Description and implementation of U-Turn Medical, a comprehensive lifestyle intervention programme for chronic disease in the sport and exercise medicine setting: pre–post observations in 210 consecutive patients

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ABSTRACT

Background Non-communicable disease (NCD) is increasing, but management remains mostly curative, disease-centred and focused on single interventions. We describe the development and implementation of a patient-centred, comprehensive, multidisciplinary lifestyle intervention programme (LIP) for patients with NCD in the sport and exercise medicine (SEM) setting (part 1) and present preliminary observational data (part 2).

Methods Part 1 is a description of the programme development and implementation. In part 2, 210 participants with NCD underwent a 12-week LIP (U-Turn Medical). Physiological, functional and metabolic outcomes were assessed at baseline and at completion.

Results 84% of patients had two or more comorbidities, requiring additional considerations for exercise rehabilitation. On completion, there were decreases in % body fat (29.8±6.7% vs 28.5±6.6%), waist (100.2±16.2 vs 97.3±14.8 cm) and hip circumference (105.4±13 vs 104±12 cm), resting heart rate (74.2±13.4 vs 71.4±11.9 bpm), resting systolic blood pressure (125.7±16.1 vs 120.1±13 mm Hg) and cholesterol (4.7±1.2 vs 4.3±0.9 mmol/L), low-density lipoprotein (3±0.9 vs 2.7±0.8 mmol/L) and triglyceride (1.4±0.7 vs 1.3±0.6 mmol/L), and increases in flexibility (12.1±11.6 vs 16.1±10.8 cm) and 6 min walk distance (559.4±156.6 vs 652.3±193.6 m; all $p<0.05$).

Conclusions A 12-week comprehensive, patient-centred LIP can be implemented successfully in the SEM setting in patients with NCDs with multiple comorbidities. Observed results show improvements in the majority of outcome variables.

INTRODUCTION

Around 80% of all non-communicable disease (NCD) deaths result from four groups of disease including cardiovascular disease (48%), cancer (21%), chronic respiratory disease (12%) and diabetes (3.5%).[1] The majority of these NCDs share four common lifestyle-related risk factors including tobacco use, physical inactivity, the harmful use of alcohol and unhealthy diet.[1] In addition, psychosocial stress is increasingly recognised as an important lifestyle-related risk factor.[2 3]

The current model for managing NCDs (curative rather than preventative) has been criticised as being costly and ineffective. Furthermore, current programmes are disease-centred and largely focus on single interventions.[1 4] Disease-centred, single or multiple lifestyle intervention programmes have been shown to be beneficial for individual disease states including cardiovascular disease,[1 5 6] chronic obstructive pulmonary disease,[2 3 7 8] diabetes,[9] chronic kidney disease[10] and low back pain.[11] However, there are high relapse rates,[8 12] and, perhaps more importantly, these programmes do not adequately cater to patients with multiple comorbidities. Yet the majority of patients presenting with a chronic disease have multiple associated comorbidities. For example, in South Africa, more than 50% of private medical insurance members have more than one chronic disease and some have up to 11 simultaneous chronic conditions.[13] Thus, new models of prevention are urgently required and should be included in the undergraduate medical curriculum.[14] This new model should be comprehensive, health-based, patient-centred and integrated for clinically effective and cost-effective prevention and management of chronic diseases.[15]

Programmes for patients with NCDs should be designed to manage established disease states and recognised risk factors, improve the patient's functional capacity while preventing injury and, most importantly, mitigate the risk of a serious medical event during exercise.

The skilled SEM physician is ideally placed to medically supervise comprehensive lifestyle management programmes in patients with active chronic disease, as he or she is (A) trained in the pathophysiology and pathology of the disease, (B) skilled in exercise prescription to facilitate improved functional capacity in disease states, (C) appreciative of the sometimes complex interaction of exercise intervention with prescribed pharmacological agents, (D) equipped to direct prevention and early management of musculoskeletal injury and (E) qualified to attend to medical emergencies, which could occur in exercising high-risk patients. However, few such programmes exist either in the broad 'general medical' setting or in an SEM setting.[16]

The aims of this two-part report are to (1) describe the development and implementation of a patient-centred, comprehensive, lifestyle intervention programme for patients with chronic disease in the SEM setting and (2) present the observed clinical results of this 12-week medically supervised lifestyle intervention programme for patients with NCD.

Part 1: Development and implementation of a patient-centred, comprehensive, lifestyle intervention programme for patients with chronic disease in the SEM setting

The U-Turn programme is a multidisciplinary, patient-centred, comprehensive, lifestyle intervention programme that was developed at the SEM Clinic within the Sports Science Institute of South Africa (SSISA). This programme was designed to provide optimal healthcare for patients with a range of established chronic diseases including cardiovascular disease, diabetes mellitus, chronic respiratory disease, cancer, fibromyalgia, chronic renal disorders, myopathies and joint degeneration. It is a medically (physician) supervised, comprehensive, patient-centred (individualised) 12-week lifestyle intervention programme followed by a further 12-week programme if indicated. The programme is open to all patients either by referral from the patient's treating physician, self-referral or referral from the patient's medical funder. The design and implementation follows a five-step process (figure 1) that is designed to provide comprehensive care for patients with NCDs.

Steps 1 and 2: Screening and medical assessment

Steps 1 and 2 consisted of an initial risk screening and a detailed medical assessment. Each patient was initially assessed by the SEM physician for an initial period of 1 h. Thereafter, a biokineticist (*Biokinetics is the South African profession concerned with preventive healthcare, the maintenance of physical abilities and final phase rehabilitation, by means of scientifically based physical activity programmes*) performed a functional and anthropometrical assessment as described. These tests lasted approximately another hour. The purpose of these two steps was to comprehensively evaluate the patient's current disease status, risk factors, risk stratification (to determine risk of medical event during exercise), risk of falling, and risk of exacerbation of chronic injury or development of an acute musculoskeletal injury. In addition, we screened and assessed the following factors: psychological markers of well-being or distress, social habits, nutritional factors, physical activity, sleep and recovery evaluation as well as knowledge of disease and lifestyle status. Functional testing included a 12-lead exercise stress test, musculoskeletal strength, flexibility and balance, as well as a 6 min walk test was conduced to determine baseline functional capacity used to guide individualised exercise prescription.

On a different occasion, there was a 30 min feedback session with the patient, during which time the results of the assessment were reviewed by the SEM physician; the physician and patient then set goals and decided on initial behaviour modifications.

Step 3: Intervention programme

An individualised comprehensive lifestyle intervention programme was constructed for each patient based on the outcome of the screening and medical assessment. Components of the intervention include individualised goal setting to optimise lifestyle-related risk factors including (1) regular medically supervised exercise sessions, (2) psychological well-being or distress, (3) counselling related to social habits, (4) individualised nutritional intervention, (5) counselling related to sleep and recovery and (6) individualised patient education (knowledge of disease and lifestyle status).

Implementation of the programme consists of a medically supervised exercise intervention as well as interventions to improve dietary factors, manage psychosocial stress, address unhealthy social habits and provide targeted health education. The programme incorporates different components in which patients acquire skills such as self-monitoring, goal setting and self-motivation that increase their physical activity levels and long-term adherence to ongoing changes.

Exercise intervention

The exercise prescription was tailored to the patient's initial functional capacity, profile of comorbidities, current ingested pharmacological agents and active disease status with the application of modifiers according to established clinical practice in SEM.[17 18]

The exercise component consisted of three individualised initial exercise sessions followed by 33 1 h group sessions at either 7:00 or 14:00 on a Monday, Wednesday and Friday. In the case of frail or elderly patients, individualised sessions were continued three times a week for 12 weeks. At least one biokineticist and an SEM physician supervised these classes. In the programme, we used a staff/patient ratio of 1:5 for high-risk patients and 1:10 for intermediate-risk patients. The individualised exercise prescriptions were based on their initial assessment of functional capacity, physical limitations and musculoskeletal injury profile, and included endurance fitness training using a combination of a walking track, pool, stationary bicycles, treadmills, elliptical machines, rowing machines (graded up to 30 min in a session), muscular strength and endurance training, flexibility training, core stability training and balance exercises. The exercise programmes progressed throughout the intervention, if the participant was ready. If a patient missed two consecutive sessions of the programme, he or she received a telephone follow-up.

Nutrition and psychosocial intervention

If indicated during the medical assessment, participants received dietary intervention through consultation with the dieticians within the Sport Science Institute of South Africa. In addition, all participants received ongoing dietary education as individual or group tutorials. Psychological support was also available throughout the programme for all participants, especially those at risk for anxiety, depression and psychosocial stress. Regular group mindfulness-based stress reduction and relaxation classes were held each week throughout the programme, during which participants were taught skills which they could apply throughout their daily lives.

Educational intervention

Patient education was in the form of group discussions and individual tutorials delivered to each participant during exercise sessions. The topics discussed were influenced by the disease profile of the participants and the knowledge deficiency noted during initial assessment. Topics included: introduction to lifestyle and disease, smoking habit and chronic respiratory disease, cardiovascular disease, cancer, diabetes mellitus, hypertension, dyslipidaemia, metabolic syndrome, obesity, arthritic conditions, low back pain, osteoporosis, depression, exercise training and monitoring, injury prevention strategies and stress management. All patients were strongly encouraged to participate in the education interventions.

Step 4: Patient monitoring

There was continuous patient monitoring during the 12-week intervention. Before starting each exercise session, all participants were briefly assessed as to their general well-being by the SEM physician. If indicated, special investigations (eg, glucometer checks) were performed. Participants who had contraindications to exercise on the day were not allowed to exercise. During

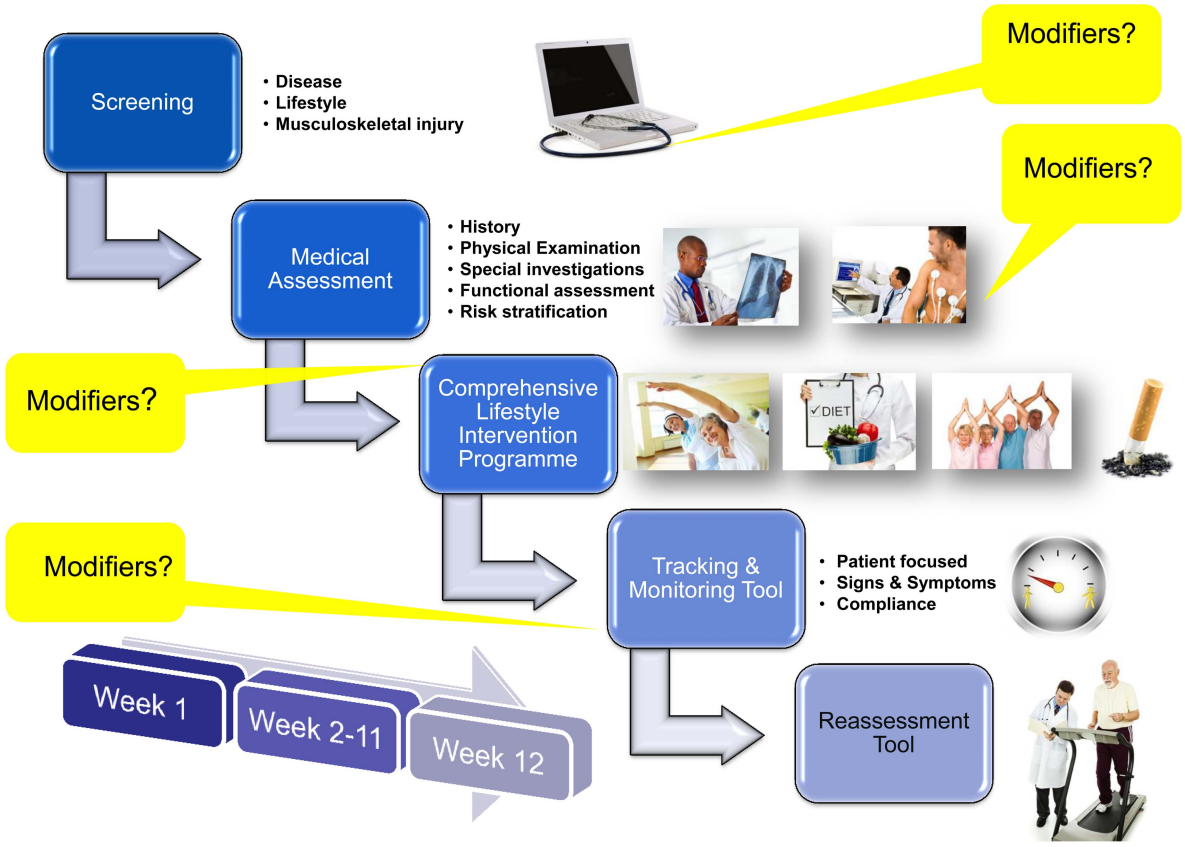

Figure 1 Five steps of the U-Turn Medical comprehensive assessment and lifestyle intervention programme.

exercise, each participant was provided with a heart rate (HR) monitor and chest strap to ensure adherence to the intensity component of the exercise prescription. Patients with arrhythmia were monitored, when necessary, using a portable ECG device.

Step 5: Reassessment

Following the 36-session exercise and lifestyle intervention programme, patients returned for a repeat detailed evaluation as outlined in steps 1 and 2. Comprehensive feedback was provided to the patient in a 30 min discharge interview. Referring practitioners received feedback in writing. Patients were then restratified according to their disease activity and risk of event during exercise (high, intermediate or low). Based on the outcome of the restratification, patients were advised as follows: (1) low-risk patients were discharged but advised to continue with their lifestyle intervention programme in the home setting with follow-up in 6–12 months; (2) intermediate-risk patients were discharged to a medically directed, group-based outpatient lifestyle intervention programme with follow-up in 3 months or (3) high-risk patients were advised to continue with a further 12-week medically supervised lifestyle intervention programme with follow-up in 3 months.

Part 2: Clinical observations in the 12-week medically supervised lifestyle intervention programme for patients with NCD

METHODS

Participants and study design

We report the pretest/post-test results among a cohort of participants who enrolled in the U-Turn programme at the SEM Clinic within the SSISA, Cape Town. Physiological, functional and metabolic data from 251 consecutive participants in the programme were audited and analysed. Participants were excluded from the programme if the medical assessment revealed contraindications to exercise. All participants signed informed consent prior to participation in the study.

Measurement of outcome variables

All outcome variables were assessed at baseline (T1) and on completion (T2) of the initial 12-week intervention.

Physiological variables

Resting HR and brachial blood pressure

Participants were seated for approximately 5 min before HR and blood pressure (BP) were measured. HR was measured using a HR monitor belt fitted to the chest and a wrist monitor (Polar Electro Oy, Finland). BP was measured using a Welch Allyn Flexiport sphygmomanometer (Welch Allyn, New York) and a Welch Allyn stethoscope (Welch Allyn, New York) as described by the American College of Sports Medicine (ACSM) guidelines.[17]

Weight, height and body mass index

Weight was measured using a TCS-A 300 kg platform scale (Clover Scales, Cape Town) and height using a Leicester 214 portable stadiometer (Lifemax, Johannesburg). Body mass index (BMI) was calculated using the formula: BMI=weight (kg)/height (m^2)

Body fat percentage

Skinfolds were measured at four sites (biceps, suprailiac, triceps and subscapular)[19] using a Harpenden Skinfold Dial Gauge Caliper (Lifemax, Johannesburg).

Waist-to-hip ratio

With participants standing erect, arms at the side, feet together and abdomen relaxed, a standard inelastic tape was used to measure the widest circumference of the buttocks (hip circumference) and the horizontal measurement at the narrowest part between the umbilicus and the xiphoid process (waist circumference). The waist-to-hip ratio was then calculated.

Functional variables

Sit and reach test

The sit and reach test was used to assess low back and hip joint flexibility.[20] Participants did some light warm up and stretching before the testing. A standard sit and reach box of 50 cm was used.[17] Participants sat without their shoes, feet flat against the box with legs straight. They were instructed to reach as far as possible with both hands held parallel while maintaining straight legs. The most distant point reached with the fingertips was then recorded. Three trials per participant were performed with the measurement from the best attempt recorded.

Six-minute walk test

The functional capacity, HR response and HR recovery were assessed in all participants at entry into the programme using a 6 min walk test. Patients were instructed to walk around a 140 m track for 6 min, covering as much distance as possible. The total distance covered was recorded on completion. HR was recorded at the end of every lap and at termination of the test. The HR recovery at 1 min post-test was recorded.

Metabolic variables

Results for blood or plasma concentrations of fasting total cholesterol, high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol, triglycerides and glucose were obtained from the participants' referring physicians and analysed for this study. The tests were all conducted in accredited private laboratories.

Statistical analysis

The Biostatistics Unit of the Medical Research Council of South Africa (MRC) conducted the statistical analysis for this study. The data were analysed using R, an open source statistical programming language (R Development Core Team). Paired t tests comparing the difference in outcome measurements between T2 and T1 were conducted to determine whether the programme had an effect on each outcome measure. The missing data were dealt with using list deletion.

RESULTS

While 251 participants were initially included in the study, 35 (13.9%) did not complete the programme (withdrawal) and 6 (2.4%) completed the programme but did not complete postintervention testing (incomplete T2 data), and were excluded from analysis. Reasons for withdrawal included a re-event of illness, financial constraints and/or difficulty getting to the classes. Data were deemed to be missing if the patient completed the 12-week programme and evaluations but some data points at T1 or T2 were not collected or were not available. Patients were deemed to have completed the programme if they had successfully completed the 32 sessions of the 12-week programme. Therefore, data on a subset of outcome variables were available for analysis from 210 patients (83.7% of the cohort) who successfully completed the programme.

Participant characteristics and comorbidities

The mean age of participants was 58±12 years of age, and 79% were men. The primary presenting medical complaint of this cohort is shown in table 1. The majority of patients (88%) had the primary diagnosis of cardiovascular disease, while 12% of patients were referred to the programme with a primary diagnosis of metabolic disease, respiratory disease, neurological disease, rheumatological disease or cancer. The number of patients with between zero and seven comorbidities is shown in table 2. Notably, 84% of patients had two or more comorbidities that required additional considerations for exercise rehabilitation and only four patients (2%) in the entire cohort had no other existing comorbidity. Of the risk factors for cardiovascular disease, 56% of participants had existing hypertension, 68% had hypercholesterolaemia and 27% had diabetes. Furthermore, 62% had a family history of cardiovascular disease, 59% were overweight, 69% were sedentary and 16% smoked.

The effects of the 12-week intervention on measured variables

The effects of the intervention programme on the physiological, functional and metabolic variables measured at entry to the programme (T1) and after 12 weeks (T2) are shown in table 3.

Physiological variables including percentage body fat, sum of skinfolds ($p<0.0001$) and waist ($p<0.0001$) and hip circumference decreased ($p<0.01$) from T1 to T2, while there were no significant changes in weight, BMI or waist-to-hip ratio.

From T1 to T2, functional variables including resting HR, resting systolic and diastolic BP decreased ($p<0.0001$), and flexibility, 6 min walk test distance and maximum HR increased ($p<0.0001$). There were no significant changes in recovery HR at 1 min.

Finally, metabolic variables including total cholesterol ($p=0.0003$), LDL ($p<0.0001$) and triglyceride ($p=0.0116$) concentrations decreased from T1 to T2, while there were no significant changes in HDL and fasting glucose concentrations.

DISCUSSION

We describe the development and implementation of a patient-centred, comprehensive lifestyle intervention programme in the clinical SEM multidisciplinary setting (U-Turn Medical). While many single-disease (disease-centred) programmes have been described and evaluated,[21–24] this programme is, to the best of our knowledge, unique because it (1) has been developed and implemented in the SEM setting using the unique skill set of the SEM physicians, (2) is a patient-centred chronic disease programme, (3) is aimed at patients with active disease status and multiple comorbidities, (4) provides the patient with comprehensive lifestyle interventions (exercise, psychosocial intervention, nutritional intervention, social habit counselling) and (5)

Table 1 Primary presenting conditions of the 210 patients

Presenting condition	Number of patients
Cardiovascular disease	185
Metabolic disease	7
Rheumatological disease	5
Pulmonary disease	5
Neurological disease	4
Cancer	2
Other	2

Table 2 Comorbid conditions in the 210 patients—number and frequency (%)

Number of comorbidities	Number of patients in the cohort	Percentage of patients in the cohort
0	4	2
1	34	16
2	56	27
3	44	21
4	41	20
5	20	10
6	7	3
7	4	2

included a risk of musculoskeletal injury screening and intervention programme. We are only aware of similar programmes that have been described for patients with risk factors for cardiac and other diseases (hypertension, hypercholesterolaemia and metabolic syndrome), but these programmes did not cater to patients with active cardiac and other diseases,[25] and did not include any other elements (1, 2 and 5) listed above.

A very important finding of this study was the extent and thus complexity of the patients' comorbidities. In our study, 83% of patients had more than two comorbidities that required additional exercise rehabilitation and other lifestyle intervention considerations.[13] This finding is in keeping with data from other studies and elucidates why such lifestyle intervention programmes should be patient-centred and presented by a multidisciplinary team.

Table 3 The physiological, functional and metabolic variables on entry (T1) and at completion (T2) of the 12-week programme in 210 patients

Variables	n	T1	T2	p Value
Physiological				
Weight (kg)	206	87.3±19.8	87.3±19.2	0.9600
BMI (kg/m^2)	207	29.7±6.3	29.7±6.0	0.5902
Percentage body fat (%)	195	29.8±6.7	28.5±6.6	<0.0001
Sum of skinfolds (mm)	195	73.9±31.1	66.5±27.2	<0.0001
Waist (cm)	203	100.2±16.2	97.3±14.8	<0.0001
Hip (cm)	202	105.4±13.0	104.0±12	<0.0001
Waist-to-hip ratio	202	0.9±0.1	0.9±0.1	ns
Functional				
Resting HR (bpm)	202	74.2±13.4	71.4±11.9	<0.0001
Resting BP: systolic (mm Hg)	204	125.7±16.1	120.1±13.0	<0.0001
Resting BP: diastolic (mm Hg)	204	77.5±9.8	72.5±8.9	<0.0001
Flexibility (cm)	167	12.1±11.6	16.1±10.8	<0.0001
6 minute walk distance (m)	193	559.4±156.6	652.3±193.6	<0.0001
Maximum HR (bpm)	175	118.7±20.8	125.9±20.8	<0.0001
Recovery HR 1 min (bpm)	138	93.3±16.4	95.7±1.5	0.0786
Metabolic				
Total cholesterol concentration (mmol/L)	77	4.7±1.2	4.3±(0.9)	0.0003
HDL concentration (mmol/L)	77	1.1±0.6	1.1±0.4	0.6154
LDL concentration (mmol/L)	76	3.0±0.9	2.7±0.8	<0.0001
Triglyceride concentration (mmol/L)	74	1.4±0.7	1.3±0.6	0.0116
Fasting glucose concentration (mmol/L)	43	6.4±1.8	6.3±1.8	0.8444

BP, blood pressure; HDL, high-density lipoprotein; HR, heart rate; LDL, low-density lipoprotein; n, number of participants; ns, not significant.

The second main aim of this study was to determine the efficacy of this comprehensive lifestyle intervention over a short intervention period (12 weeks). The main finding from this pilot study was that improvements in the majority of the physiological, functional and metabolic outcome variables were evident in patients with a range of chronic diseases who participated in the 12-week comprehensive lifestyle intervention programme.

A reduction in body fat, waist and hip circumference was measured in the participants following participation in the programme. A similar programme run in the USA, the 'Lifestyle 180 programme', reported similar improvements in waist and hip circumference, however, body fat was not measured.[25] In contrast to our results, they also reported improvements in body weight and BMI.[25] The most likely explanation for this difference is that the duration of the 'Lifestyle 180' programme was 30 weeks, while the U-Turn programme was only 12 weeks long. The decrease in waist circumference reflects a decrease in abdominal obesity. This is of clinical importance, as abdominal obesity has been associated with type II diabetes mellitus.[26] There was, however, no change in the waist-to-hip ratio. This most likely occurred as a result of a decrease in waist and hip circumferences.

An important risk factor for cardiovascular disease is hypertension.[27 28] The physical conditioning achieved by regular exercise decreases HR and BP at rest[29 30] and reduces workload on the heart, helping to alleviate cardiovascular disease-related symptoms including angina.[29 30] The U-Turn programme led to improvements in a number of important functional measures including resting HR, resting systolic and diastolic BP and maximum HR. These findings are similar to other studies, which have demonstrated improvements in resting HR and BP after 8[31] and 30 weeks of an exercise intervention.[32] It is important to note that while the participants in our study were either not clinically hypertensive or were well controlled on medication at onset, there was still an improvement in the cardiovascular parameters measured.

Distance walked during the 6 min walk improved by 102 m or 19% test over the course of the programme. This test is commonly used in clinical settings and chronic disease rehabilitation programmes to measure the impact of multiple comorbidities on exercise capacity and endurance[33] and is a reliable measurement of functional capacity in patients with chronic disease.[34] An improvement of more than 70 m or 12% is clinically significant[33 35] and increases day-to-day functional capacity and reduces morbidity. The U-Turn programme resulted in an average improvement of 19%. Similar improvements in the 6 min walk test have been demonstrated in patients with heart failure after 12 weeks of exercise.[36]

The intervention also led to a 33% improvement in flexibility of the hamstrings and lower back. This improvement is clinically important, as increasing flexibility in these muscles decreases the likelihood of developing lower back injury and pain.[37 38] No other studies, to the best our knowledge, have reported flexibility changes over the course of a similar lifestyle programme.

Metabolic outcome measures also improved, with a reduction in total cholesterol, LDL and triglyceride concentrations from entry to completion. This occurred although over 70% of participants were using cholesterol-lowering medication and the lipid profiles of the majority of participants were well controlled at the start of the programme. The reduction in total cholesterol, LDL and triglycerides observed is consistent with the Lifestyle

180 study despite the shorter duration of the U-Turn programme.[25] However, Lifestyle 180 reports an increase in HDL, which was not observed in our study.[25] Another similar programme conducted over 6 months demonstrated a reduction in the total cholesterol/HDL ratio; however, the authors did not report individual total cholesterol, LDL or HDL results.[39]

There was no change in fasting glucose concentrations, in contrast to the Lifestyle 180 study which showed a decrease in fasting glucose.[25] Indeed, the mean fasting glucose concentrations in the patients in this study indicate that control could be improved. These discrepant results could be caused by the relative short duration of the U-Turn intervention or the fact that relatively more patients with diabetes or metabolic syndrome were included in the 'Lifestyle 180' study. Furthermore, weight loss has been associated with improved insulin function and glucose control; therefore, the absence of weight loss in the present study might have contributed to the lack of change in glucose concentration.

These data, together with other similar studies, suggest that a multicomponent lifestyle approach is a very effective intervention for reducing the risk factors for chronic disease.[25 40] Our study is however unique in that the beneficial effects were observed in a relatively short time period (12 weeks); the U-Turn programme is medically supervised and it is multidisciplinary in nature.

We are aware of a number of important limitations. First, for the second part of this study, a randomised controlled trial would have provided a stronger study design and eliminated any potential selection bias than the pretest/post-test design in this observation study that we present in this report. It should be noted that as lifestyle intervention is the first-line therapy for patients with chronic disease, there is an ethical dilemma in withholding this form of advice or intervention from patients with chronic disease.[41]

A second limitation is that the programme was restricted to one centre, which could have resulted in selection bias. This prototype programme is currently being incorporated into a novel electronic web-based platform that encompasses an automated patient screening process, electronic patient record and standardised assessment and monitoring protocols to facilitate application of standards and facilitate research in multiple centres. Output from the online screening and clinical assessment will allow for the provision of individual-targeted educational programmes and the creation of comprehensive offering of online interventions and programming to be administered and medically supervised. Our programme is currently being introduced on a larger scale nationally, and this will reduce the geographical selection bias in future studies.

We note that a longer observation period would have provided a better opportunity to examine even greater physiological changes or provided an opportunity for patients to convert to previous behaviour and perhaps lose the benefit we report. A 3–6-month observation period is suggested for future studies of this programme. Another limitation of this observational study is that missing data have been dealt with by list deletion, which could affect the validity of the results. Future analysis incorporating a larger sample of patients will assess the missing data patterns and mechanisms and will acquire the most relevant statistical method.

CONCLUSION

In conclusion, we describe a 12-week patient-centred comprehensive lifestyle intervention programme, and we show that it can be applied in a multidisciplinary SEM setting. We showed that the majority of patients entering a chronic disease prevention programme suffer from multiple (>2) comorbidities (84% of patients), and therefore require a patient-centred rather than a disease-centred approach to management. We report that a cohort of patients with a range of chronic diseases and comorbidities who participated in this pilot programme showed a reduction in risk factors as well as improved functional capacity. These results suggest that there is a possible association between an integrated, comprehensive, lifestyle intervention programme in the SEM setting that combines exercise, nutritional, psychosocial and educational interventions, and the observed positive short-term health outcomes.

What are the new findings?

- We describe a novel multidisciplinary, patient-centered, comprehensive, lifestyle intervention programme developed and implemented in the sport and exercise medicine setting.
- In total, 83% of patients had more than two comorbidities that required additional exercise rehabilitation and other lifestyle intervention considerations.
- Results suggest improvements in the majority of the physiological, functional and metabolic outcome variables.

How might it impact clinical practice?

- Clinicians should be aware of the high prevalence of multiple comorbidities in their patients with non-communicable disease.
- Clinicians can implement similar programmes in their own practice of sport and exercise medicine.

Contributors WD, as guarantor, was responsible for the overall content, study concept, study planning, data collection, data interpretation, manuscript (first draft), manuscript editing and facilitating funding. MS was involved in study concept, study planning, data collection, data interpretation and manuscript editing. FH was involved in data collection, data analysis, data interpretation and manuscript editing. EJ and TP were involved in data analysis including statistical analysis, data interpretation and manuscript editing.

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Competing interests WD and MS are clinical programme directors of U-Turn. They are in the process of developing electronic platforms for programme delivery that may develop into commercial interests.

Ethics approval The study protocol was approved by the Research and Ethics Committee of the University of Cape Town (Rec ref: 296/2005) in accordance with the Declaration of Helsinki.

Provenance and peer review Not commissioned; externally peer reviewed.

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