smart Woundcare

The TeleWound Project

Final Report v2Apr2012

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Final Report

Background

Wounds of all aetiologies are a common problem requiring substantial input of health care resources both in terms of cost and the use of staff resources (1, 2). Wound prevalence increases with age and it is therefore highly likely that the costs of wound management will increase as the population ages. An audit of wounds in Bradford and Airedale demonstrated that wound management is an issue in all health care settings

(3-6) but that it is a particular issue in nursing homes (7) where access to specialist

wound care services is often difficult due to funding issues, the underlying care needs and mobility problems of the patient population.

Developments in information technology and in particular data recording techniques have allowed systems for remote data capture to be developed. Bradford Experience (8) with one such system, digital pen and paper technology, has allowed a system of wound record keeping to be produced which has evolved into a National Wound Assessment Form (9).

Telemedicine has been demonstrated in isolated case studies to be of potential benefit in wound management (10). A “TeleWoundcare” project, expanding on this concept, was developed to test the hypothesis that provision of such a wound care support could improve the delivery of care.

To this end a remote wound management system was developed where information captured on the patient and their wound, combined with visual data of the wound itself, was transmitted to a remote expert for assessment. This system brings together mobile “smartphone” technology, which allows photographs to be taken of wounds, and combines this with data captured on the digital paper forms (via a Bluetooth link with a digital pen) and transmits this encrypted information to a secure server. From this server a wound expert, working remotely, can access the information and offer advice to the local care team, when it is needed, on managing that wound.

Aims and objectives

The aim of this study was to establish if digital pen and paper technology, digital photography and mobile phone technology could be effectively utilized to transmit sufficient wound data to allow a remote specialist in wound care to provide support to local health care professionals working in nursing homes thus enhancing care and improving outcome for this vulnerable and elderly patient group.

Study design

Ethical approval was obtained to undertake this project (REC number 10/H1302/83)

Thirty-two nursing homes in Bradford and Sheffield were selected and were asked to take part in the study. Once consent has been obtained from the nursing home the home was randomised based on the home's known bed numbers so that residents in that home who had a wound would continue to receive their standard care (control group) or received enhanced care with remote expert support (evaluation group).

Sixteen homes, eight in each city, acted as a control group whilst the remaining homes, eight in each city, were the evaluation group. Additional consent was obtained from each individual patient and the patient's General Practitioner was informed of the study.

Evaluation Group

Patients presenting with wounds in an evaluation care home were first consented and registered by the research nurse. A unique identifier number was provided for each patient and the details stored both electronically and in paper format along with the standard patient notes.

For every wound, a weekly wound assessment form was completed by the care home. This form used the project ID from the registration form, the date of birth and the patient initials to identify the patient. The wound diagnosis made by the care home staff, the state of the wound and information on pain, exudate levels and treatments were recorded. Additional forms could be submitted at any time. Wound images were taken using a smartphone camera and this data was electronically linked to the digital paper form. Once all the data was collected, the wound images and information were uploaded together to the secure server for remote assessment by tissue viability nurse consultants. The paper copy of the wound assessment form was stored with the patient's records at the care home.

Control Group

The same registration and consenting procedure was followed and the same data was collected. This information was held separately and not forwarded directly to the remote expert only becoming available at the end of the study period when the remote experts reviewed it.

Inclusion criteria

All patients with a wound of any aetiology, resident in the selected nursing homes were considered eligible to participate in the study. Written informed consent to participate was obtained. Consent was obtained from a family member or guardian where any patient lacked the ability to give his or her own consent.

Exclusion criteria

Any patient from whom it was impossible to obtain a valid consent.

Method

The staff in the evaluation homes received training information technology equipment necessary to support the data capture for the study and received on-going support from the research nurse who attended each home but did not intervene with wound care.

The smartphone device was purely for use in this trial with other phone functions disabled. A specifically designed series of data capture forms were used which employed digital pen and paper technology to enter, encrypt and transmit data to a central server. The secure data storage server which distributes the necessary clinical data to the specialist wound care expert ran bespoke software, which allowed data and images to be received over a secure internet connection.

The staff at the control homes received training in the use of the supplied digital camera, the same wound data was collected by the research nurse using the same digital pen and paper forms.

The study ran for a six-month period and any patient who developed a wound during this period was considered eligible for inclusion in the study. Patients remained in the study whilst they had an open wound. Any patient who developed a recurrent or new wound

after the healing of an initial study wound was eligible to re-enter the study, and for a

patient with multiple wounds all of the patient's wounds were included in the study.

The research nurse recorded details of the number of patients with a wound deemed unable to participate or who declined to participate or withdrew their consent.

Wound data from the intervention and control group were reviewed by both the remote expert nurse consultants and agreement reached on management.

Results

Forty-nine patients (19M:30F) were recruited into the study (26 Bradford 23 Sheffield) These 49 patients had 64 wounds (31 Bradford; 33 Sheffield) the average age of the 49

patients was 81.02 yrs. 25 patients had 28 pressure ulcers, which was the most common wound type, (18 sacral area; 9 on the heel 1 on the head). 14 patients had leg ulceration (22 wounds), 7 patients had foot ulceration (8 wounds), 5 patients had surgical wounds (one of these patients also had a pressure ulcer) and one patient had a fungating wound. 13 patients had multiple wounds. 40 patients who had their weight recorded 13 were underweight (BMI<18) (Sheffield 10; Bradford 3) of these 7 had a severe pressure ulcer (category 3 or 4), 6 had one or more leg ulcers. 6 patients who had their weight recorded were over 80Kgs (Bradford 5; Sheffield 1) these patients had a variety of wounds.

Twenty-seven patients (11M:16F-35 wounds) were in the Bradford and Sheffield intervention group (average age 80.4 years range 51-95) and 22 patients (8M:14F-29 wounds) in the control group (Average age 81.65 range 63-94). 14 intervention (16 wounds) and11 control patients (12 wounds) had a pressure ulcer. 9 patients with 14 leg ulcers were in the intervention group and 5 patients with 8 leg ulcers were in the control group. Three patients with 3 foot ulcers were in the evaluation group and 4 patients with 5 foot ulcers were in the control group one of these patients also had a leg ulcer. Four patients with 4 surgical wounds were in the control group one patient also had a pressure ulcer one patient with a single surgical wound was in the evaluation group. The solitary patient with a fungating wound was in the evaluation group.

The remainder of this document will concentrate on the results of the Bradford arm of the study.

Bradford Results (Kathryn Vowden)

Thirty-nine patients with a wound were identified in the16 nursing homes with 942 beds (4.14%). It proved impossible to obtain adequate patient consent to participate in the study from 13 patients or their family (7 control; 6 intervention). 26 patients were consented to participate in the study (17 intervention- 20 wounds: 9 control – 11 wounds).

Eight patients had a sacral pressure ulcer (3 category 4, 2 category 3 and 3 category 2), 5 patients had a heel pressure (1 bilateral - 2 category 4 and 4 category 3), one of these patients also had a surgical wound.

Five patients had a leg ulcer (two patients had bilateral leg ulceration). Six patients had a foot ulcer, one of these also had a leg ulcer, 3 patients had a surgical wound and one patient had a fungating wound.

Eleven of the 26 patients would have required a visit, the most common reason being for vascular assessment of patients with a leg or foot wound. Two patients required treatment with “skilled” compression bandages.

Bradford Intervention Group

Seventeen patients with 20 wounds were recruited to the intervention group, 6 patients with a sacral pressure ulcer (2 category 4, 1 category 3 and 3 category 2), 4 patients

with a heel pressure ulcer (1 category 4, 3 category 3), 4 patients with leg ulceration (6 wounds), 3 with a foot ulcer and one patient with a fungating wound. 4 patients with a single wound died during the study period. Two patients (3 wounds) were unhealed at the end of the study.

Eight patients had 10 unhealed wounds prior to the study, the average duration of these wound was 26 months (range 6m-60m). Of these wounds 7 healed during the study period, one patient remained unhealed and 2 patients died. Treatment was changed at study entry in 5 patients with 7 wounds care being considerably modified in 4 patients with 6 wounds. The remote care system recognised that one patient required urgent review by the vascular team during the study period.

The community tissue viability nurse prior to study entry had seen 3 patients, 2 patients with Category 4 pressure ulcers and one patient with an ischaemic foot ulcer. Two patients with long duration leg ulcers (4 wounds) were treated by the district nursing team and had not been referred to, or assessed by, any other health care professional. Remote access changed patient management in 8 cases (10 wounds) preventing admission in one case and allowing early appropriate admission in another. It was estimated that outcome improved in 7 patients with earlier healing in 5 patients.

Nine patients developed 10 wounds during the study period (3 patients with category 2 pressure ulcer; 3 patients category 3 pressure ulcers one of these patients also had a category 4 pressure ulcer (2 of these were admitted to the nursing home with 3 wounds). 2 patients with a leg ulcer, one with a foot ulcer and one patient had a fungating wound. 2 of these patients died, one category 4 pressure ulcer remained unhealed at the study end. All the remaining wounds healed within the study period.

Of the 14 patients who had a weight recorded 2 patients at different homes were markedly underweight both of these patients had leg ulcers.

Bradford Control Group

Nine patients (11 wounds) were recruited into the control group. 2 patients had a sacral pressure ulcer (category 3 and 4), 2 patients had heel pressure ulcers (category 3 and 4), 3 patients had surgical wounds, one patient had a leg ulcer, 3 wounds were foot ulcers. 2 patients had multiple wounds (surgical wound and heel pressure ulcer; leg ulceration and foot ulceration). The vascular team were involved in 2 patients care, the orthopaedic surgeons were involved in one patients care, and the general surgeons were involved in one patients care. A GP was noted to be involved in the care of one patients' sacral pressure ulcer.

The average duration of the 10 wounds was 40.2 months. 4 wounds (3 patients) healed during the study period. One of these patients had a foot ulcer for 30 years (this patient was seen by the Vascular Department during the study period and healed with their wound care recommendations).

Staff in the nursing homes used appropriate first line dressings on pressure ulcer wounds. Some staff recognised deterioration and this was reported however there was some delay in response by the community tissue viability nurses. Antibiotic therapy was prescribed from the GP in 3 of the 9 patients; one patient had two courses of antibiotics prior to community tissue viability nurse review. Nursing home staff seemed less able to assess and manage leg and foot wounds.

On review by the two "remote" experts it was agreed that they would have changed management in 7 of the 9 patients (there being opportunities for alternative treatments in two of these patients with long term surgical wounds).

There were some deviations in terms of product usage from the agreed Bradford Wound care Formulary and an inappropriate use of topical steroids in the control group and in patients prior to entry into the intervention group.

Sheffield results (Brenda King)

Sheffield has a large nursing home population of 50 homes with approximately 3642 beds. From this sector of healthcare sixteen nursing homes with a total of 1058 beds were recruited to the Sheffield arms of the TeleWound Project, with eight homes in the intervention group (468 beds) and eight in the control group (590 beds). In total 23 patients with 30 wounds were recruited to the two groups over a six month period. If this was extrapolated to the 3642 beds it would only suggest a potential figure of 80 patients with wounds (2.17% prevalence), which may be a significant underestimate of the wound population in nursing homes. An audit in East Riding in 2006 (11) placed the wound prevalence in Nursing and Residential homes at 12%. However, there were certain issues identified, which may have affected recruitment.

There was poor recruitment in the intervention group with two homes not recruiting at all and four sites only recruiting one patient each. The main reason the two sites did not recruit at all to the study was due to staff sickness and change of staff. Other issues reported, which hindered recruitment in the other homes included; the electronic pen and camera phone being locked away and other staff not having access, equipment battery failure was also reported and maintaining motivation, as it was perceived by some to be more work with weekly completion of the full assessment form.

In the control group there was recruitment from all of the homes in the study. It was not possible to gain consent for only two patients to participate in the study. Both were in the intervention group and consent was declined by their next of kin.

Sheffield Intervention Group

Ten patients with 15 wounds were recruited from six homes to the intervention group six of these patients were from one home. This particular home had been used by the Community Tissue Viability Service to spot purchase beds to enable patients with wound problems to be admitted for a period of intensive management supervised by the Tissue Viability Team. During the study period, two patients with bilateral leg ulceration (4

wounds) who were recruited to the study were patient admitted to the Tissue Viability beds in this home. Motivation to recruit by this site was high and all patients recruited were known the Community Tissue Viability Team. As a result inclusion of this home into the study may not have been appropriate; however, being able to view images remotely aided the management and significantly reduced the need for the Tissue Viability Nurse to visit.

The wounds in the intervention group consisted of 8 leg ulcers (4 patients with bilateral ulceration), 5 pressure ulcers, four sacral and one ischial wound (1 category 4, 1 category 3 [from the images this appeared more consistent with a moisture lesion] and 3 category 2 ulcers), the remaining two wounds included a head wound and a surgical site following amputation of a great toe.

The average age of the patients was 81 years (range 62 to 91) with the two youngest patients being those admitted by the Tissue Viability Nurse Consultant (62 and 74 years). There were two patients with dementia, two patients with peripheral arterial disease, two patients with heart disease, one with renal failure and one with terminal cancer.

Of other the patients not admitted under the care of Tissue Viability one patient had been known to the Tissue Viability service for many months, a further five had been referred and the remaining two had not been referred. One of these had been admitted to the home with the wound and it was progressing well. The other was in the residential unit and was being visited and managed by the community District Nursing Service.

Sheffield Control Group

Thirteen patients with 18 wounds were recruited to the control group. These consisted of, 7 pressure ulcers 5 sacral (3 category 4, 1 category 3, 1 category 2) and 3 heel ulcers (1 category 4, 1 category 2, 1 not documented). One patient had both a sacral pressure ulcer and a heel ulcer this patient had bowel cancer and was receiving palliative care.

There were 4 patients with 5 leg wounds, one patient had longstanding bilateral leg ulcers this patient had dementia and was non concordant with dressings and bandage regimes and was previously under the care of the vascular team. A further patient with a leg ulcer had been referred to Community Tissue Viability by Vascular services this patient also had dementia, gross lower leg oedema, was again non concordant with care and was sleeping in the chair. Despite difficulty in being able to manage this patient and treat appropriately he was regularly referred back to the Tissue Viability service as the nursing home staff needed support with his management. The ability to remotely oversee this patient's care would have significantly reduced the need for visits. The third patient with a leg wound was admitted to hospital with haemoptysis, was not known to Community Tissue Viability and the outcome of admission was not known. The fourth patient was recorded as a lower leg / skin tear rather than ulcer. This would have been a patient that would have benefited from the TeleWound system, as there was concern that the nursing staff were treating this as a simple wound. Local guidelines recommend that a full leg assessment including Ankle Brachial Pressure Index should be performed

as soon as possible for any lower leg wound to prevent the development of chronic ulcers on patients with underlying co morbidity.

The other wounds recorded included a non-healing fistula next to a stoma this patient was under the care of the stoma team, a patient with bilateral foot ulcers who had been referred to the vascular team.

Seven of the patients in the control group had been referred to and seen by the community Tissue Viability Service during the study period with four of these having been seen by the community Tissue Viability Service for previous episodes of wound problems two of these for the a recurrence of the same problem.

It is not possible to comment on the duration of the wounds in this group, as this information was not consistently recorded by the research nurse. It could however, be obtained from the records of the patients who had been seen by the Tissue Viability team.

This was an elderly co-morbid population the average age was 81 years (range 63 – 94), 10 were documented as having dementia or Alzheimer's, five had Diabetes, two had a history of cerebral vascular accidents one had transient ischaemic attacks and Parkinson Disease and there was one terminal patient.

As per the study protocol the Research Nurse had just taken the available information from the wound assessment forms located the patient's records in the control group. This would have been focused on the wound and therefore, there was a significant amount of missing data on the study wound assessment forms completed by the Research Nurse. Some of the fields on the study assessment form would not routinely be on the wound form, as this information would be located elsewhere in the records.

On review of the data by the two 'remote' experts the information and the images were of sufficient quality to be able to identify if appropriate wound practice had been provided and to monitor the progression of the wound. In three cases on assessing the images it was clear that the wound was improving. Whereas in one case, there was quite a clear deterioration in the wound, this was one of the patients who had not previously been referred or seen by the community Tissue Viability Team and it was a Grade 4 sacral wound, which should have been referred. There was only one case in the control group where the images were not good enough to be able to assess remotely.

On a further patient again not seen by the community Tissue Viability team there were two different wound management products documented as being applied to the wound. It was possible from remotely assessing this to identify what would have been appropriate to use and remote advice could have been provided.

Conclusions from Sheffield

Positives

- Earlier triage of wounds
- Able to offer interim treatments
- Able to consider direct referral without waiting for TV to visit
- Ability to monitor the wound progress remotely
- Triggers to those that need review
- Remote support and education
- Links to the wound policies
- Data would allow remote advice for some patients

Negatives and the way forward verifying data before it is inputted into the data base

- Better quality images / training on taking images
- Data base needs to be able to flag the ones that need to be reassessed
- Too cumbersome
- Need to able to see the assessments next to the corresponding image/s
- Identified that completion of the national wound assessment form provided a more comprehensive set of information to allow a remote opinion to be made
- Control group lacked some data on the assessment form probably due to the fact that the data was elsewhere in the records but to see all the data that influences wound care may be positive for making decisions
- Data missing from the control group included some fundamental aspects of assessment including pressure ulcer risk assessment tool
- Lack of Doppler assessment – no space provided to identify why Dopplers may not have been recorded

Discussion

The study confirms the hypothesis that digital pen and paper technology, enhanced digital photography and mobile phone technology can be effectively utilized to transmit sufficient wound data to allow a remote specialist in wound care to provide support to local health care professionals working in nursing homes.

Although the patient numbers are insufficient to allow any statistical analysis the experience of the remote experts and the case studies included in the appendix illustrate the potential benefits of the system. Results support the recently published conclusions on the use of telehealth (12) which quotes the reduction in hospital admissions and reduction in morbidity and mortality obtained in the Whole Systems Demonstrator Programme (13) and indicate that both quality improvement and cost savings should be possible if such a wound monitoring system as utilised in this study was more widely applied.

Gaining adequate informed consent for this study proved difficult for some patients. The main difficulty experienced was associated with the patients' mental capacity when the

patient's next of kin was not available to sign the consent. These issues could, in part, be addressed by the care home staff seeking patient or relative approval at a more convenient time and would not prove to be a limitation to the use of the system outside of a clinical trial environment.

Feed-back from the nursing homes in the active arm of the study indicated that, once familiar with the equipment, staff found the remote support beneficial (Appendix 2) Review of the technology did highlight that some improvements would be necessary if the system was to be rolled out across a larger population. The mobile phone, in particular, was difficult for staff to manage. The main issue was linking the image to the data and difficulties in sending data. Bradford has areas where transmission of data using the existing 3G networks is difficult. These areas would require attention by telecommunication groups before development of this or other "telecare" service could be fully utilized. The digital pen and paper technology requires data validation to ensure accurate transcription and "translation" of handwritten script which was not possible in the pilot study but would be included in a working system. The database would also require some amending to allow smooth running and easy and rapid access of data files.

One of the main benefits in the study is the ease of monitoring progress of the wounds. Early recognition of wound deterioration is key to preventing serious complications that require treatment and hospitalisation. This aspect of the system and the advantages of TeleWound monitoring was demonstrated by patients who provided with early specialist intervention in their care home and others who early intervention by staff prevented hospital admission. By use of this system patients could also be monitored by specialist teams without the need for outpatient review.

The impact of the TeleWound care system is illustrated by the following case studies (Appendix 1) which highlight the potential and actual benefits in the TeleWound care system to individual patients and their carers. The views of nursing home staff are highlighted in Appendix 2.

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Appendix 1- Selected Bradford case studies

Case study 1 Intervention (Active) arm TeleWound Care Study

Past history

Mr TL is resident at the nursing home in a nursing care bed. The qualified nurses employed by the home give all nursing care. Mr TL has a primary diagnosis of senile dementia and a significant history of arterial disease. In the past he has undergone an amputation of his right leg in order to treat this disease. A dry gangrenous patch appeared on his left great toe. The community tissue viability nurse visited him on 9/05/2011 at this time the wound had been present for about 7 weeks. Mr TL was unable to tolerate the recommended dressing so the home nurse had been leaving the toe open to the air.

Study entry

On study entry 24/06/2011 the toe was stable the wound remained dry. Nursing home staff continued to observe the wound and take study data and photos. On 1 /09/2011 the wound had deteriorated rapidly and had become painful with signs of infection and increased necrosis. A review by the remote expert advised that an urgent admission was made for arterial investigation and IV antibiotic therapy. The GP made a domiciliary visit and the patient was admitted directly to the vascular ward. He was treated with IV antibiotic therapy until his toe again was considered to be stable. He was discharged on 14/09/2011 with a further 5 days of oral antibiotics. Data collection continued to the end of the study on 1/11/2011. Mr TL remained comfortable, his wound remained dry but unhealed this wound is not expected to heal but the toe is progressing towards auto amputation. He had no further problems and pain control has been improved.

The implications and benefits:

This case illustrates that the TeleWound system allowed early recognition of deterioration and prompt appropriate action was taken to prevent further and on-going deterioration which could have serious consequences.

Case Study 2 Intervention (Active) Arm TeleWound Study

Past History

Mrs F came to the home in Aug 2009 with a primary diagnosis of senile dementia and was reported to have suffered leg ulceration over a period of 4 years prior to admission. Mrs F has a previous history of breast cancer with metastatic spread to her left lung. Despite her age and this diagnosis she remains fully mobile with one walking stick.

The district nursing team visited Mrs F three times weekly to change 3 layer compression bandages to both legs. Despite regular and frequent bandage change the notes reported significant strike through, her bandages frequently becoming wet and malodourous. She was miserable and uncooperative. It was reported by the care home

staff that she had become slightly aggressive and was reluctant to let anyone change her lower limb dressings.

Study Entry

Mrs F was consented to study entry by the care home staff and her son on 14/06/2011. She was expressing non-verbal signs of pain and the nursing home matron expressed concerned about this. She had raised this concern with the district nurse but no action had evidently been taken. Communication with Mrs F was difficult due to her dementia although there were some lucid moments. It was however evident that the wounds were having a significant impact on her quality of life. The Photographs and assessment sheet was completed and sent to the remote expert the same day who, based on this information, decided to make a domiciliary visit later that day.

Expert assessment at the visit identified that Mrs F clearly suffered extreme pain during dressing procedures. The wounds, on exposure, highlighted the extent of ulceration and there were clear signs of infection present. There was considerable superficial skin damage from failure to control exudate, inappropriate dressing selection and from poor application of compression bandages. This was causing the areas of ulceration to extend and deteriorate. The skin on both legs was macerated and in poor condition with infected eczema, the right leg being more severely affected than the left.

Advice from the expert as the result of remotely triggered domiciliary visit;

- Wound swabs to be taken for culture and sensitivities antibiotics were to be prescribed.
- Topical antimicrobial in the form of Flamazine as primary dressing
- Foam dressing applied as a secondary layer for absorbency
- Topical steroid cream to the inflamed weeping eczematous peri-wound skin.
- Analgesia to be reviewed for dressing change.
- Compression was removed, wool and crepe bandage applied temporarily
- Compression to be re-applied by skilled staff reducing the number of visits and following reassessment of the Doppler ABPI

Following the introduction of this treatment plan it was possible to re-introduce reduced compression bandaging by research team staff. An improvement was notable immediately twice weekly visits were appropriate for two weeks followed by weekly dressings using antimicrobial dressings and compression applied by skilled team members.

Mrs F's pain resolved rapidly and the staff reported considerable changes to Mrs F's behaviour; she became co-operative with her dressing treatment and was generally much happier.

During the following weeks the remote expert gave further advice regarding changes in the care plan and no further domiciliary visits by the expert were required. Progress was made towards healing. 12 weeks from the visit by the expert the right leg ulcer was healed and after 15 weeks the left leg ulcer was healed.

The implications and benefits:

Review of care prior to study entry highlights;

- *Long term inappropriate treatment*
- *Poor application of compression bandages causing skin damage*
- *Poor documentation of care*
- *The only action taken to address issues by the then care team was to increase the number of visits.*
- *No referral or advice was sought.*

The plan by the remote expert highlights

- *Reduced number of visits when appropriate treatment used*
- *Appropriate dressings used to reverse the effects of skin damage from infection*
- *Antibiotics and antimicrobial dressings. These may have been avoided if earlier appropriate treatment had been used*
- *Correct application of compression bandage improved healing*
- *Improved the patients quality of life*
- *Immediate pain reduction which had a positive effect on her mood and wellbeing and her quality of life*
- *Cost saving from reduced nurse visits*

Case Study 3 Intervention (Active) Arm TeleWound Study

Past History

Mrs W occupied a residential bed in the nursing home where she was resident; all her nursing care was given by the district nursing service. Mrs W has previously suffered from a fractured right neck of femur resulting in orthopaedic surgery of total right hip replacement. She had significant mobility problems and was chair bound. A hoist and two carers were required for all moving and handling events. Her BMI was 46. She had Type 2 diabetes controlled with Glicazide 60 mg daily. She had an allergy to penicillin.

Study entry

Consent was taken and Mrs W was registered into the study on 28/06/2011. She had a wound to her left great toe. The wound had been present for around 3 months. The wound bled easily, was wet, fragile and caused her pain at dressing changes. Mrs W reported that this wound caused her great distress. The wound was treated with an antimicrobial dressing (Suprasorb X) and retention bandage. The wound and toe showed signs of local infection this being the cause of her pain. The treatment objectives were to manage bacterial burden and protect granulation/epithelialisation.

Photos were taken on 28/6 and the remote expert reviewed the photographs and information. Although a visit was not required by the remote expert antibiotics were requested and prescribed by the GP. The patient required podiatric surgery to relieve the infected ingrowing toe nail. The remote expert contacted the podiatry team and requested a domiciliary visit to treat the infected ingrowing toe nail. This was arranged and the podiatrist visited, having viewed the photographs, with the correct equipment to perform Doppler assessment and procede with the necessary treatment a dressing (Inadine) was applied.

The wound was monitored by the remote expert on: 11/7, 17/7, 22/8, 6/9, 8/9, 15/9, 28/9 when the wound healed.

The implications and benefits:

The system allowed the appropriate care to be delivered without delay and within the home environment and eliminated the need for the patient to be transferred to the hospital OPD clinic for treatment. The photographs and information were shared with the lead podiatrist who could ensure appropriate team member would provide treatment.

Case Study 4 Intervention (Active) Arm

Past History

Mr M had been in the Nursing home for 6 months he is paraplegic and was admitted with a Category (Grade) 4 pressure ulcer to his sacral area. On admission to the home his skin was in poor condition, the available documents included photographs illustrating the skin damage and subsequent images taken by the nursing home staff showing improvement over time.

The Community tissue viability team had seen the patient in November and January and suggested a plan of care. This included a high risk pressure relieving mattress (powered alternating pressure mattress) a cushion for his wheelchair and dressing for the wound which was requiring daily changes.

Just prior to study entry the wound started to become malodourous and a further referral was sent to the tissue viability nurses in May requesting a review. As a result of their visit antibiotics were requested and a plan for hospital appointment made as the TVN felt surgery would be indicated.

Study Entry

At the same time the patient was recruited onto the TeleWound study and the Nurse Consultant reviewed that referral was made to the community TVN the case and arranged a visit to the home. She recommended increasing the amount of time off the sacral area. This did however mean that the patient would spend longer periods on his bed and be positioned on his sides to ensure pressure was not directly on the ulcerated area.

On examination of the wound the TeleWounds Nurse Consultant noted that there was a loose fragment of bone embedded in the wound base. This fragment was sharp and causing trauma to the wound bed during patient movement and whilst sitting out. At a planned visit the nurse consultant was able to remove the bone fragment which allowed healing to occur.

The increased time of pressure relief was continued and the on-going care included dressings to encourage healing and the progress to healing was carefully monitored using the TeleWound system to ensure no further complications developed. The wound did heal without further complication and the patient was able to then gradually spend more time socialising without being on extended periods of bed rest.

The implications and benefits:

- *The plan for surgical review (made prior to study entry) was delayed and then cancelled as the TeleWounds Nurse Consultant was able to address the issue in the home.*
- *There was a delay in healing prior to study entry the progress made after this was rapid and progressive*
- *There was no further need for antibiotics*
- *Reduced expenditure for dressings and wound care as the wound began to heal less costly dressings were required and less nursing time needed.*
- *Once healed the need for high spec pressure relieving equipment reduced to that of moderate spec*
- *The patient now can sit out and socialise for longer periods improving his mood and quality of life*

Case Study 1 Control Arm

No remote intervention TeleWound data capture only

Past history

Miss B has been resident in the nursing home since February 2005. Miss B occupies a residential bed with all nursing needs provided by the district nursing services. She has a primary diagnosis of bi-polar disorder. She also has anaemia, hypertension, and a BMI of 37.7. She has mobility problems and can only transfer and walk limited distances with assistance from one carer.

In Feb 2007 Miss B developed a wound to the dorsum of her right foot, which became infected, this required hospital admission for IV antibiotics. On discharge from hospital she was referred to the district nursing service for wound care for her leg ulceration which healed in September 2007.

She suffered a recurrent ulceration in April 2008 which required the district nursing service for wound care. The district nurse used a Comfeel dressing which caused the wound and surrounding skin to deteriorate. Contact with the district nurse was increased to twice weekly visits. In May 2009 referral was made to the community TVN service with a non-healing ulcer. No documentation regarding a TVN visit was evident. The district nurse changed treatment to Trimovate and cover with Mepilex light border, which was ineffective. The wound remained open despite several changes to the dressing regimen over the next few months. In Sep 2010 a leg ulcer assessment was completed by the district nurse, which included Doppler assessment and compression therapy was commenced. Although 2 further referrals to the TVN service were made there was no record of a visit. The wound was noted to be healed on 29/07/2011.

Summary

Over a period of 4 years 5 months this patient had suffered 2 episodes of ulceration. The last episode of open ulceration had lasted for approximately 3 years and 2 months. During this time she received twice weekly visits from the district nursing service for wound care intervention and a variety of dressings had been applied the dressings had caused further damage or delayed healing. She had 3 referrals to the TVN service over this period but no documented evidence of a visit by the service in her nursing notes or her Nursing Home notes

This case illustrates:

Inappropriate dressing use Comfeel which caused skin and ulcer deterioration and the use of a steroid cream which is inappropriate prolonging the healing process. There was a significant delay in the start of compression treatment and consequent further delay in healing. Some gaps in the documentation and lack of rationale for treatment decisions.

Remote assessment and monitoring would have ensured appropriate treatment was commenced earlier and the route to healing monitored more closely.

Case Study 2 Control Arm

No remote intervention TeleWound data capture only

Past History

Mr H Is a Registered Nursing Home patient. He was admitted to the nursing home on the 4th august 2011.

Mr H had suffered a stroke on the 21st of May 2011 and was found at home between the bed and the radiator by his daughter.

He was admitted to hospital with a dense hemiplegia. He had also suffered an aspirate pneumonia following the stroke which was treated with antibiotics. His past medical history includes Ischemic heart disease; peripheral vascular disease. During his hospital stay he developed a category 3 pressure ulcer on his left heel on 10/07/2011. Mr H was discharged in to nursing home care on 04/08/2011 with the heel pressure ulcer.

Current situation

On 04/08/2011 pressure ulcer was assessed by nursing staff as 100% necrotic, and dressed with Aquacel Ag and Duoderm. TVN 's visited on 11/08/2011 a Doppler assessment confirmed peripheral vascular disease 18/08/2011. Dressings were changed to Actiform cool and Allyven heel to be changed 3 times weekly, they requested use of heel trough at all times. This regimen continued with the wound remaining static. When the dressing regimen was changed on 15/09/2011 to Iodoflex and Allyven heel the wound the wound began to make progress and Granulation was noticed, this continued and the wound continued to heal.

06/01/2012 classed as Healed.

Summary

Mr H's Pressure ulcer had been a direct result of his stroke and subsequent dense left hemiplegia with a severe contracted leg and restlessness whilst in bed. This was recognised as was the high-risk status. Some of the dressings used were inappropriate for this wound it is not clear why these were used and this action could have caused lasting and long term damage placing his limb at risk. When a suitable dressing was used the wound improved.

As Mr H's general condition improved so his wound improved fortunately the wound improved to healing.

This case illustrates:

Remote treatment using TeleWound would ensure the patients dressing regimen would be appropriate and in line with other health problems. Monitoring the effects of treatment changes is an important part of care. TeleWound care allows such monitoring.

Appendix 2: Quotes from Bradford nursing home staff

Tele Wounds Nursing Homes Interview (Intervention group).

How have you found the TeleWound Project?

A "The phone was difficult, we forgot to turn it off and charging it took ages-so we lost confidence in the equipment"

B "Technology was initially difficult- not easy at all we have only just got the hang of it."

B "Being part of the TeleWounds study has increased my awareness and knowledge of tissue viability"

C "We have had signal problems which has been time consuming to sort out the photos particularly have been difficult."

D "Its been OK our patients have done really well,"

E "I am a bit of a technophobe so it took me a while to get used to it but I am OK now"

What is your opinion on the concept of TeleWounds?

A "The concept of TeleWounds is marvellous"

A "The support during the study has been fantastic"

A "The speed of decision making and appropriate action is really great"

B "Great – a patient was treated in the home instead of sending him to a clinic"

C "a good concept, its just been difficult for us with signalling"

D "the benefits are clear"

E "Much quicker"

How can the TeleWound system be improved?

A "the quality of the phone"

B "The pens fine, the camera is the problem"

C "the technology so it does not take such a long time"

D "I had problems registering a patient I didn't realise until after the week end"

D " the pen was OK it was just the phone"

E "We had some signalling problems but they seemed to get sorted as time went on"

With these changes would the TeleWound System be acceptable method of service delivery?

A "absolutely! Really great idea"

B "I would be very happy to continue even with the current technology"

C "certainly has potential"

D "Yes I would want to continue"

E "Yes would continue"

Would you be prepared to use this method of service delivery without any changes?

A "Yes"

B "I would be very happy to continue even with the current technology"

C "if they can sort out the signalling problems Yes"

D "Yes I want to continue"

E "Yes- Now I have got used to it"

How does TeleWound service compare with the current service?

A "We have had some problems with the current service. The local D/Ns help as they visit the residential patients. We use their expertise."

D "the speed of response"

C "She (community TVN) is scary"

E " The timing we wait too long for the community TVN"

How long do you usually wait for a TVN to visit after sending a referral?

A "About a week" they come from Airedale

B "We have a delay of about 7 days for a TVN to visit

C ".. we can refer to TVNs but it takes about a week before patients to be seen the TVNs are always so busy"

D "between 4 days and a week"

E "one, two even three weeks - its too long"

What happens to patients who require a follow up or monitoring visit?

A "We don't get a routine follow up visit

B "very few patients are seen again even if there is documentation stating they will visit we have to request a further follow up, this consultation is usually (more than 50%) by phone.

C "The TVNs are always so busy"

E "no we don't get follow up"

What support do you have when Adult Protection issues around pressure ulceration arise?

A "we did have a case a while ago" as a result of this we learned a lot and made a lot of changes"

B "I usually have no support and I feel quite vulnerable."

C "don't know"

D "The community TVN is quick to report"

E "We report any pressure ulcers to the CQC we have had no problems"

How is wound care training usually provided? How is this funded?

A "We have a link nurse who goes to the TVN link nurse meetings there are 4-6 sessions she attends and feeds back. We have a training budget and can use this if we need.

B "We have a tissue viability link nurse who is very keen but does not like attending the meetings.

B "Training is provided by a private company (one of the TVNs) we have a training budget and the manager will pay. There is some pressure for us to do tissue viability training as we have very dependent patients.

C "We don't get any training the tissue viability link nurse left last year so we don't have any. We would like more training"

D "We have a training budget and we get the TVNs company training we don't have any problems with this"

E " We have external training courses "

Would staff prefer: on the job training, face to face study days, e-learning packages?

A "We prefer face to face training and on-the-job. The D/Ns did a research project working with the HCA including basic skin care and pressure ulcer prevention education this resulted in a significant reduction in the number of pressure ulcers it was really good.

B "Face to face works best but it is expensive, some may do e-learning

C "Any training would be helpful, we have a computer so we can do e-learning particularly useful for the level 3 HCAs and students"

D "Face to face, we have a computer in the office this can be difficult for staff to use so e-training might be difficult.

E " e-learning would be a great idea for our nursing home group to have a pathway and they would need to be involved