Project Title

Diabetic Foot in Primary and Tertiary (DEFINITE) Care: A Health Services Innovation in Coordination of Diabetic Foot Ulcer (DFU) Care within a Healthcare Cluster

Project Lead and Members

Project leads:

- Dr Elaine Tan, Associate Consultant, NHGP Toa Payoh
- Dr Lo Zhiwen Joseph, Consultant, Woodlands Health

Project members:

- Dr Liew Huiling, Consultant, Department of Endocrinology, Tan Tock Seng Hospital
- Dr Desmond Ooi, Senior Consultant, Department of General Surgery, Khoo Teck Puat Hospital
- Dr Hoi Wai Han, Senior Consultant, Department of Endocrinology, Woodlands Health
- Dr Gary Ang, Consultant, Health Services and Outcomes Research, National Healthcare Group
- Ms Rose Low, Manager, Group Integrated Care, National Healthcare Group

Organisation(s) Involved

National Healthcare Group Polyclinics, Woodlands Health, Tan Tock Seng Hospital, Khoo Teck Puat Hospital, National Healthcare Group

Healthcare Family Group(s) Involved in this Project

Medical, Healthcare Administration

Applicable Specialty or Discipline

Endocrinology, General Surgery, Health Services and Outcomes Research, Group Integrated Care, Podiatry

Project Period

Start date: Jun 2020

Completed date: On-going

Aims

- To achieve coordinated multi-disciplinary team (MDT) care across primary and tertiary institutions for patients with diabetic foot ulcers (DFU)
- To decrease the clinical and economic burden of DFU within our healthcare cluster.

Background

See poster appended/ below

Methods

See poster appended/ below

Results

See poster appended/ below

Lessons Learnt

In such a multi-disciplinary and inter-institutional program involving more than 60 healthcare providers, clinical staff and senior management buy-in and endorsement is of utmost importance. We managed to achieve this with passionate institutional and departmental leads, who meet regularly (fortnightly prior to program roll-out, then monthly for the first 6 months and 2-monthly thereafter) to discuss and address issues faced on the ground, from a finance perspective and from an operations perspective. Quarterly journal clubs ensure best-evidence practice is adopted. We also had the support of a health services and outcomes research (HSOR) unit, which provided data to steer out programme and help provide regular updates and outcomes to senior management.

Patients' and carers' engagement is key to provide a value-based healthcare system. Within our programme, we quickly identified key issues of high defaulter rates, poor health literacy and lack of standardised patient education resources. Data provided by HSOR helped identify at risk sub-group populations, for whom we could develop targeted education programmes. We also adopted patient-reported outcome measures (PROM) and aim to utilise patient-activation measures (PAM) within our programme to further guide our direction.

Manpower resource challenge is inevitable, as there is a shortage of trained Podiatrists within Singapore. With up-skilling of nurses and also creation of the unique post of a Diabetic Foot Coordinator (DFC), we helped bridged this gap. Concurrently, we also utilised technology to help with wound care monitoring, through the use of a patient-owned wound surveillance application.

Conclusion

See poster appended/ below

Additional Information

2022 National HIP Best Practice Medal – Care Redesign

DEFINITE Care was launched in June 2020 and is funded for 3 years, with discussions for a further 3-year funding currently in place. Upon establishing a MDT and inter-institutional coordinated workflow for patients with DFU across primary and tertiary care, we are looking to intervene further up-stream in the DM foot disease, targeting patients at risk of developing DFU, through risk-stratified Foot Surveillance screening under the NHGP DM Foot STEP programme, in accordance with the Agency for Care Effectiveness' Appropriate Care Guide for "Foot Assessment in People with DM" guidelines 2019. We also aim to foster stronger collaboration with primary care partners (e.g. primary care network GPs, community nursing), community partners (e.g. Diabetes Society, NTUC Health, 7 Vision) and other National DM-related programmes (e.g. SiDRP, HALT-CKD, National Performance Steering Committee National DM Collaborative).

DEFINITE Care currently is implemented across all existing 7 polyclinics and 2 hospitals within National Healthcare Group, with further plans to scale-up in 2 upcoming polyclinics and 1 upcoming hospital, when they are opened to provide clinical care. Through National Performance Steering Committee's National DM Collaborative, we are also sharing our know-how and experience with the other 2 major healthcare clusters, on the workflow of MDT care for patients with DFU.

Project Category

Care & Process Redesign

Quality Improvement, Workflow Redesign, Value Based Care, Productivity

Care Continuum

Primary Care, Preventive Care

Keywords

Patient-Carer Health Literacy, Multi-Disciplinary Team

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Diabetic Foot in Primary and Tertiary (DEFINITE) Care

Dr Joseph Lo (WH), Dr Elaine Tan (NHGP), Dr Liew Huiling (TTSH), Dr Desmond Ooi (KTPH), Dr Hoi Wai Han (WH), Mr Rose Low (NHG-GIC), Dr Gary Ang (HSOR)

National Healthcare Group
Adding years of healthy life

Mission Statement

DEFINITE Care is an inter-institutional and multi-disciplinary team (MDT) health systems innovation within NHG. It aims to achieve coordinated MDT care across primary and tertiary care for patients with Diabetic Foot Ulcer (DFU). The 4 workplans of DEFINITE Care are to (1) scale up existing primary care DM Foot Screening and Surveillance, Treatment, Escalation Programme for ulcer prevention (DM Foot STEP) and tertiary care MDT-style Lower Extremity Amputation Prevention Program (LEAPP) clinics, (2) closed-loop coordination of care between primary and tertiary institutions, (3) adoption of a patient-centric and patient-owned digital wound imaging app and (4) health economics analysis to evaluate cost effectiveness and long-term financial sustainability of the programme

Core Team Members

	Name	Designation	Department
Program Director	Dr. Joseph Lo	Consultant	Surgery, WH
Institution Leads	Dr. Elaine Tan	Associate Consultant	NHGP (Toa Payoh)
	Dr. Liew Huiling	Consultant	Endocrinology, TTSH
	Dr. Desmond Ooi	Senior Consultant	General Surgery, KTPH
	Dr. Hoi Wai Han	Senior Consultant	Medicine, WH
Program Evaluation	Dr Gary Ang (Consultant), HSOR		
Podiatrists	Chelsea Law (KTPH), Pauline Ang (NHGP), Tiffany Chew (TTSH)		
Program Manger	Ms. Rose Low		Group Integrated Care
DM Foot Coordinators	Ms Koo Hui Yan, Ms Julia Choo, Mr Low Kai Qiang		

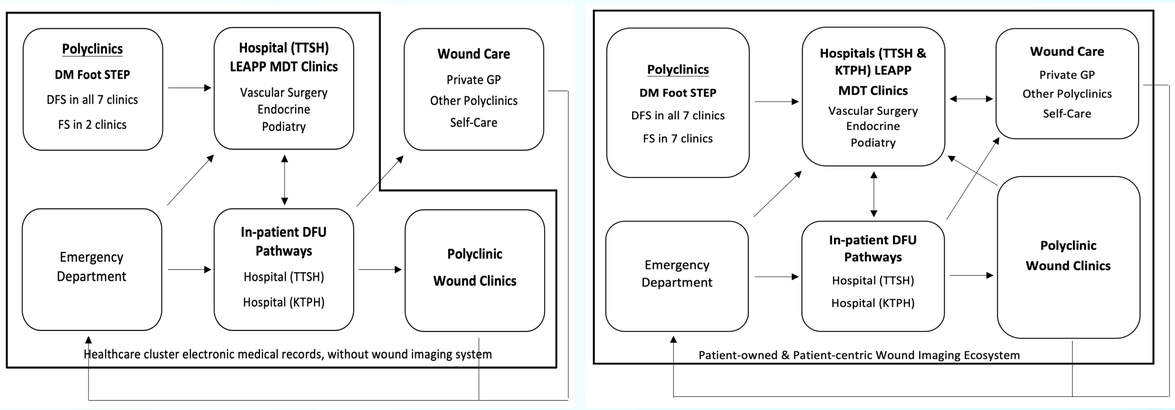
Evidence for a Problem Worth Solving

- 1 in 3 patients with diabetes are at risk of developing DFU [1] and Singapore has three times the OECD average of DM-related lower extremity amputations (LEA) [2]
- In Singapore, there is an estimated ~1,500 DM-related LEA each year (average of 4 per day) [3]
- This is associated with a heavy economic burden of disease, with estimated gross healthcare cost per patient for hospital care (inpatient and specialist outpatient) and primary care at USD $16,920 in 2017 [4]. For patients who present with DFU-only, eventual minor LEA and major LEA, their mean cost per patient-year was USD $3368, $10,468 and $30,131 respectively [5]

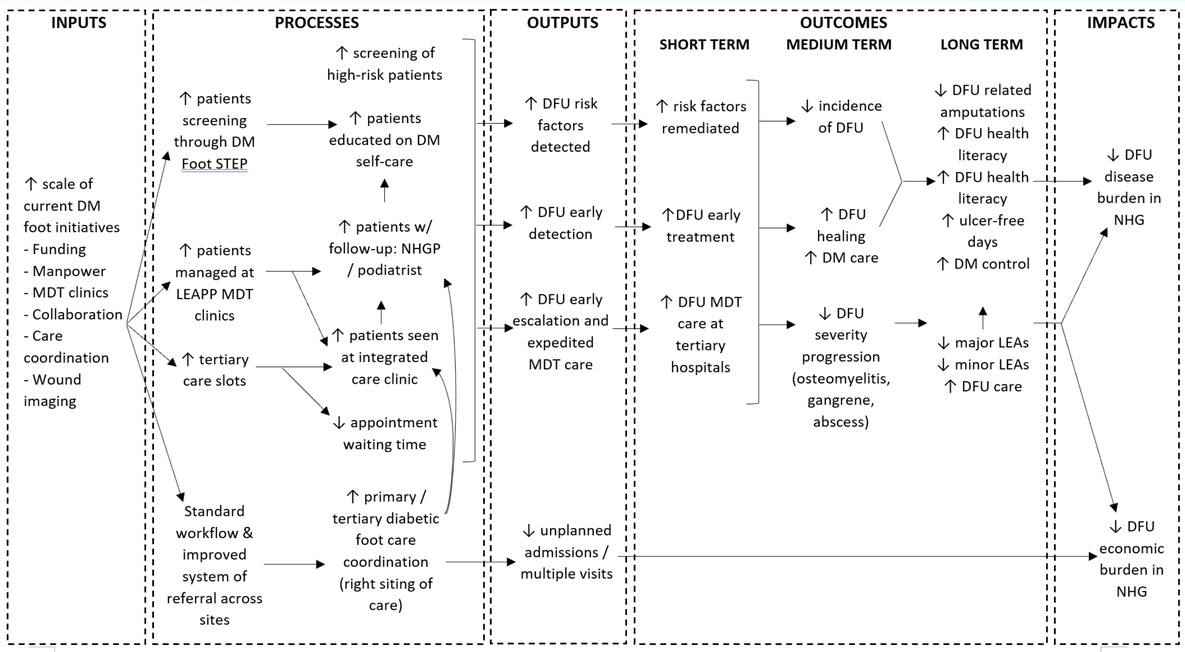
Current Performance of a Process

- Retrospective data from 2013-2017 showed a high clinical and economic burden of DFU, with incidence of minor amputation at 36.4% and major amputation at 6.5% [5]
- Within NHG, the Diabetic Foot Workgroup convened in 2017 identified health services deficiencies for DFU care, which included variability in diabetic foot screening (DFS) rates across different primary care polyclinics, lack of uniformity in provision of the rapid access MDT LEAPP clinic services for patients referred from primary care to tertiary care, high patient default rates, lack of a wound imaging system within our electronic medical records system and lack of coordination across primary and tertiary care with respect to co-managed patients post diabetic limb salvage procedures from the hospitals

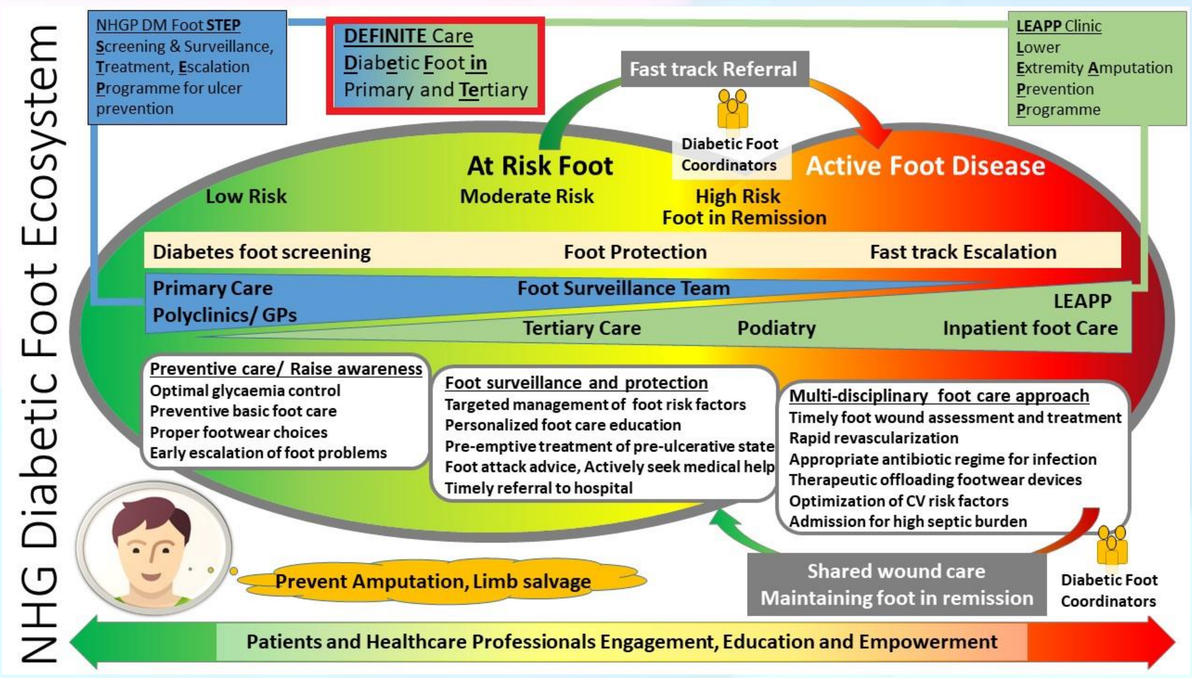
Flow Chart of Process (Before/After)



Programme Logic Model



Implementation Ecosystem



Results

Between June 2020 and December 2021, there were 3,475 unique patients with DFU with mean age at 65.9 (SD 12.9) years, 61.2% male, mean baseline HbA1c at 8.3% (SD 2.1) with mean diabetes duration at 13.3 (SD 8.8) years, mean diabetes complication severity index (DCSI) at 5.6 (SD 2.7) and mean Charlson Comorbidity Index (CCI) at 6.8 (SD 3.1).

Outcomes	DEFINITE Care (Jun 2020-Dec 2021) (n=3,475)	Retrospective (2013-2017) (n=1,729)	p value
Minor LEA, n (%)	**302 (8.7)**	**630 (36.4)**	0.0001
Major LEA, n (%)	**176 (5.1)**	**113 (6.5)**	0.0338
1-year mortality, n (%)	255 (9.1)	107 (6.2)	0.1326

Cardiovascular Profile (95% CI)	Pre-DEFINITE Care	Post-DEFINITE Care	p value
Mean HbA1c, % (n=2,083)	**8.4 (8.3-8.4)**	**7.9 (7.8-7.9)**	0.0001
Mean BMI, kg/m^2 (n=1,730)	27.0 (26.7-27.2)	27.0 (26.7-27.2)	0.3040
Mean LDL, mmol/L (n=1,243)	**2.2 (2.2-2.3)**	**2.1 (2.1-2.2)**	0.0001
Mean TC, mmol/L (n=1,134)	**4.1 (4.0-4.2)**	**3.9 (3.9-4.0)**	0.0001
Mean TG, mmol/L (n=1,134)	**1.7 (1.7-1.8)**	**1.6 (1.6-1.7)**	0.0016

Cost Savings

- A pilot case-cohort study in 2018 on the clinical and economic outcomes of a MDT approach in DFU management (LEAPP Clinic) demonstrated a significant decrease in mean time from referral to index clinic visit (38.6 to 9.5 days, p <0 .001), increase in outpatient podiatry follow-up (33% to 76%, p <0 .001), decrease in 1-year minor LEA rate (14% to 3%, p=0.007) and decrease in 1-year major LEA rate (9% to 3%, p=0.05) [6]
- Simulation of cost avoidance demonstrated an annualised cost avoidance of USD $1.86 million for patients within the LEAPP cohort and we expect direct healthcare costs savings within DEFINITE to be similar/higher

Problems Encountered

- High defaulter rates: the average defaulter rate from July 2020 to June 2021 for TTSH and KTPH is 17.3% and 14.2% respectively
- To improve patient-carer health literacy with engagement, education and empowerment
- To develop standardized patient education resources
- Manpower resource challenges: shortage of Podiatrists trained in DFU care ; hiring of suitable candidates for the role of Diabetic Foot Coordinator
- Continual engagement of clinical staff and senior management to ensure buy-in and program endorsement

Strategies to Sustain

- With more than 60 healthcare professionals across disciplines and institutions within DEFINITE Care team, we organise bi-monthly Clinical Review Meetings and quarterly Journal Clubs sessions to review our progress and share evidence-based practices and knowledge respectively
- In collaboration with HSOR and as part of the 3-year program, we will further perform sub-group analysis to enable targeted interventions for risk-stratified population and demonstrate the long-term financial sustainability through health economics analysis
- To foster stronger collaboration with primary care partners (e.g. CN-PCN team, community Nursing, GPs), community partners (e.g. Diabetes Society, NTUC Health, 7 Vision) and other National DM-related programmes (e.g. SiDRP, HALT-CKD, NPSC National DM Collaborative)
- The team will aim to eventually involve patient representatives (patients with healed DFU and patients with major amputation), for a more balanced and patient-centric team

References

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