

Application of simplified diabetic foot assessment in an acute medical unit

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Article points

1. This project aimed to assess whether the introduction of local training in simplified assessment and structured management of the diabetic foot increased risk assessment in vulnerable patients by non-specialist practitioner
2. Audit was performed before and after training and an aide-mémoire were implemented.
3. The proportion of patients assessed by non-specialist practitioners significantly increased following training, resulting in a 26% absolute and 43% relative risk reduction.
4. Local training and simplified foot assessment have the potential to reduce the risk of diabetic foot ulcers and lower-extremity amputations.

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The incidence of diabetes is increasing and the associated mortality and morbidity are high. This quality improvement project investigated whether locally-delivered training relating to simplified assessment and structured management via an *aide-mémoire* reduced the incidence of diabetic foot ulceration and lower-extremity amputation when utilised in a busy acute medical unit in the North West of England. The aim was to make foot risk assessment simple and accessible to the non-specialist medical practitioner, in order to improve the assessment of a vulnerable cohort of patients. A prospective audit was performed using traffic light criteria based on a structured literature review and national guidance. The absolute risk reduction (0.26) and relative risk reduction (0.43) indicated a significant improvement in foot assessment following training, with a number needed to treat of 3.8. Decentralisation of foot assessment confers a reduction in risk to the patient.

It is estimated that over 5 million people in the UK will have been diagnosed with diabetes by 2025 (Smith, 2014). The associated morbidity and mortality from complications remains unacceptably high (Kerr et al, 2017). The National Institute for Health and Care Excellence (NICE, 2015) recommends that six care structures be in place to improve the detection and prevention of diabetic foot complications:

- Access to a foot protection team
- Clear step-down protocols from multidisciplinary teams
- Local training in diabetic foot assessment
- Clear pathways to refer patients for specialist assessment
- Access to urgent vascular assessment
- Vascular discussion time within the multidisciplinary team.

The recent National Diabetes Inpatient Audit (NaDIA; NHS Digital, 2019), however,

demonstrated that the necessary framework is not *in situ* on a national scale.

Background

The survey accompanying the 2018 NaDIA, which was completed by North Manchester General Hospital, stated that five care structures were in place but that there was no evidence that diabetic foot assessment training was being delivered locally. One hypothesis for this is that podiatry had focussed upon utilisation of the Pressure Ulcer Risk Primary Or Secondary Evaluation Tool (PURPOSE-T), which is not advocated by NaDIA (NHS Digital, 2019) and as such would not have been included within the data. A quality improvement project was undertaken that aimed to address this discrepancy and extend the excellent training that had been given to nursing colleagues to non-specialist medical practitioners.

NICE Guideline 19 (NICE, 2015) is tailored specifically to the specialist practitioner. It is complex and the multivariate risk stratification outcomes are a barrier to both training and uptake (Madanat et al, 2014). The International Working Group on the Diabetic Foot's recently-updated guideline (Bus et al, 2020) incorporates the use of the Ipswich touch test (IpTT), which was proposed by Rayman et al (2011) for the identification of loss of protective sensation (LOPS) by the non-specialist practitioner or when equipment is not available. It was posited that simplification of the NICE guideline and tailoring assessment to the non-specialist practitioner may improve uptake of diabetic foot risk stratification. It was also posited that, when applied to an inpatient setting, this may improve mortality and morbidity as well as reducing harm within this cohort of patients. The current study aimed to ascertain whether simplified assessment and a structured management plan disseminated through locally-delivered training and supported with an *aide-mémoire* could reduce diabetes-related foot complications in an inpatient acute medical unit in the North West of England.

Method

NICE (2018) and Williamson et al (2017) recommend the utilisation of the Population/ Problem, Intervention, Comparator and Outcomes (PICO) of interest to formulate a review question. The review question posited in the quality improvement project was: "Does a simplified diabetic foot assessment and risk stratification criteria that utilises the IpTT improve outcomes and reduce adverse events in an inpatient cohort on an acute medical unit when performed by the non-specialist medical practitioner?" This question was analysed for themes or 'conceptual buckets' (Table 1). From the four conceptual buckets identified, Medical Subject Headings (MeSH) and the thesaurus were used to produce descriptors. These were used to search four eminent databases: EMBASE, CINAHL, PubMed and Medline. The inclusion and exclusion criteria were then determined (Table 2). Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA), as advocated by Moher et al (2009), was used to perform the literature review, see Figure 1.

Table 1. Conceptual buckets and their associated search terms.

1: Simplified diabetic foot assessment and risk stratification	2: The Ipswich touch test	3: Improve outcomes and reduce adverse events	4: Urgent/emergency care within an inpatient cohort
<ul style="list-style-type: none"> • Diabetic foot • Diabetic feet • Diab* • Foot • Diabetic foot screening • Assess* • Triage • Identif* • Guideline* 	<ul style="list-style-type: none"> • Ipswich touch • Exam* • Neuropathy • Diabetic neuropathy • Diag* • Diabetic neuropathies [Mesh] 	<ul style="list-style-type: none"> • Patient outcomes • Reduc* adverse events • Patient outcome assessment [Mesh] 	<ul style="list-style-type: none"> • Acute medical ward • Accident and emergency • Emergency department • A and E • Acute • Emergency service hospital [Mesh]
Total search terms: 25			

Identification and stratification of risk

Examination of the themes identified inconsistency within the literature with regards to which aggregated assessment criteria are synonymous with risk (Sousa Muro et al, 2018). However, LOPS, absent foot pulses, deformity including Charcot, history of previous diabetic foot ulcer (DFU) or lower extremity amputation (LEA) have all been individually validated as core identifiers of increased mortality and/or morbidity (Urbancic Rován and Rován, 2016).

End-stage renal failure was incorporated by both NICE (2015) and the International Working Group on the Diabetic Foot (Bus et al, 2020) based on benefit *versus* risk. However, there was insufficient evidence within the literature to advocate this as a core assessment criterion for risk stratification. The International Working Group on the Diabetic Foot felt that, should a patient be on renal replacement, their risk would manifest in the presentation of another risk factor and therefore they would not be neglected.

Madanat et al (2014) suggest that there are several barriers to increasing the uptake of risk stratification:

- Availability of equipment
- Complexity of assessment
- Lack of training.

LOPS can be determined using the IpTT, which has improved both uptake and patient outcomes (Rayman et al, 2011; Peace et al, 2018).

Key words

- Diabetic foot assessment
- Non-specialist practitioner
- Quality improvement
- Risk reduction

Table 2. Inclusion and exclusion criteria.

	Inclusion	Exclusion
Design	Any study design with peer review	Non-peer-reviewed articles, case reports or books
Time since first publication	≤7 years	≥7 years
Abstract	Present	Absent
Language	English	Any other language
Participants/sample	Nursing/associated healthcare professionals/ medical staff	Auxiliary staff, carers, assistants
Interventions	<ul style="list-style-type: none"> • General risk stratification for the development of complications affecting the lower limb in patients with diabetes • Utilisation of the Ipswich touch test to identify sensory neuropathy • Assessment of peripheral arterial disease/arterial insufficiency in relation to risk stratification or foot screening • Screening following trauma • Foot care advice as part of diabetic foot screening • Prevention of ulceration in relation to diabetic foot screening/risk stratification • Offloading as an outcome of diabetic foot screening • Frequency of foot examination as a result of diabetic foot screening • Improving uptake of diabetic foot screening 	<ul style="list-style-type: none"> • Utilisation of equipment to identify sensory neuropathy unless a direct comparison between the 10g monofilament (standard comparator), neurothesiometer (gold standard comparator) or the Ipswich touch test • Screening based on blood tests • Perception/thought-gathering in isolation • Neuropathy other than sensory, including painful • Exercise-related • Management of the condition • Management or treatment of peripheral arterial disease/arterial insufficiency • General foot care • Trauma assessment in isolation • General healthcare • Ulceration or wound care treatment/management • Any ulcer/wound not related to the diabetic foot or diabetic foot screening • Wound infection • Off-loading or pressure redistribution • Frequency of foot examination • Improving patient compliance
Outcomes	Cost saving in relation to diabetic foot screening/ complication prevention in the UK health economy	Cost saving not related to foot screening/complication prevention or in a different health economy to the UK

Training for the non-specialist should occur regularly and be provided in various formats, as this has been demonstrated to improve engagement (Kempegowda and Saeed, 2016). Multivariate risk stratification was deemed an important component of the efficient utilisation of resources, however it did not infer a reduction in mortality or morbidity (Monteiro-Soares et al, 2012). Therefore, if deemed 'at risk', patients should still be referred to a specialist team, ie the local podiatry team for Gestalt assessment. Utilisation of the multivariate risk stratification process was deemed best practice, only when utilised by the specialist practitioner (Monteiro-Soares et al, 2012). There was limited evidence that the IpTT and an 'at-risk' or 'not-at risk' classification system

would provide a viable solution for improving patient outcomes when used by the non-specialist practitioner. However, there was sufficient evidence to endorse a quality improvement project to investigate this further.

Audit, training and re-audit

A short pre-implementation audit was conducted over a 4-week period or until a maximum of 50 patients had been included. In patients where it was identified risk assessment had not been performed, this was undertaken, as it was deemed best practice. Local performance was benchmarked against standards from NG19 (NICE, 2015) and the National Diabetes Footcare Audit (NHS Digital, 2018). A traffic light system was used in which

items included in the audit were marked green if completed within 24 hours, amber if done after 24 hours and red if they had not been completed at all. A week after the changes were embedded in practice, a follow-up, test-of-change audit using the same traffic-light criteria was performed over a 4-week period or until a maximum sample of 50 patients had been included.

The inclusion criterion for both the audit and re-audit was any patient with diabetes admitted to the unit during the evaluation period. Patients were excluded if they were unable to respond to questions or receiving palliative care.

A short 15–20-minute teaching session was delivered to all staff in the acute medical unit prior to change being implemented. Pre- and post-teaching questionnaires were used to identify areas in which learning had occurred. Stickers (Figure 2) were designed to serve as an *aide-mémoire*, provide a structured assessment and support a locally-agreed management plan. Stickers were available on the ward — only those who attended training knew what they were but anyone could use them. They are pretty self-explanatory. Every patient with diabetes had a foot assessment or were supposed to (not all did).

Ethics

To ensure the audit had high ethical accountability, approval was obtained from the University of Bolton’s ethics board and registered with the Trust’s audit department.

Results

The pre-implementation audit included 50 patients (30 female and 20 male), the majority of whom (47; 94%) had type 2 diabetes and the remainder (3; 6%) type 1 diabetes. Four (8%) patients had a DFU and three (6%) had a history of DFU documented within 24 hours of admission to the acute inpatient ward. The presence of LOPS, peripheral vascular disease/absent foot pulses and inflammation or infection were all documented for one patient within the first 24 hours of admission (total n=3). No patients had received education about foot risk or undergone assessment for offloading, Charcot foot, significant deformity or for the presence of pregangrene/established gangrene or ischaemic rest pain. None had undergone all aspects of a

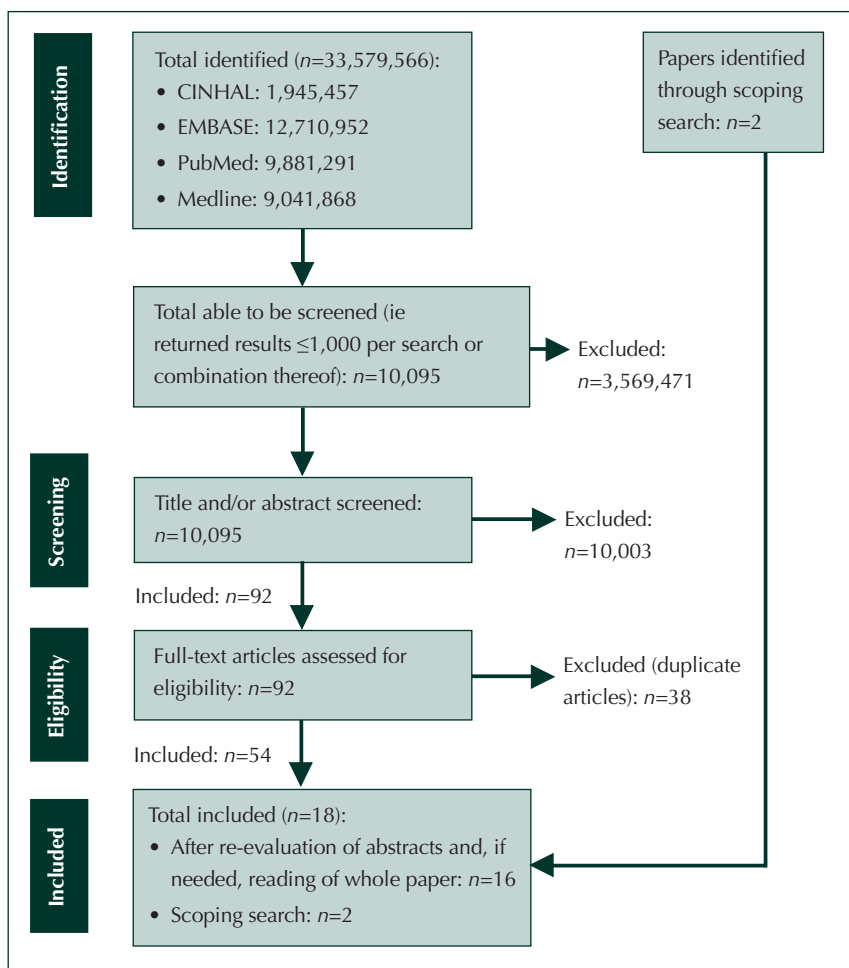


Figure 1. PRISMA flow chart of the literature selection process.

DIABETIC FOOT RISK ASSESSMENT			
NB: If current FOOT ulceration, infection, inflammation, ischaemic rest pain, gangrene / pregangrene Charcot REFER to Hospital PODIATRY for urgent review. All other 'at risk patients' can be referred via their GP to Community Podiatry, if not already known to them.			Date: _____ Clinician Name: _____ Signature: _____
TAKE OFF FOOTWEAR, SOCKS & DRESSINGS, BEFORE EXAMINATION!			
HISTORY	Y	N	IF YES = AT RISK we need to Protect and Refer:
History of foot ulceration or amputation?			1. Inform Ward Nurse, needs monitoring daily and if appropriate pressure redistribution 2. Community Podiatry referral via GP on discharge summary
History of vascular surgery or PAD?			
History of Charcot?			
ON VISUAL INSPECTION			
Current <u>foot</u> wound?			1. Medical illustration must be arranged <input type="checkbox"/> Tick when DONE 2. Inform Ward Nurse for dressings and pressure relief 3. Refer to Hospital Podiatry
Is there inflammation or infection?			1. Deformity will require review by Ward Nurse daily 2. Refer to Community Podiatry via GP on discharge
Is there significant deformity? <i>i.e</i> (deformity and evidence of pressure)			
ON EXAMINATION			
Loss of protective sensation? <i>(Using Ipswich Touch Test, Loss at ≥ 2 sites)</i>			1. Inform Ward Nurse as feet will require monitoring daily and pressure redistribution to be considered 2. Ref to community Podiatry on discharge via GP
Absent foot pulses?			1. Ward Nurse to monitor daily 2. Refer to Community Podiatry
Ischaemic rest pain?			1. URGENT referral to Vascular, consider Duplex imaging 2. Inform Ward Nurse for dressings and pressure redistribution 3. Refer to Hospital Podiatry
Current gangrene or pregangrene?			1. Complete non weight bearing 2. Arrange x-ray (weight bearing) 3. Refer to Hospital Podiatry 4. Refer to Orthopaedics
Suspected Charcot? <i>*Hot spot ≥2 °C (MRI needed)</i>			

Figure 2. Diabetic foot assessment figure.

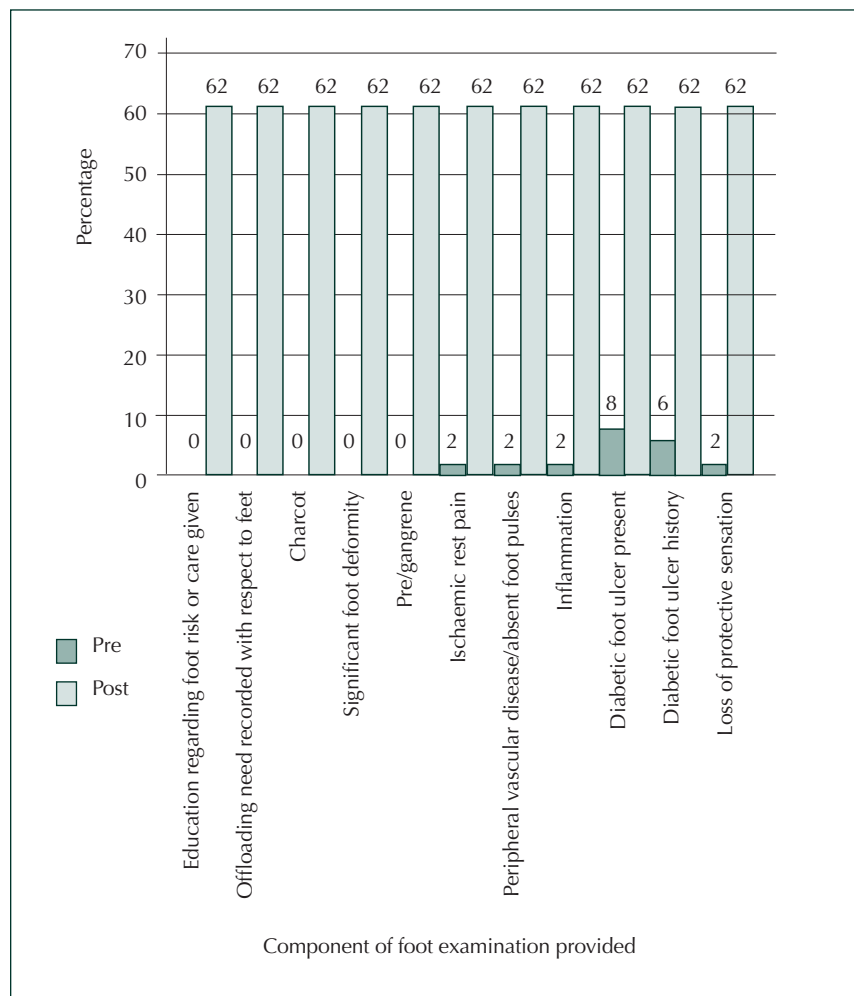


Figure 3. Percentage of patients (n=50) who received various aspects of foot examination within 24 hours of presentation before and after the traffic light implementation audit.

Diagnosis	Number of patients (%)
New-onset rest pain	1 (2)
Absent pedal pulses	1 (2)
Bacterial infection	2 (4)
Significant deformity	6 (12)
Diabetic foot ulcer	4 (8)
Loss of protective sensation	9 (18)

comprehensive foot assessment and only seven (14%) patients had received a partial foot assessment (Figure 3). All had a body map that had been completed by the nursing staff. As a result of the risk assessment conducted alongside the pre-audit, 23

additional or ‘missed’ clinical diagnoses were made (Table 3). Sixteen (32%) patients were diagnosed as being at risk of increased morbidity or mortality as a result of their diabetes and foot risk.

The post-implementation audit included 22 female and 28 male patients; 48 (96%) of which had type 2 diabetes and two (4%) had type 1 diabetes. Of these patients, 31 (62%) had received a comprehensive foot risk assessment and management plan. Ten ‘missed’ lower limb pathologies were identified: significant deformity (n=4), DFU (n=1), inflammation (n=1), and individuals had LOPS (n=4).

The percentages of patients with diabetes who received the various components of foot examination before and after training are compared in Figure 3.

Comparison of the pre- and post-teaching questionnaire scores indicated that non-specialist practitioner understanding had improved in all key learning outcomes (Figure 4). The area with the greatest increase in understanding was the IpTT, where non-specialist practitioner confidence increased from 30% to 94%, a total increase of 64%.

Discussion

The structured literature review identified that many assessment criteria within current guidelines are based upon weak evidence. However, loss of sensation, absent foot pulses, deformity including Charcot and history of previous DFU or LEA were all individually validated as core identifiers of increased mortality or morbidity. This core set of risk factors may be useful in providing simplified, minimum criteria for the non-specialist medical practitioner wishing to identify patients at risk of DFU or LEA.

Teaching non-specialist practitioners about various aspects of foot examination resulted in improved knowledge and confidence in all foot examination learning outcomes measured. The training package underpinned the expected level of practice and met the National Diabetes Footcare Audit recommendation that training be delivered locally (NHS Digital, 2018). Feedback from non-specialist practitioners indicated that the area of training that resulted in the greatest increase in knowledge/confidence related to the IpTT. This test

has been shown to have 78% sensitivity and 94% specificity for detecting LOPS when compared to the gold standard 10g monofilament (Sharma et al, 2014). It does not require special equipment and the increase in the proportion of patients assessed using the IpTT following training supports the assertion by Alonso-Fernandez et al (2013) that uptake of foot examination is improved when no equipment is needed.

When compared to the pre-implementation audit results, the post-implementation audit showed a 68% increase in the uptake of risk assessment following training. This resulted a reduction in the number missed diagnoses, from 23 to 10, which translated into an absolute risk reduction of 0.26 (CER 0.46 – AER 0.2) and a relative risk reduction of 0.43 with a number needed to treat of 3.8, indicating a significant improvement post-training. It follows that increasing the identification of risk and providing a structured, evidence-based management plan will result in reduced patient mortality and morbidity.

A Plan Do Study Act (PDSA) cycle and follow-up audit is planned for 6 months after the training has been rolled out to other areas. Training should be given regularly, as this has been proven to maintain standards and improve uptake (Kempegowda and Saeed, 2016).

Renal replacement was omitted as an independent risk factor for DFU or LEA as it was felt that, should such patients develop one of the core risk-factors for increased morbidity/mortality, this would be detected as part of the foot assessment. Further research is recommended in order to identify whether renal replacement is an independent variable for increased risk.

The initial results from this quality improvement project are promising and, had clinicians been reminded daily to utilise the tool for all people with diabetes, may have been further improved. The findings seem to support the use of simplified assessment and outcomes (at risk/or at risk) to increase the identification of increased morbidity and mortality in practice.

The current work has built on the concept of the Check, Protect and Refer (CPR) for Feet algorithm devised by the Scottish Diabetic Foot Action Group (2017) and provides a structured tool for

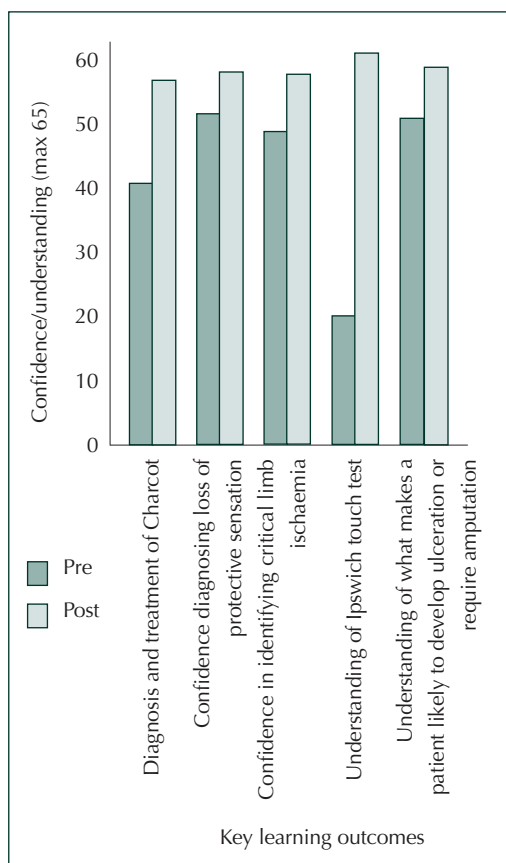


Figure 4. Participant confidence and understanding scores before (pre) and after (post) training.

the ‘check and refer’ part of the Group’s check list. It is hoped that the provision of local teaching and *aide-mémoires* could be used in conjunction with the CPR for Feet model to provide non-specialist medical practitioners with an effective tool in the armamentarium of DFU and LEA prevention.

Conclusion

The provision of local teaching and *aide-mémoires* to support structured management plans in addition to removing the need for equipment improved the uptake of diabetic foot risk assessments and the identification of lower limb pathologies by non-specialist practitioners. It is hoped that these changes in clinical practice will result in reductions in patient mortality and morbidity. The initial results of this small quality improvement project are encouraging; however, further research is needed to quantify the impact of training and implementation of structured management plans on DFUs, LEA and mortality

as well as to determine the relevance of renal replacement as an independent variable in DFU and LEA risk. ■

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