot ulcers. Overall time to healing with the use of honey bandages will be compared with previous data on healing time for diabetic foot wounds treated with different modalities. Final results of the study will then be disseminated to stakeholders on healing benefit and cost efficiency of the intervention.

## Title

### **1. Rationale for the Project**

Diabetes is a serious concern in the United States that is extremely costly for patients, society and the healthcare system. In 2017, diabetes directly cost \$237 billion (Armstrong et al, 2020). According to a recent study, diabetic foot ulcers by themselves are an independent risk factor for premature death, and patients that sustain a major lower-limb amputation because of a diabetic foot ulcer five year mortality rate of 56% (Armstrong et al, 2020). Promoting early healing of these wounds and preventing the need for amputation as long as possible is imperative in the care of our diabetic patients. Working in the inpatient wound and surgical unit, I have seen many, many patients admitted for minor and major amputations as treatment methods for non-healing diabetic foot ulcers. Many of these patients required several amputations over the years and face increasing difficulty in mobility and function. Seeing these patients made me realize how important it is to develop early effective wound care for diabetic patients, to help speed up wound healing time and avoid inpatient admissions for wounds as long as possible. Many patients also enter the healthcare system with late and serious wounds because they are concerned about healthcare costs. Finding an effective and cost-efficient method for treating diabetic foot wounds in the outpatient setting should be a priority. One very promising wound healing agent is honey-impregnated bandages. Honey has long been used in wound care, and recently has gained new popularity as the science behind its healing properties has been discovered. Honey has a broad spectrum of antimicrobial activity related to its acidity, osmotic effects, and hydrogen peroxide formation, and it can aid wound healing through autolytic debridement, odor control, and decreasing inflammation (Alam et al., 2014). Honey dressings are

cost effective, non-irritating, and have been shown to have activity against MRSA (Cooper, 2017).

## **2. Literature Synthesis.**

Honey dressings have many interesting characteristics, and in order to evaluate the effectiveness based on current research and seek an improvement in diabetic foot care, the following question was formulated. In diabetic patients with foot ulcers (P) how do honey dressings (I) compared to traditional dressings (C) affect wound healing (O) over twelve weeks (T)? In looking for current relevant data available on the use of honey in wound care for the diabetic foot ulcer, EBSCOhost, MEDLINE, CINAHL, ALT Healthwatch, Google Scholar and the NIH database were searched. Keywords “honey”, “wound”, “diabetic”, “foot”, “ulcer” and “wound care” were used in different combinations. Limitations were selected based on publication date from the last 5-10 years, English language, and peer-reviewed source. Twelve studies were selected for review. Of these studies, seven were literature and systematic reviews, two were controlled trials, two were randomized controlled trials and one was a systematic review with meta-analysis.

Honey dressings show promise in the current available research. Some honeys were found to have antimicrobial effects against many microorganisms including MRSA even after diluted to 5% of original concentration (Reese, Willoughby, Davis, Silver, & Venn, 2011). The ability of honey to inhibit bacterial growth, or minimum inhibitory concentration (MIC), varies somewhat between types of honey, therefore medical-grade honey is recommended (Watts & Frehner, 2016). Considering the rise of antibiotic-resistant microorganisms, honey provides a promising treatment option in that it may decrease the need for topical antibiotic and antiseptic



use, decreasing the risk of resistance development (Vyhlidalova, Kozahova, & Zelenikova, 2018).

When compared to povidone iodine dressings, honey was found to be superior to in decreasing wound size in chronic wounds (Gulati et al., 2014). Pain reported was significantly decreased by the end of treatment, and a statistically significant reduction in the surface area of wounds treated with honey was noted (Gulati et al., 2014). Al Saeed (2013), compared honey with iodine dressings and found that bacterial clearance time was significantly shorter in wounds treated with honey. When comparing healing times of diabetic foot ulcers bandaged with saline dressings or honey, one study showed that the honey group demonstrated a significantly greater rate of completely healed wounds than the control group (Imran, Baig, & Hussain, 2015). In another study, use of honey dressings were associated with a 50% reduction in toe amputations compared to the control group (Asamoah et al., 2014). After a systematic review and analysis of available research, Wang, Guo, Zhang, and Wang (2019) state that “the evidence indicates that honey dressing can increase the wound healing rate and the bacterial clearance rate. In addition, it can shorten wound debridement time, wound healing time, and bacterial clearance time”, and thus they conclude that use of honey in the treatment of diabetic foot ulcers “may be able to shorten the length of hospital stays, save health resources, enhance confidence of patients, and promote patient’s satisfaction to treatment” (p. 130).

### **3. Project Stakeholders**

Project stakeholders in this case are specifically hospital administration and providers, particularly podiatrists. Collaboration with and support from these gatekeepers is imperative to the success of this implementation project. Buy-in from the providers is essential. A persuasive case for the increased benefit of honey therapy on patient outcomes as compared to current

standards must be made. Cost efficiency for implementation and cost sustainability are critical areas to address when discussing project plans with upper administration. Managers need to know what it will cost and what it will take to prepare for and to maintain this implementation project. Staff in the wound care unit will be directly affected by this change as it requires a change in method and measurement of wounds. In order to promote best possible acceptance of the project, it is also important to include staff in the early stages of change. Demonstrating how the use of honey dressings can improve patient outcomes and allaying fears by explaining the simplicity of the intervention in daily experience will help relieve potential pushback.

#### **4. Implementation Plan**

Implementation begins with adequate education of the staff who will be performing the intervention. Educational fliers hung up in the breakroom and restrooms with highlights of key points. Announcements and basics on wound care can be provided in huddle or in-services on the unit. Emails with images and step by step instructions can be sent to all staff involved wound care. All of these educational techniques would be very inexpensive and easy to disseminate.

Wound care decisions should be made with evaluation of the wound bed in mind. Honey is available as a non-adherent pad, gel or ointment. Selection of the best option depends on the amount of wound exudate. The goal of wound care is to provide a moist but not wet environment. If the initial wound presents with a dry wound bed, moisture needs to be maintained, so the honey paste can be applied with an occlusive dressing as coverage. This will ensure that the wound is not dried out by the environment. For exudative wounds, the excess moisture needs to be wicked away from the healing site. A section of honey sheet can be applied directly to the wound bed after cleansing and absorptive gauze dressings should be applied over

top. Dressing changes may need to be more frequent initially in order to wick away moisture from the surrounding tissue to prevent maceration (Reese et al., 2011). Dressings should be changed when saturated, and once the drainage decreases, honey dressings may be left in place for 4-7 days (Reese et al., 2011). Wounds should be assessed once to twice weekly to determine therapy efficacy and wound size should be measured in millimeters and recorded for evaluation records. Wound appearance, drainage properties, wound size and patient toleration of dressing change should all be documented in the medical record for each dressing change.

**5. Timetable/Flowchart**

The major phases include preparing the plan, presenting a case to invested and affected parties, piloting the project, and evaluating results. As seen in the chart below, the first step in the process is identifying and establishing allies throughout the organization, and permission needs to be obtained from the proper channels. Then, disseminate the evidence and create excitement and understanding of the coming change in practice. Ensure all supplies, clinical tools, and necessary education has been prepared. Finally, implement the project, monitoring progress weekly, and following up with any concerns that arise during implementation. Lastly, celebrate success and share the results with all those involved in the process, including the stakeholders. Hockenberry, Brown and Rodgers (2015), share helpful steps for implementing EBP change and are listed in the table below along with projected actions to be taken and estimated timeline.

Implementation Step	Action	Timeline
Establish a Formal Implementation Team	Collaborate with WOCNRNs, Director, Team Lead, Nurse Educator, Providers Prepare a compelling presentation which highlights the current evidence regarding diabetic foot ulcers, cost of treatment,	1-2 months prior to projected start of project

	<p>evidence in favor of honey dressings, current practice in the facility and ways for improvement.</p> <p>Meet with gatekeepers of the facility (Director, CNO, or Physicians) to present research and obtain necessary permission for change implementation.</p> <p>Meet with direct supervisors to discuss anticipated costs, supplies needed, and any anticipated changes in workflow. Develop relationship and work as allies for the improvement of patient care on the unit.</p> <p>Meet with Nurse Educator to create educational material for the staff who will be implementing the change.</p>	
Build Excitement	<p>Fliers, Huddle, Emails about project</p> <p>Start early in spreading the news of a unit project. Present change as a project or goal that staff can own.</p> <p>Plan a party or celebration to be held on completion of the project.</p>	Begin in the month leading up to start of project, about 2-3 weeks prior to start date.
Disseminate Evidence	<p>Fliers, Huddle, Emails, Poster in breakroom</p> <p>Print the educational materials that were prepped in collaboration with the Nurse educator and place around the unit in high traffic areas such as the bathrooms and breakroom.</p> <p>Collaborate with the charge nurse to include details of the project in unit huddles or whenever unit announcements are made.</p> <p>If possible, ask the unit director to speak at the staff meeting prior to the start of project implementation. Discuss all details that are pertinent to the nurses who will be performing wound care and take time to answer questions or concerns.</p> <p>Provide instructions on measuring wound size, applying honey dressings, how often to change dressings, and patient education topics</p>	Begin in the month leading up to the start of the project
Develop Clinical Tools	<p>Collaborate with EMR team to ensure documentation options for honey as a wound dressing.</p> <p>Collaborate with supplier for obtaining dressings</p> <p>Ensure adequate quantity of honey sheets, honey paste, gauze, and non-adherent dressings for typical number of patients seen with diabetic foot wounds in that facility.</p> <p>Collaborate with Director and Team Lead on budget for dressings</p>	Begin as soon as permission is granted for project 1-2 months prior to beginning project
Pilot Test	<p>Begin project in selected department</p>	Start of the project
Preserve Energy Sources	<p>Check in weekly with staff on how implementation is going</p> <p>Address any concerns with dressing use or documentation</p> <p>Round in department and ask nurses how wound care is going.</p> <p>Monitor number of patients receiving honey as an intervention.</p> <p>Ensure all patients received baseline wound photo and measurements</p> <p>Weekly follow-up with photo and measurements to monitor wound progression.</p>	Ongoing throughout project

Celebrate Success	Provide a unit party at the end of the project. Cake and drinks in the breakroom. Send out updates on results. Share statistics and success stories with staff.	At the end of the twelve-week project
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**6. Data Collection Methods**

Data collection methods include gathering baseline data from the WOCRN regarding the facility baseline before implementation of the honey project. Data will be collected and documented by staff nurses and wound care specialist nurses. An initial baseline assessment should be conducted on each patient which includes the description of the wound and exudate, measurements of the wound bed and a photo to track progress. Reassessments should be conducted as each dressing change and measurements and photos should be taken weekly and documented in the patient record. Primary data of interest throughout the implementation period is measurement of the wound bed itself. Wounds should be measured in mm at the widest portion of the wound. Length, width and depth should all be noted in the patient chart. Measurements should be taken when doing dressing changes and weekly during evaluation by a wound care specialist. Healing time will be calculated using mm/week after the end of the intervention. Secondary data of interest includes the Likert pain scale, complication rates, and satisfaction survey results from staff and patients. Survey results will be collected at the end of the project for staff and prior to discharge for patients.

**7. Cost/Benefit Discussion**

Cost is always a major factor in any proposed change, especially in healthcare. The biggest cost for this project will be the honey dressings themselves. Online, an individual sheet of medical-grade honey dressing mesh costs \$3.50 for a small sheet and approximately \$10 for a large sheet. Large non-adherent honey sheets are usually large enough to last for at least two

dressing changes each. Although sheets are a little quicker and easier to use, medical-grade honey paste is also available. A 1.5 oz tube of this honey paste costs \$18 for an individual tube. Buying supplies in bulk in the hospital setting should result in a lower per unit price. Honey dressings do not usually need to be changed daily, so this would be up to a once or twice a week expense, depending on size and level of exudate of the wound. All other supplies that are used with changing wound dressings will already be available and already a part of the unit budget. Plain gauze and saline for cleansing is relatively inexpensive and would already be stocked in most units. Amounts used of these products are not likely to change with the use of honey bandages. No additional software is needed. Training and education dissemination should be of minimal to no cost as well. Emails with the information, pictures of supplies and explanation of change can be sent to all unit staff. Updates and explanations could be given during shift huddle meetings during the weeks leading up to implementation. Fliers in the break room and restrooms with essential need-to-know details could also be put up in the month leading up to the change. These methods would be low-cost. Paper and ink would be the only additional cost, and they would only total to a few dollars.

Wound care supplies may run as much as \$120 per patient if they require two dressing changes per week for twelve weeks. This expense, however, is offset by the excessive cost of complications from non-healed wounds requiring surgical intervention. Foot ulcers in the diabetic can end up being extremely serious and expensive. Diabetic patients often suffer from complicating comorbidities of the lower extremity such as peripheral neuropathy, arterial disease, vascular problems, and ulcerations that contribute to delayed healing of diabetic foot infections (Alam et al., 2014). 85% of lower-limb amputations are preceded by diabetic foot ulcers (Asamoah et al., 2014). The five-year mortality rate for diabetics with infected foot

wounds is as high as 56% (CDC, 2020). Chronic diabetic wounds are also associated with increased healthcare costs. Healing an infected diabetic wound cost approximately \$17,500, and cost for wounds requiring lower-limb amputation can range from \$30,000 to \$33,500 (Alam et al., 2014). By implementing a small change in wound care to speed up recovery time and avoid major surgical intervention, patients and health care systems can save an enormous amount of money.

## **8. Discussion of Results**

After completion of the project, the final step is evaluation of the intervention. A second round of statistics are needed including the following. How many patients were admitted with diabetic foot ulcers? How many were treated with honey dressings? What was the average healing time? For those not fully healed, what percentage of the wound was healed at the end of the study? How many patients had complications, infections, or required surgical intervention? Were there any readmissions? If so, how many? What were the patient satisfaction scores with use of honey dressings? What did the average cost per patient end up being? In order to obtain this data, permission will be needed. Once all this information is gathered, it needs to be compared to the baseline data obtained before the start of the project. Data and comparisons can be analyzed, and final results must be shared with the director and providers. This pre- and post-intervention analysis is important not only for research and data purposes but for the organization as well; with so much focus on outcome-based reimbursement, the stakeholders in the organization need data to back up their practice changes (Brewer & Alexandrov, 2015).

The evaluation strategy for this project centers primarily around measurements of wound size and healing time with honey dressing therapy. Effectiveness of the intervention would be measured in total days to healing and mm/day in wound size reduction. These numbers should be

compared to baseline statistics for average wound healing prior to the start of the intervention project. To analyze the statistical significance of these results, I would use the t-test to compare the difference between the two average healing times, prior to intervention and post-intervention averages (Polit & Beck, 2017). A p-value of 0.05 would demonstrate a statistically significant difference in treatment methods (Melnik & Fineout-Overholt, 2015). Findings that demonstrate a statistically significant difference in wound healing time ultimately demonstrate a financially feasible intervention. Shorter healing times leads to fewer overall supplies used and better reimbursement through insurance companies. Additionally, I would give each patient who was treated with honey dressings a satisfaction questionnaire asking about patient comfort with the intervention, pain perception and overall satisfaction in order to evaluate how well received the project was by the patients. The questionnaire would have a five-point Likert scale with answers of 4 and 5 rated as positive responses. 80% of questionnaire responses with results of 4 or 5 would demonstrate that the intervention was very well accepted by patients.

### **9. Conclusions/Recommendations**

After reviewing the available research surrounding the use of honey dressings in wound care, honey was found to be beneficial to the healing process of chronic wounds. Additional research on the use of honey in diabetic wounds specifically would be beneficial in building our current understanding and knowledge. In light of the available research, recommendations for wound management of diabetic foot wounds include the use of honey impregnated bandages since evidence demonstrates improved healing times with the use of honey bandages over simple gauze bandages or iodine bandages. After completion of the project, recommendations for the future include continued use of honey dressings in the wound care for diabetic foot ulcers and continued data collection on successful healing rates. Departments can evaluate the methods



used in the implementation of the project to make adjustments and plan ways to sustain the project long-term. As new research and new possible interventions arise, I recommend that leaders, providers and colleagues keep their knowledge up to date on the latest advancements in wound care and continually evaluate the latest evidence and options. Diabetic foot wounds are complicated health conditions that carry along with them many serious implications for the patient. Seeking to continually provide the highest quality care should be the primary concern of any healthcare facility.

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## Appendix A: Evaluation Table

In diabetic patients with foot ulcers (P) how do honey dressings (I) compared to traditional dressings (C) affect wound healing (O) over twelve weeks (T)?

<b>PICOT Question Type</b> (Circle): <b>Intervention</b> Etiology Diagnosis or Diagnostic Test Prognosis/Prediction Meaning
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Citation: (i.e., author(s), date of publication, & title)	Conceptual Framework	Design/ Method	Sample/ Setting	Major Variables Studied and Their Definitions	Measurement of Major Variables	Data Analysis	Study Findings	Strength of the Evidence (i.e., level of evidence + quality [study strengths and weaknesses])
Author, Year, Title	Theoretical basis for study Qualitative Tradition		Number, Characteristics, Attrition rate & why?	Independent variables (e.g., IV1 = IV2 =)  Dependent variables (e.g., DV = )	What scales were used to measure the outcome variables (e.g., name of scale, author, reliability info [e.g., Cronbach alphas])	What stats were used to answer the clinical question (i.e., all stats do not need to be put into the table)	Statistical findings or qualitative findings (i.e., for every statistical test you have in the data analysis column, you should have a finding)	Strengths and limitations of the study Risk or harm if study intervention or findings implemented Feasibility of use in your practice Remember: level of evidence (See Melnyk & Finout-Overholt, pp. 32-33) + quality of evidence = strength of evidence & confidence to act

Alam, F., Islam, M. A., Gan, S. H., & Khalil, M. I. (2014). Honey: A Potential Therapeutic Agent for Managing Diabetic Wounds	None Stated	Review	11 studies	IV1= Honey application DV1= Wound Healing	Healing time	N/A	N/A	Medical basis for use of honey Mechanisms of action described Honey and alternative dressings described and compared Studies varied
Al Saeed, M. (2013). Therapeutic Efficacy of Conventional Treatment Combined with Manuka Honey in the Treatment of Patients with Diabetic Foot Ulcers: A Randomized Controlled Study.	none stated	CT	59 subjects AR: 2 personal reason and CABG	IV1= Manuka Honey in wound care DV1= Length of stay DV2= Time to eradication of infection DV3= Percent healed	Time Percentage	SPSS Standard Deviation Non-parametric	P<0.05 statistically significant findings Honey improved wound healing No significant difference between control and treatment group samples	Low risk to patient Small sample size Double-blinded study Statistical values not listed individually Random sampling Findings statistically significant High level of evidence
Asamoah, B., Ochieng, B.M.N., & Meetoo, D., (2014). The clinical role of honey in treating diabetic foot ulcers: a review	None Stated	Review	5 published studies 2 Quasi-experimental trials Two-arm RCT Two-arm Clinical Controlled Trial 1-arm experimental study	IV1= Honey application IV2= Povidone Iodine DV1= Healed ulcers DV2= Change in size DV3= Signs of infection DV4= Complications	Wound size and grade Bacterial load	Statistical significance (p) CI	Varied p= 0.0089 completely healed ulcers with honey p= 0.0006, CI=1.1133-1.4848 completely healed ulcers in honey group vs. control	Well organized study Statistically significant findings Low risk for adverse reaction Multiple studies
Gulati, S., Qureshi, A., Srivastava, A., Kataria, K., Kumar, P., & Ji, A. B. (2014). A prospective randomized study to compare the effectiveness of honey dressing vs. povidone iodine dressing in chronic wound healing.	None stated	RCT	23 patients in intervention group (honey) 22 patients in control group (iodine) Followed for 6 weeks or complete healing  AR: 3 2 adverse reaction to iodine	IV1= gamma-irradiated Neem Honey dressing IV2= Povidone Iodine dressing DV1= Complete healing DV2= Wound surface area DV3= Pain scale	Complete healing Wound size Wound swabs and cultures Visual Analog Pain Scale	Freidman test Wilcoxon rank Mann-Whitney	Test groups were statistically comparable at start  Complete healing: 0% with iodine 31.82% with honey Surface area reduction: 4.25cm to 1.95cm with iodine 4.35cm to 0.55cm with honey Statistically significant p<0.05 Pain score: 7 to 5 with iodine 7 to 1 with honey	Limitations: small study, short time frame, unable to blind Computer randomization for group selection No adverse effects with honey dressing Statistically significant difference in reduction of wound size Used tegaderm occlusive dressing in combination with honey and iodine

			1 lost to follow-up					
Imran, M., Baig, M., Hussain, M., (2015). Randomized, Controlled Clinical Trial of Honey-Impregnated Dressing for Treating Diabetic Foot Ulcer	none stated	RCT	179 patients in intervention group (honey) 169 in control (saline) Followed for up to 120 days	IV1= honey dressing DV1=wound healing	Complete healing, time to healing, wound deterioration	Chi-square Mann-Whitney U-test	Statistically significant results for complete healing and wound healing time	High level of evidence Low risk for intervention No reported adverse effects Statistically significant results
Jeffrey, S., (2008). A honey -based dressing for diabetic foot ulcers: a controlled study: The Diabetic Foot Journal,11(2) 87-91.	None stated	CT	17 patients 9 hydrocolloid 8 honey  AR: 1	IV1= Honey dressing IV2= Hydrocolloid dressing DV1= Healing rate DV2= glycemic control DV3= pain	Healing rate cm/week Pain Scale Pt report of odor Fructosemide levels for glycemic control	Fisher's Exact test Mann-Whitney U test Chi-squared SPSS	p>0.05 baseline analysis comparing groups  Control Healing rate: 0.11-1cm /week Honey rate:0.13-0.45 cm/week	Small sample size Neither group complained about pain, odor or application Not randomized No statistical difference between hydrocolloid and honey Honey at least as effective No effect on pt's glycemic control
Jull, A.B., Cullum, N., Dumville, J.C, Westby, M.J., Deshpande, S., & Walker, N. (2015). Honey as a topical treatment for wounds. <i>Cochrane Database of Systematic Reviews</i> , (3).	None stated	SR	26 trials (3 acute wounds, 11 burns, 10 chronic wounds, 2 mixed pop)	IV1= Honey dressing DV1 = Wound healing time	Time to complete healing Proportion of fully healed wounds	N/A	Statistically significant healing improvement when used on burns	High level of evidence Low risk intervention Investigated several types of wounds Study results discussed individually. Unable to make definitive statement on DFU based on quality of studies examined
Reese, A., Willoughby, D., Davis, S. C., Silver, T., & Venn, T. (2011). Revisiting the use of honey for treating chronic wounds	none stated	Literature Review	34 articles (RCT and case studies)	IV1= Honey in wound care DV1= wound healing DV2= granulation tissue	Time Presence of granulation tissue	N/A	Varied by study. All demonstrated granulation tissue after honey	High level of evidence Low risk intervention Easy to implement Well tolerated Examined RCT and case studies All showed granulation tissue Effective against MRSA
Vandamme, L., Heyneman, A., Hoeksema, H., Verbelen, J., & Monstrey, S. (2013). Honey in modern wound care: A	None stated	SR	55 studies (25 RCT, 2 Controlled clinical trials, 5 Clinical	IV1= Honey application DV1= Wound healing time DV2= antibacterial effect	Time Pain scale Bacterial load	N/A	Several of RCTs found statistical significance in wound healing time  Anti-inflammatory, antibacterial effect,	High level of evidence Low risk to patients Many studies evaluated Showed effects against MRSA Significant findings in stimulating wound healing



systematic review. <i>Burns: Journal of the International Society for Burn Injuries</i> , 39(8), 1514-1525.			trials, 23 Case reports)	DV3= pain reduction			debridement & pain reduction not statistically significant	Unable to perform meta-analysis r/t difference in studies
Vyhřídlová, D., Kozáková, R., & Zeleníková, R. (2018). Management of non- healing wounds with honey dressings: A literature review.	none Stated	Literat ure Review	8 RTC 5 PS 8 SR	IV1= honey in wound care DV1= healing time DV2= wound odor DV3= pain	Time Percentage	N/A	Varied by Study	High level of evidence Low risk to patient Easily implemented Wide base of evidence Conclusions not fully consistent across studies
Wang, C., Guo, M., Zhang, N., & Wang, G. (2019). Effectiveness of honey dressing in the treatment of diabetic foot ulcers: A systematic review and meta-analysis	None stated	SR & Meta- analysi s	SR: 11 studies Meta- analysis: 6 studies (7 RCT, 1 QE)	IV1= Honey in wound care DV1= Wound healing rate DV2= Bacterial clearance rate DV3= Wound debridement time DV4= Wound healing time DV5=	Time to heal Bacterial load	Review Manager (for meta-analysis) Chi-square Confidence Interval	Honey was related to faster healing times than other dressings, p<0.01 Honey associated with earlier bacterial clearance than other dressings, p<0.01 Mean healing time less for honey group, p<0.05	High level of evidence Selected only high quality studies for analysis Detailed in process of study selection and criteria Limited by small number of studies that met inclusion criteria Faster healing times and faster bacterial clearance with the use of honey
Watts, R., & Frehner, E. (2016). Evidence Summary: Wound management: medical- grade honey	None Stated	Review	6 RCT 5 Obs studies 6 Case series 7 Case reports 3 Review articles	IV1= MGH application DV1= Wound swab for bacteria DV2= Wound healing time DV3= Wound odor DV4= Pain	Wound size over time 0-10 scale for pain	Statistical significance (p)	Varied by study	Many studies examined Clinical significance found Low risk Evaluated several signs of healing

Legend:

- AR= Attrition Rate
- CT= Controlled Trial
- RCT= Randomized Controlled Trial
- SR= Systematic Review
- PS= Prospective Studies
- Pt= Patient
- QE= Quasi-Experimental Studies

Appendix B

Flowchart

Implementation Step	Action	Timeline
Establish a Formal Implementation Team	<p>Collaborate with WOCNRNs, Director, Team Lead, Nurse Educator, Providers</p> <p>Prepare a compelling presentation which highlights the current evidence regarding diabetic foot ulcers, cost of treatment, evidence in favor of honey dressings, current practice in the facility and ways for improvement.</p> <p>Meet with gatekeepers of the facility (Director, CNO, or Physicians) to present research and obtain necessary permission for change implementation.</p> <p>Meet with direct supervisors to discuss anticipated costs, supplies needed, and any anticipated changes in workflow.</p> <p>Develop relationship and work as allies for the improvement of patient care on the unit.</p> <p>Meet with Nurse Educator to create educational material for the staff who will be implementing the change.</p>	1-2 months prior to projected start of project
Build Excitement	<p>Fliers, Huddle, Emails about project</p> <p>Start early in spreading the news of a unit project. Present change as a project or goal that staff can own.</p> <p>Plan a party or celebration to be held on completion of the project.</p>	Begin in the month leading up to start of project, about 2-3 weeks prior to start date.
Disseminate Evidence	<p>Fliers, Huddle, Emails, Poster in breakroom</p> <p>Print the educational materials that were prepped in collaboration with the Nurse educator and place around the unit in high traffic areas such as the bathrooms and breakroom.</p> <p>Collaborate with the charge nurse to include details of the project in unit huddles or whenever unit announcements are made.</p> <p>If possible, ask the unit director to speak at the staff meeting prior to the start of project implementation. Discuss all details</p>	Begin in the month leading up to the start of the project

	<p>that are pertinent to the nurses who will be performing wound care and take time to answer questions or concerns.                  Provide instructions on measuring wound size, applying honey dressings, how often to change dressings, and patient education topics</p>	
Develop Clinical Tools	<p>Collaborate with EMR team to ensure documentation options for honey as a wound dressing.                  Collaborate with supplier for obtaining dressings                  Ensure adequate quantity of honey sheets, honey paste, gauze, and non-adherent dressings for typical number of patients seen with diabetic foot wounds in that facility.                  Collaborate with Director and Team Lead on budget for dressings</p>	<p>Begin as soon as permission is granted for project                  1-2 months prior to beginning project</p>
Pilot Test	<p>Begin project in selected department</p>	<p>Start of the project</p>
Preserve Energy Sources	<p>Check in weekly with staff on how implementation is going                  Address any concerns with dressing use or documentation                  Round in department and ask nurses how wound care is going.                  Monitor number of patients receiving honey as an intervention.                  Ensure all patients received baseline wound photo and measurements                  Weekly follow-up with photo and measurements to monitor wound progression.</p>	<p>Ongoing throughout project</p>
Celebrate Success	<p>Provide a unit party at the end of the project. Cake and drinks in the breakroom.                  Send out updates on results.                  Share statistics and success stories with staff.</p>	<p>At the end of the twelve-week project</p>