


Fast-Track Pathway: An Effective Way to Boost Diabetic Foot Care

Narges Iashkarbolouk¹, Mahdi Mazandarani¹ , Mohammad Reza Mohajeri Tehrani¹, Maryam Aalaa², Mahnaz Sanjari³, Neda Mehrdad⁴ and Mohammad Reza Amini⁵

¹Endocrinology and Metabolism Research Center, Tehran University of Medical Sciences, Tehran, Iran. ²Evidence Based Medicine Research Center, Endocrinology and Metabolism Clinical Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran. ³Osteoporosis Research Center, Endocrinology and Metabolism Clinical Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran. ⁴Elderly Health Research Center, Endocrinology and Metabolism Clinical Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran. ⁵Diabetes Research Center, Endocrinology and Metabolism Clinical Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran.

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ABSTRACT: Diabetes is a chronic disease that challenges global health issues in many aspects. Diabetic foot ulcer (DFU) is one of the most common causes of reduced quality of life and increased hospitalization, amputation, treatment costs, and mortality in patients. Improper patients' knowledge, unsatisfactory education and training of healthcare workers, and limited facilities are the major cause of delayed referral and downscale management in DFUs. The diabetic foot clinical pathway is pivotal in providing best practices based on the latest standards and patient preferences. In the diabetic foot clinical pathway provided by the Iran Ministry of Health, the common concepts and grading systems are well defined for diabetic foot specialists so that patients can be diagnosed correctly and referred properly. Based on clinical examination guidelines, patients with diabetes are classified into low-risk, moderate-risk, high-risk, and active diabetic foot ulcer groups. One of this Pathway's main objectives is to prevent the patient from getting the first ulcer, prevent frequent recurrence ulcers, and most importantly, prevent minor and major amputation.

KEYWORDS: Diabetic foot ulcer, referral, guideline, primary diabetic care, healthcare system

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CORRESPONDING AUTHOR: Mohammad Reza Amini, Diabetes Research Center, Endocrinology and Metabolism Clinical Sciences Institute, Tehran University of Medical Sciences, NO 10, Jalal-AL-Ahmad St., Chmaran HWY., Tehran 14117-1313, Iran. Email: mramini@tums.ac.ir

Introduction

Diabetes mellitus is a chronic disease that needs sufficient and continuous examination and routine follow-up to be under control. Diabetic patients are at risk of various complications, and Diabetic foot ulcer (DFU) is one of them that directly affects their quality of life.¹⁻³

The burden of DFU is associated with an increasing prevalence of diabetes and population life expectancy. Several studies have mentioned that the lifetime prevalence of diabetic foot ulcers is 19%–34%, with an annual prevalence of 2%. Even after successful treatment, the recurrence rate is 40% at 1 year and 65% at 3 years.^{4,5} According to the First Nationwide Diabetes Report of the National Program for Prevention and Control of Diabetes, the prevalence of diabetic foot complications was estimated at 6.2%.⁶

Diabetic ulcers are the most common cause of hospitalization for people with diabetes. DFUs can lead to infection, gangrene, amputation, and even death if not given proper care or delayed treatment. In addition, lower limb amputation causes long-term admissions, multiple rehabilitation treatments, and the need for home care and social support.^{7,8} As the evidence shows, appropriate treatment and early referral of patients with

DFUs lead to a better healing rate and prevention of advanced complications. Late referral affects treatment prognosis and increases the possibility of delayed recovery and amputation.

Furthermore, with the increased incidence of DFUs, the demand for diabetic foot care centers raised too.⁹⁻¹² According to studies, delays in referral to specialist foot care appear to be a common theme due to differences in healthcare structures across Europe. A survey by Diabetic Foot International in Europe declared that in 55–66% of patients, the duration of DFUs is unknown, and the time to diagnosis is delayed by more than 3 weeks.^{13,14}

Health care authorities provided guidelines focusing on improving healing rates, reducing healing time, and educating healthcare professionals and patients about the risk and consequences of DFUs. They also emphasized the importance of prompt referral to diabetic foot centers to achieve proper outcomes.¹⁵ The referral patterns of DFUs from primary care to tertiary/specialist clinics for diabetic foot care and general physicians' (GP) perceptions of DFU referrals have not been investigated in Iran. Specific indications of care should be followed, and a standard referral pathway should be established to reduce referral delays and adverse outcomes.



There is an ongoing need to raise awareness of the risks of DFUs among GPs, and nurses and accentuate the importance of early referral to diabetic foot teams in Iran.

Fast-Track Pathway Goals

DFUs are one of the medical challenges facing diabetic patients. Without appropriate treatment, management and referral, they can progress rapidly and become the reason for amputation and expensive treatment.

Early and prompt referral and evaluation by a specialist are key to improving patient outcomes. Although studies reported that only 22% were referred to a specialist clinic in the DFU, approximately 50% of patients were referred to a diabetic foot specialist after an unknown duration or 1 month after the onset of ulcers.^{16,17}

Early detection and on-time referral are important factors in the DFUs prognosis. It can reduce medical costs, increase healing, reduce ulcer severity, and potentially reduce morbidity and mortality in these patients. A study by Pankhurst, et al 2018 declared that there was a lack of referral training among health professionals, and they did not know when patients must be referred, and this caused delays in referring patients.¹⁸⁻²⁰

Patient and clinician education plays an essential role in diabetes health care. The physician's role in primary care is crucial for early referral to a specialist care facility as well as for initiating targeted interventions. Previous research has shown that GPs are often poorly trained in managing diabetic foot care and do not perform diabetic foot examinations for every patient. Many studies observed relation between a lack of knowledge about the consequences of delayed referral and facing poor outcomes in patients with DFUs.^{9,21,22}

National health systems establish protocols based on their medical equipment, annual budget, facilities, and human sources. So applying one protocol to all countries is not practical. Hence, managing DFUs from the beginning at the first examination to the end must be specified in every health system.^{23,24}

According to the studies, despite establishing diabetes management guidelines, it seems that without suitable education, training, and proper protocols, achieving our goals in DFUs management is impossible. Therefore, to solve this issue, the International Diabetic Foot Care Group (IDFCG) and diabetic foot international introduced a new, easy-to-perform method called the Fast-Track Pathway for DFUs.

The Fast-Track Pathway

Neglected and delayed referral DFUs can promote from curable simple superficial infection to deep layer infection, sepsis, osteomyelitis, gangrene, amputation, and sometimes death. Therefore, it is reasonable for health care organizations to adopt valuable methods for early identification, treatment, and prevention of later complications of DFU.²⁵⁻²⁷

Given the significant differences in health care and pathway infrastructure and between national and international guidelines for management, dedicated DFU pathways between

primary care and diabetic foot specialist units can be designed and implemented for different national health services.²⁸

We developed new national algorithm for DFU care, reflecting the integrated services based on the specific facilities, requirements, guidelines, and legislation of local and national programs in Iran.^{8,29}

In Iran, the Ministry of Health and Medical Education, in collaboration with the Diabetic Foot Research Group (DFRG) of Diabetes Research Center of Endocrinology and Metabolism Research Institute of Tehran University of Medical Sciences, has published a Fast Track Pathway for DFUs screening, management, and control based on their facilities, human resources, and up-to-date knowledge.³⁰

According to these guidelines, primary health care staff (GPs and other first-step health workers) are responsible for principal clinical examination and early detection of diabetes complications, especially DFUs in patients. Diabetic foot examination should be done for all diabetic patients during the first visit, and based on the risk of developing a diabetic foot ulcer, they should be treated and followed up regularly. Primary health care staff must also educate them about self-care and preventing this condition and should be warned about the crucial consequences of unnoticed ulcers.^{19,29-31}

As shown in Figure 1, during routine follow-ups, when symptoms of infection (fever, irregular pulse, and respiratory rate, drowsiness, illness), and signs of active infection (ulcers, gangrene, cellulitis, signs of ischemia (pale or cold limbs)) or acute Charcot feet (warm, erythematous or swollen limbs), presented on physical examination, the patient should be referred immediately to general surgeons or diabetic foot care centers for surgical, supportive or vascular interventions. With this approach, diabetic patients with clinical signs and symptoms of severe DFU are referred at the right time and receive appropriate treatment, leading to better outcomes. When deformities and other conditions like callous, trigger finger, irregular nail pattern, hallux valgus, arch foot, and fungal infection are detected in a physical exam, peripheral artery diseases (PADs) and loss of protective sensation (LOPS) must be assessed in patients. PADs evaluated with a history of intermittent claudication, Ankle Brachial Index (ABI) <0.9, or undetectable pulse in posterior tibialis or dorsal Pedis arteries. On the other hand, a positive 10gr monofilament test with or without either a diapason test or digital vibration test is in favor of LOPS in patients.^{29,32-35}

If PAD or LOPS is present in a patient, first, we should consider the patient's risk assessment as the next step. Patients were divided into 3 large groups, and the treatment was followed based on their category and condition.

1. Low-risk patients: there is no evidence of LOPS or PAD. Low-risk conditions such as callous may be presented. Educating patient at this point is crucial. They need to examine at least once a year for primary care follow-up.

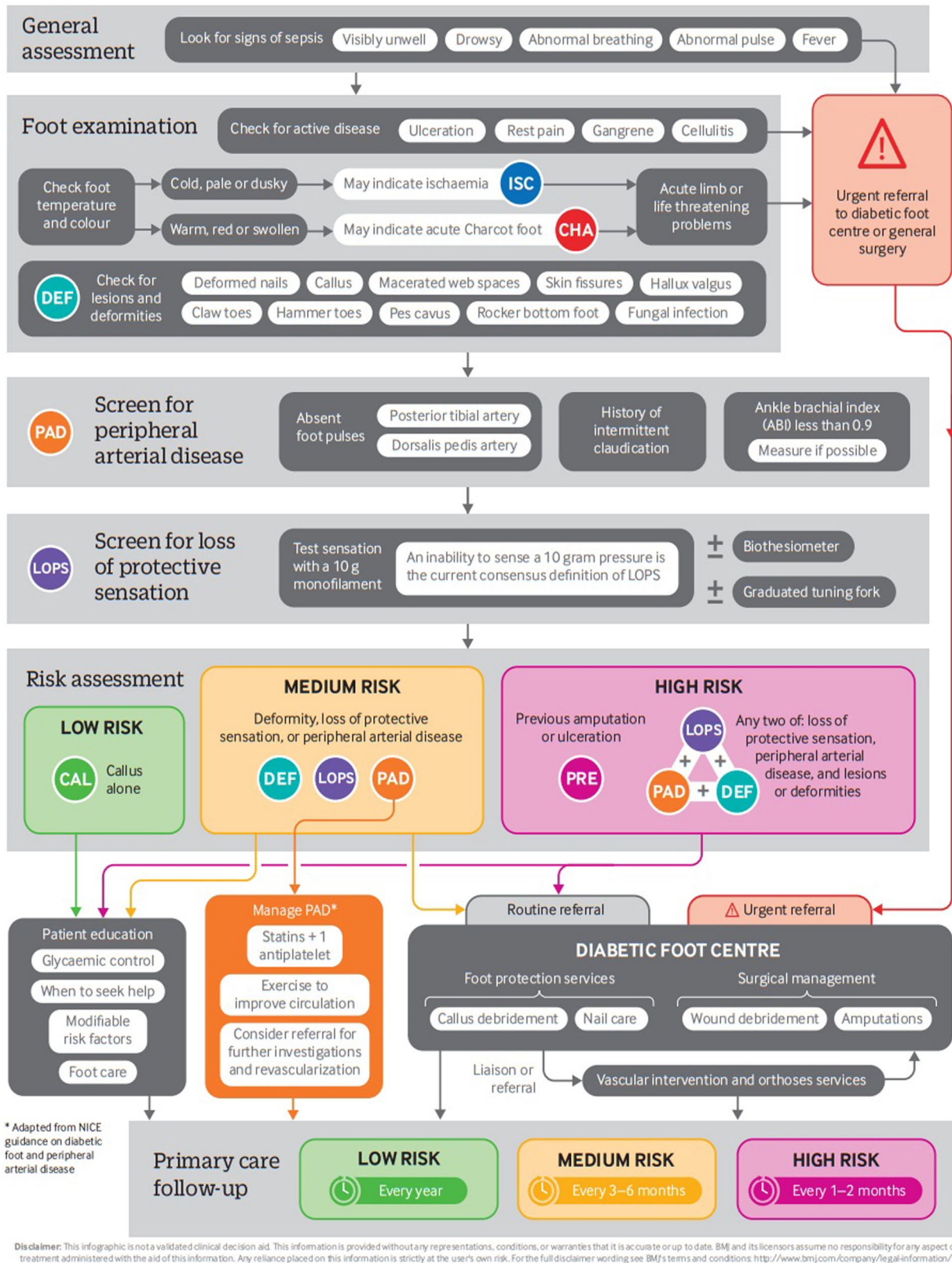


Figure 1. Algorithm for evaluating the risk of diabetic foot. Adapted from Mishra et al.²⁹

2. Moderate risk: the presence of deformities, LOPS, or PAD. Treating with a standard PAD regime and educating patients must be considered. We must refer patients to a diabetic foot care clinic for routine check-ups. Their

primary care routine follows up has to be at least every 3 to 6 months.

3. High risk: history of previous DFUs with at least 2 of the following: PAD, LOPS, and deformities. In this category,

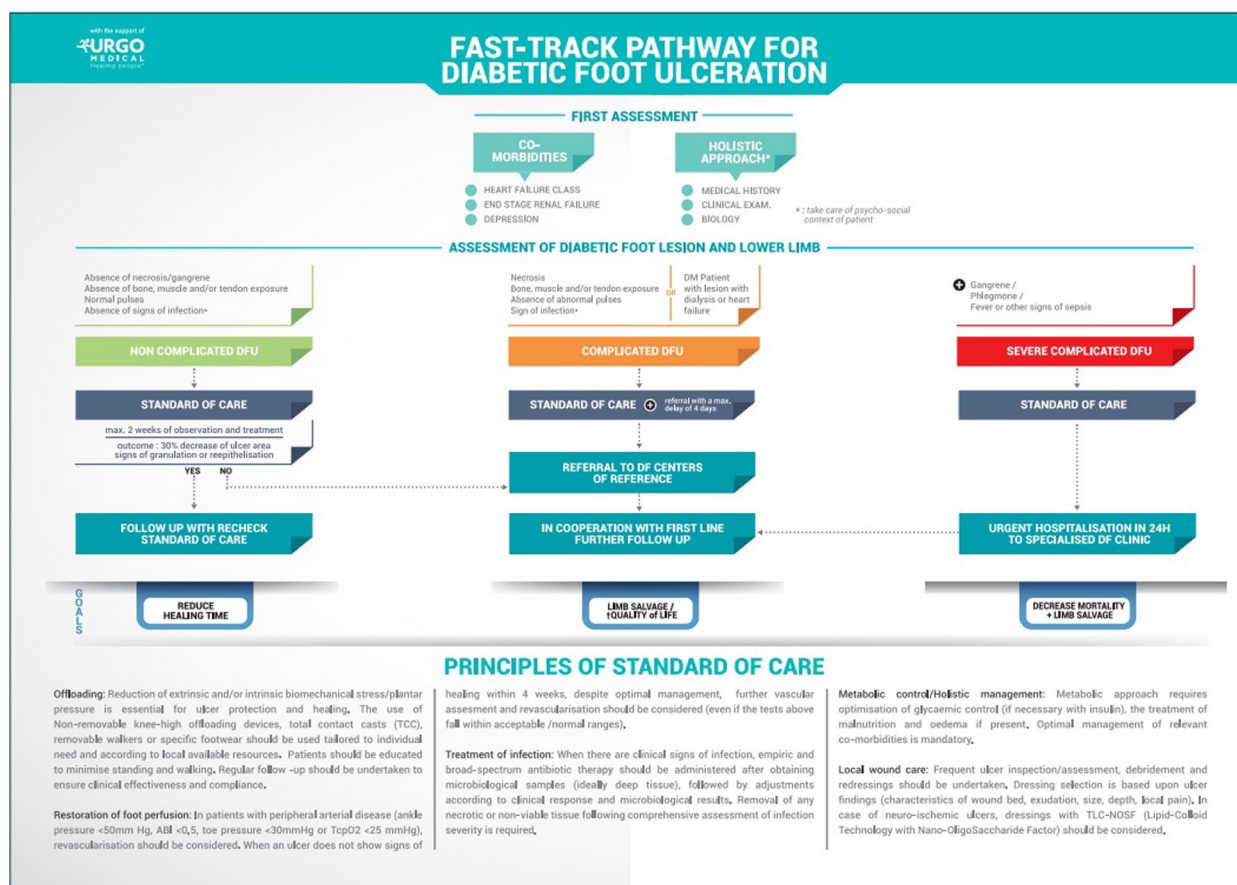


Figure 2. Fast track pathway for patients with diabetic foot ulceration. Adopted from Meloni et al.⁸

patients must be referred to a diabetic foot care center and educated about their condition. They should be in touch every 1 to 2 months for primary care follow-up.

After a diagnosis of active DFU in a patient, primary health care staff should assess it. How to deal with each type of wound is different based on its characteristics and nature. The approach to active DFUs is shown in Figure 2. DFUs are divided into 3 categories: Uncomplicated, complicated, and severe complicated ulcers.^{7,8,29}

An uncomplicated ulcer is defined by the presence of at least 2 of the following after excluding other non-infectious causes: Local swelling or stiffness, erythema more than 0.5 cm around the wound, tenderness or pain, local warmth, and purulent discharge. It only affects the skin and subcutaneous tissue and the presence of erythema less than 2 cm around the ulcer. There is no evidence of necrosis and gangrene, and bone, muscle, or tendon are not visible. Arterial pulses are normal, and there is no sign and symptoms of systemic infection. Initial treatment should be started in these patients, and patients must be re-examined after 2 weeks. GPs must refer these patients to diabetic foot care centers if the ulcer is contaminated. As a result of this protocol, the healing time of patients' ulcers is reduced, and subsequent adverse effects are prevented.^{7,8,29,36-38}

Complicated ulcer involves the deeper structures of the skin, and subcutaneous tissues (such as bone, joint, tendon, and

muscle) or erythema is seen more than 2 cm around the ulcer. Necrosis is seen, and other structures such as bone, muscle, or tendon are visible. Patients may develop systemic infection response, and arterial pulses are not normal. DFUs in patients with comorbidities like heart failure or renal failure is also classified as complicated ulcer. GPs should start a standard DFU regime for these patients and must be referred to the diabetic foot care center as soon as possible (maximum within 4 days). Although these patients have negative risk factors, using this method increases the possibility of preserving the limb and improving the quality of life for the patients.^{7,8,29,39,40}

Sever complicated ulcer is any foot infection with systemic inflammatory response syndrome, accompanied by 2 or more of the following. Body temperature more than 38 or less than 36°C, Heart rate greater than 90 beats per minute, Breathing more than 20 breaths per minute or PCO₂ < 32 mmHg, White blood cells more than 12000 or less than 4000 per cubic millimeter or band cell or other immature forms more than 10%. After starting the initial standard treatment, these patients should be immediately referred to medical centers for hospitalization (maximum of 24 hours). By providing this solution, due to the timely and rapid referral of these high-risk patients, the probability of limb preservation increases, and the mortality rate decreases.^{7,8,29}

The major strength of this study is that this method has been modified in Iran according to the conditions and facilities

of the country. In addition, the limitation of this study is that this method is being implemented for the first time throughout Iran, and it is still impossible to make a definite opinion about its outcomes.

Conclusion

Due to longer life expectancy, chronic patients experience more complications than before. Diabetes is a chronic disease that affects a person's quality of life. One of the challenges in today's medicine is the treatment of DFUs.

These ulcers reduce patients' quality of life and increase their hospitalization, amputation, treatment costs, and mortality. As mentioned earlier, most studies have shown that the lack of patient awareness, along with the inadequate level of training, education, and skill preparation of health care staff and insufficient facilities, are the main reasons for the delayed referral and poor treatment, which lead to progression in DFUs.

Based on these facts, many endocrinological research centers in every country published appropriate guidelines to improve patients' prevention and treatment of DFUs. In cooperation with the Diabetic Foot Research Group (DFRG) and Diabetes Research Center (DRC) in Iran, the Iranian ministry of health and medical education announced a new method called the Fast-Track Pathway for diabetic patients with DFU. According to this method, during the initial visit, a general evaluation and physical examination are done on diabetic patients to check the complications of diabetes. These patients are examined in terms of the risk of developing DFUs and are classified if DFUs are observed. Each patient is treated according to the level of risk and the type of existing ulcer in the protocol.

By applying these protocols, patients with a high risk of complications are identified earlier and referred to medical centers sooner, which causes a reduction in irreparable complications such as amputation and death in patients. This guideline also helps patients without ulcers or low-risk ulcers to prevent their DFUs progression and receive adequate treatment and education. In other words, our goal for introducing this method included the following, 1. Increase in quality of life, 2. Reduction in the healing process, 3. Preserving limbs from preventable amputations, 4. Reduction in mortality, 5. Increase awareness in patients about DFUs and their complications, 6. We are reminding the importance of training, appropriate education, and skills for GPs, as the first line of the health care system, 7. Designing an effective and applicable protocol based on our country's financial, human resources, and medical supplies.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Author contribution(s)

Narges lashkarbolouk: Data curation; Investigation; Project administration; Writing—original draft; Writing—review & editing. **Mahdi Mazandarani:** Investigation; Methodology; Project administration; Writing—original draft; Writing—review & editing. **Mohammad Reza Mohajeri Tehrani:** Investigation; Methodology; Validation; Visualization; Writing—original draft. **Maryam Aalaa:** Formal analysis; Supervision; Validation; Writing—original draft. **Mahnaz Sanjari:** Funding acquisition; Investigation; Writing—original draft. **Neda Mehrdad:** Conceptualization; Methodology; Project administration; Writing—review & editing. **Mohammad Reza Amini:** Conceptualization; Investigation; Project administration; Resources; Supervision; Writing—review & editing.

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ORCID iD

Mahdi Mazandarani  <https://orcid.org/0000-0001-8972-6171>

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