Working Group

Leung Yat Sze Annie
RN, CDE, BSN, MSc, FHKAN (Medicine-Diabetes)

Ng Chi Wah Fanny
RN, BSN, MSN, DDME, FHKAN (Medicine-Diabetes)

Sin Wai Man Celia
RN, BSc (Hons)N, MSc, DDME, FHKAN (Medicine-Diabetes)

Wong Suk Chi
RN, BSN, MSc, FHKAN (Medicine-Diabetes)

Cheng Hop Chun
RN, BSN

Project Advisor

Prof. Winnie KW So
PhD, RN, FAAN

Proof Reader

Dr. Grace PC Hui
MRCP, FHKCP, FHKAM (Med)
MSc (Sports Medicine and Health Science)

Artwork

Cheung Lok Ping
RN, BSN



Physical Activity/Exercise and Diabetes

A Guide for DM Nurses



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香港糖尿科護士協會有限公司
Association of Hong Kong Diabetes Nurses Limited

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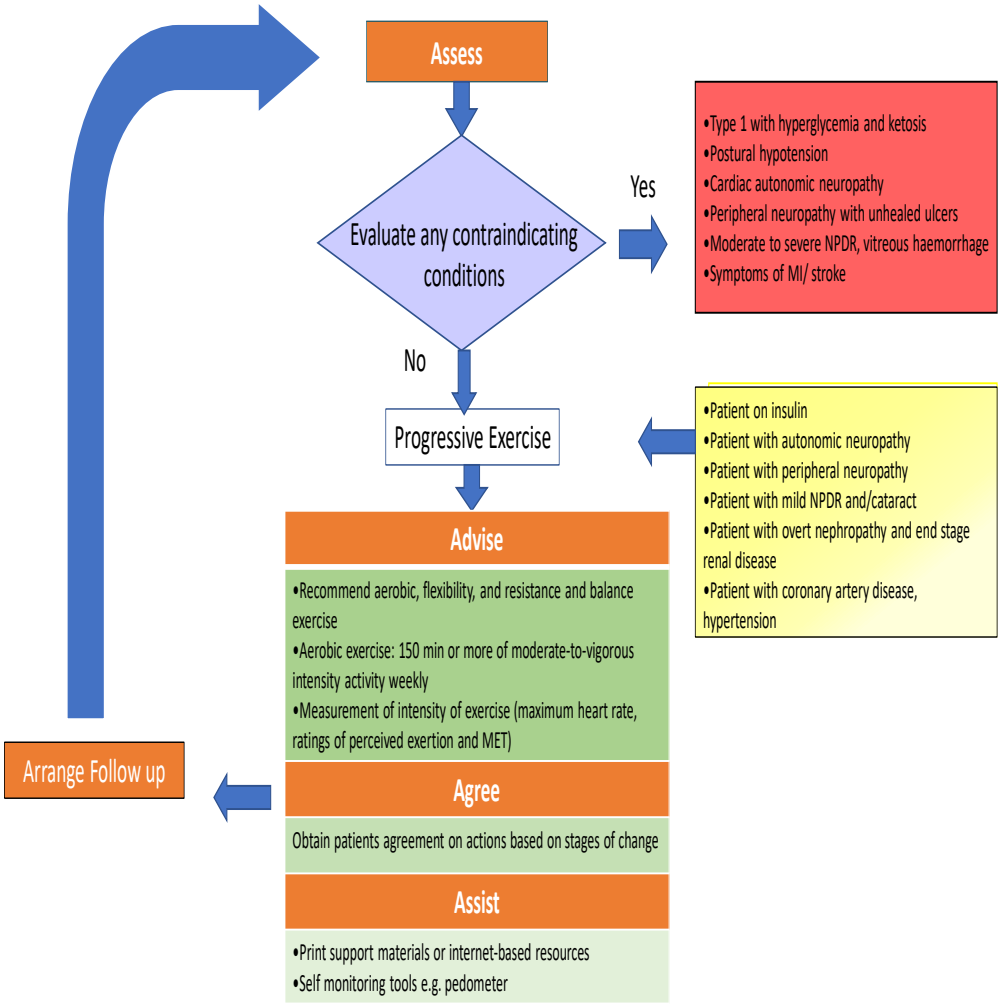
About this Guide

For achieving people with diabetes to improve overall health outcome, the ultimate low-cost therapy is to incorporate regular physical activity (PA)/ exercise into their lifestyle. Exercise that works toward improving or maintaining glycemic targets, achieving weight management goals, and improving cardiovascular risk factor within individualized treatment goals is recommended for all adults with diabetes.

This guide is written for diabetes nurses who may come cross diabetes patients in order to improve their knowledge, attitude, and practice regarding exercise. It also provides diabetes nurse with evidence-based guidance and promotion of exercise for adults with diabetes. Strong evidence supports the efficacy and cost-effectiveness of performing exercise as a component of quality diabetes care, including its integration into the medical management of diabetes. Your encouragement may be the greatest influence on their decision.



Workflow for promoting Physical Activities/Exercise



APPENDIX 2

Guidelines for data processing and analysis of the IPAQ:https://sites.google.com/site/theipaq/scoring-protocol

IPAQ Scoring Protocol (Short Versions) At A Glance

Categorical Score- three levels of physical activity are proposed

1. Inactive

✧ No activity is reported **OR**

✧ Some activity is reported but not enough to meet Categories 2 or 3.

2. Minimally Active

Any one of the following 3 criteria

✧ 3 or more days of vigorous activity of at least 20 minutes per day **OR**

✧ 5 or more days of moderate-intensity activity or walking of at least 30 minutes per day **OR**

✧ 5 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 600 MET-min/week.

3. HEPA active

Any one of the following 2 criteria

✧ Vigorous-intensity activity on at least 3 days and accumulating at least 1500 METminutes/week **OR**

✧ 7 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 3000 MET-minutes/week

Continuous Score

Expressed as MET-min per week: MET level x minutes of activity x events per week

Sample Calculation

MET levels MET-min/week for 30 min episodes, 5 times/week

Walking = 3.3 METs 3.3 x 30 x 5 = 495 MET-min/week

Moderate Intensity = 4.0 METs 4.0 x 30 x 5 = 600 MET-min/week

Vigorous Intensity = 8.0 METs 8.0 x 30 x 5 = 1,200 MET-min/week

TOTAL = 2,295 MET-min/week

Total MET-min/week = (Walk METs*min*days) + (Mod METs*min*days) + Vig METs*min*days)

Assist

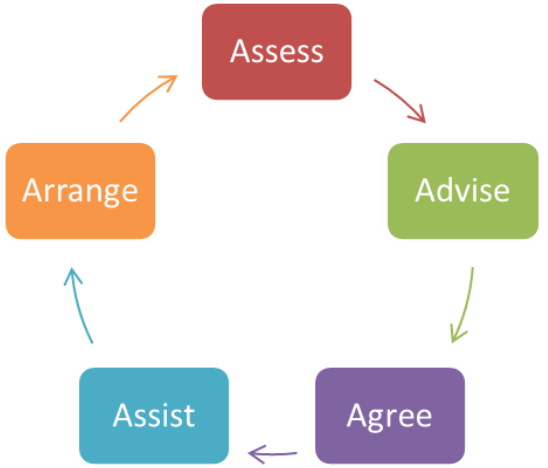




Arrange

- arrange a follow-up visit to help the patient stay motivated and to evaluate their progress

The Five A's Behavior Change Model [11, 25]



Assess	• Assessment Tool: International Physical Activity Questionnaire (IPAQ short version for years old) (Appendix 1) • Guidelines for IPAQ data processing and analysis
Advise	• Recommendation for physical activity
Agree	Pre-contemplation (not ready) → Contemplation (Unsure) → Preparation (ready) → Action → Maintenance
Assist	• Printed support materials or internet-based resources • Self-monitoring tools e.g. pedometer
Arrange	• Schedule a follow-up visit, provide phone or email contact • Refer additional assistance, e.g. physiotherapy • Community-based programs

Assess

Appendix 1

國際身體活動問卷

最近 7 天身體活動自我填答短問卷版

我們對找尋人們在他們日常生活中多種的身體活動有興趣，這個問卷會問你在最近 7 天花在身體活動的時間，請回答每一個問題，甚至如果你想自己是一個沒有活動的人，請想一想你在工作時的活動、像是你在家裡或園藝的部份、從一個地方到一個地方及在你空閒的時間運動或娛樂。

想一想在最近 7 天裡你做過所有**強而有力的活動**，強而有力的身體活動是指以費力的身體負荷且讓你呼吸較正常更為急促的活動，僅回想你所做過每次至少 10 分鐘的那些身體活動。

1. 最近 7 天裡，你花多少天做強而有力的身體活動，像是提重物、苦力、有氧運動或快騎腳踏車？
   _____ 每週幾天
   ☐ 沒有強而有力的身體活動 ➔ 跳到問題 3
2. 在參與強而有力身體活動的那些天，你通常花多少時間做強而有力的身體活動？
   _____ 每天幾個小時
   _____ 每天幾分鐘
   ☐ 不知道/不確定

想一想最近 7 天你做過所有**適度的活動**，適度的活動是指以適度的身體負荷並且讓你呼吸比正常費力一些的活動。

3. 最近 7 天裡，你花多少時間做適度的身體活動，像是提輕的物品、正常的速度騎腳踏車或網球雙打？不包含走路。
   _____ 每週幾天
   ☐ 沒有適度的身體活動 ➔跳到問題 5
4. 在參與適度身體活動的那些天，通常你花多少時間做適度的身體活動？
   _____ 每天幾小時
   _____ 每天幾分鐘
   ☐ 不知道/不確定

想一想最近 7 天你花多少時間在**走路**，包含工作、在家、從某地到某地、娛樂、遊戲或休閒時的走路。

5. 最近 7 天裡，你花多少天走每次至少 10 分鐘的路？
   _____ 每週幾天
   ☐沒有走路➔跳到問題 7



6. 在走路的那些天，你通常花多少時間在走路？
   _____ 每天幾小時
   _____ 每天幾分鐘
   ☐ 不知道/不確定

7. 最後的問題是在最近連續 7 個非假日時間（扣除週六與週日）你花多少時間在坐著，包含花在工作、家裡、做作業及休閒時的坐著，這或許可以包含花在書桌、拜訪朋友、讀書或看電視的躺著或坐著。
   _____ 每天幾小時
   _____ 每天幾分鐘

☐ 不知道/不確定

Consideration	Precautions
Initially to consider exercising in a supervised cardiac rehabilitation program	
● HR should be kept ≥10 bpm below onset of exercise-related angina[7] ● Onset of chest pain on exertion, but exercise induced ischemia may be silent in some with diabetes	
● Some BP medications (such as ß-blockers and rate-slowing calcium channel blockers) can cause an abrupt drop in BP after exercise, and incorporating a cool-down routine is important[9] ● Ensure adequate hydration	Avoid Valsalva maneuver during resistance training[14] because it can cause BP fluctuations and in some cases, arrhythmias[28]
● Start at a low intensity and progress as able to more moderate activities ● Restart exercise after MI in a supervised cardiac rehabilitation program[7]	Stop exercise immediately should symptoms of MI (such as chest pain, radiating pain, SOB, and others) occur during physical activity and seek medical attention[7]
● Start at a low intensity and progress as able to more moderate activities ● Restart exercise after stroke in a supervised cardiac rehabilitation program	Stop exercise immediately if symptoms of a stroke (occurring suddenly and often affecting only one side of the body) happen during exercise
Focus more on doing low-or moderate-intensity activities	Avoid activities that cause an excessive rise in heart rate[7]
Low-or moderate intensity walking, arm ergometer, and leg ergometer preferred as aerobic activities[26-27]	

Special precautions and contraindications

Cardiovascular	Recommend
Coronary artery disease	● All activities okay ● Coronary perfusion may actually be enhanced during higher-intensity aerobic or resistance exercise[7]
Exertional angina	All activities okay
Hypertension	● Both aerobic and resistance training may lower resting BP[7] ● Several RCTs had shown reduction in systolic BP (4-8 mmHg)[16]
Myocardial Infarction	Both aerobic and resistance exercise are okay
Stroke	Both aerobic and resistance exercise are okay
Congestive heart failure	
Peripheral artery disease	Lower-extremity resistance training improves functional performance[23]

Types of Activity

Advise

Recommended Physical Activity participation for persons with type 2 diabetes

	Aerobic	Resistance	Flexibility and balance
Exercise	150 min or more of moderate-to-vigorous intensity activity weekly, spread over at least 3 days/week, with no more than 2 consecutive days without activity. Shorter durations (minimum 75 min/week) of vigorous-intensity or interval training may be sufficient for younger and more physically fit individuals.	2–3 sessions/week of resistance exercise on nonconsecutive days.	2–3 times/week for older adults with diabetes. Yoga and tai chi may be included based on individual preferences to increase flexibility, muscular strength, and balance.
Level of evidence	Category B	Category B	Category C

Adults with type 2 diabetes, interrupting prolonged sitting with 15 min of postmeal walking and with 3 min of light walking and simple body-weight resistance activities every 30 min improves glycemic control[30] (ADA, 2016)

How to measure intensity of exercise?

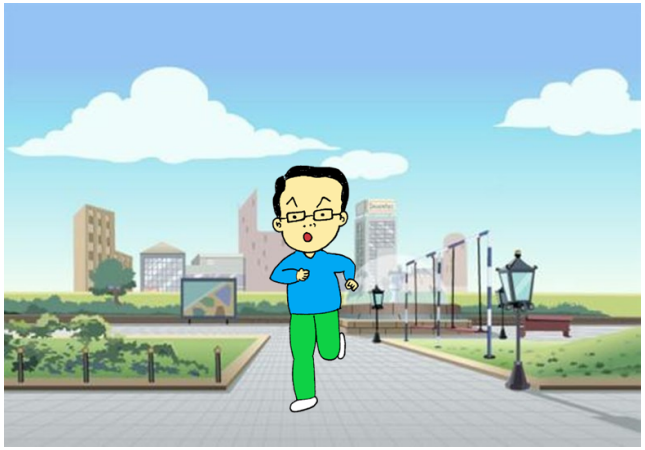
Maximum Heart Rate[20]

Moderate-intensity physical activity: target heart rate = 65 to 75% of his or her maximum heart rate (220 – person's age)

Vigorous -intensity physical activity: target heart rate = 76 to 95% of his or her maximum heart rate (220 – person's age)

Example

找出目標心率區域 (通用於一般成年人) 計算目標心率區域的公式：	Find out Your Target Heart Rate Zone (Applicable to General Adults) Formula for Finding out Your Target Heart Rate Zone:
(220 - 年齡 /age) x 60% ～ (220 - 年齡 /age) x 90% (220 - 20) x 60% ～ (220 - 20) x 90% 心率：120 ～ 180 bpm	
例如：20 歲跑步者的 目標心率區域是 120 至 180 次	For example: The Target Heart Rate Zone of a 20-year-old runner during exercise should be 120 to 180 beats per minute (bpm)



Consideration	Precautions
Annual eye exam should be performed to monitor progression[7]	
	● Avoid activities dramatically elevate BP, such as vigorous activity of any type[26] ● Avoid vigorous exercise; jumping, jarring, and head-down activities; and breath holding[6,17]
	No exercise should be undertaken during a vitreous haemorrhage[7]
● Consider supervision for certain activities ● Activities that are more dangerous due to limited vision, such as outdoor cycling	

Consideration	Precautions
● Begin at a low intensity and volume if aerobic capacity and muscle function are substantially reduced[26]	High intensity or strenuous physical activity is best avoided[26]
● Doing supervised, light to moderate aerobic physical activity undertaken during dialysis (HD) sessions may be beneficial and increase compliance[17,18] ● Electrolytes should be monitored when activity done during dialysis sessions	

Special precautions and contraindications

Eye Disease	Recommend
Mild nonproliferative retinopathy (NPDR)	All activities okay[26]
Moderate to severe NPDR	
Unstable proliferative retinopathy	
Cataract	Do not impact the ability

Kidney Disease	Recommend
Microalbuminuria	● All activities okay[26]. ● Do not accelerate progression of kidney disease even though protein excretion acutely increases afterward[2,6] ● Greater participation in moderate-to-vigorous leisure activity and higher PA levels may actually moderate the initiation and progression of diabetic nephropathy[22,30,32]
Overt nephropathy	All activities okay
End-stage renal disease	

Aerobic Exercise

● Ratings of perceived exertion[5]

Based on the subjective physical sensations a person experiences during physical activity, including

- increased heart rate
- increased respiration or breathing rate
- increased sweating
- muscle fatigue

RPE	Exertion Felt
6	No exertion at all
7	Extremely light
8	
9	Very light (easy walking slowly at a comfortable pace)
10	
11	Light
12	
13	Somewhat hard (It is quite an effort; you feel tired but can continue)
14	
15	Hard (heavy)
16	
17	Very hard (very strenuous, and you are very fatigued)
18	
19	Extremely hard (You cannot continue for long at this pace)
20	Maximal exertion

**moderate-intensity activity in Borg Scale level: 12-14

Aerobic Exercise

Metabolic equivalents (MET)

- Expressed as absolute expenditure of energy for a given activity
- 1 MET is the rate of energy expenditure while sitting at rest (by convention: oxygen uptake of 3.5 mL/kg/min)
- Recommendation by the joint America College of Sports Medicine and American Heart Association exercise[13]
  - <3 METs: Light
  - 3-6 METs: Moderate
  - >6 METs: Vigorous

Examples of Moderate Intensive Exercise (Spot)[22]

Practising Tai Chi for 40 minutes	3.5-4.0 METs
Playing table tennis for 40 minutes	3.5-4.0 METs
Going on an excursion for 25 minutes	5.5-6.5 METs
Swimming for 25 minutes	5.5-6.5METs
Low impact aerobics for 30 minutes	4.5-5.5METs
Contemporary dance, jazz dance or hip-hop dance for 30 minutes	4.5-5.5 METs
Fitness (multi-gym) for 50 minutes (weight training for main muscle groups with light to medium weights)	2.5-3.5 METs
Practising yoga for 60 minutes	2.0-3.0 METs
Social dance for 30 minutes (fast tempo)	4.5-5.5 METs
Latin dance for 30 minutes	4.5-5.5 METs
Cycling for 30 minutes (finish 8 km)	4.5-5.5METs
Walking for 30 minutes (finish 3.2 km)	4.5-5.5METs
Playing in a volleyball match for 45 minutes	3.0-3.5METs
Playing in a football match for 45 minutes	3.0-3.5 METs
Practising golf swings for 50 minutes	4.5-5.5 METs

Consideration	Precautions
● May cause postural hypotension, chronotropic incompetence, delayed gastric emptying, altered thermoregulation, and dehydration[6] ● Exercise-related hypoglycemia may be harder to treat in those with gastroparesis	**Postural hypotension**: activities with rapid postural or directional changes to avoid fainting or falling[7] **Cardiac autonomic neuropathy**: obtain physician approval and possibly undergo symptom-limited exercise testing[6] before commencing exercise[8] **Autonomic neuropathy**: hot environment and hydrate well[7]
● Proper care of the feet and use appropriate footwear to prevent foot ulcers and lower the risk of amputation[6] ● Consider inclusion of more non-weight bearing activities[17], particularly if gait altered and with an open ulcer and flexibility, balance training e.g. yoga & tai chi[7]	Weight-bearing activity with unhealed ulcers[7]

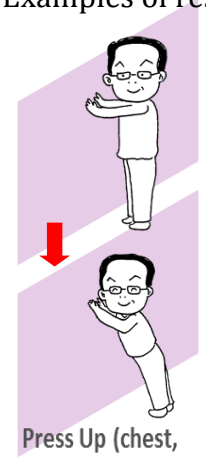
Special precautions and contraindications

Nerve Disease	Recommend
Autonomic neuropathy	
Peripheral neuropathy	● Exercise is a feasible, safe, and promising supportive measure for neuropathic patients. Endurance training has the potential to prevent the onset of and reduce the progression of diabetic peripheral neuropathy. Balance exercises were shown to have the highest effect on the motor as well as sensory symptoms, in all types of peripheral neuropathy[31] ● Regular aerobic exercise may prevent the onset or delay the progress of peripheral neuropathy in both type 1 & 2 diabetes[4] ● Individuals with peripheral neuropathy and without ulcer may participate in moderate weight-bearing exercise[29] ● Moderate walking is not likely to increase risk of foot ulcers or reulceration[21]

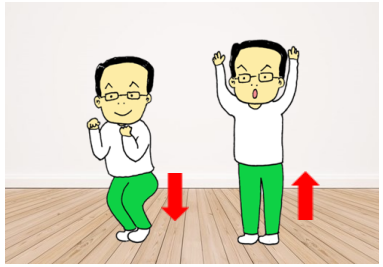
Resistance Exercise

Frequency	At least twice weekly
Intensity	Moderate (50% of 1-repetition maximum [1-RM]) or Vigorous (75-80% of 1-RM)
Duration	Include 5-10 exercises involving major muscle groups, and involve 10-15 repetitions, progressing over time to heavier weights that can be lifted only 8-10 times

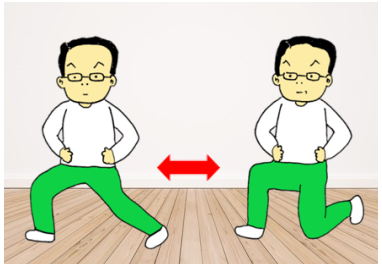
Examples of resistance exercise[20]



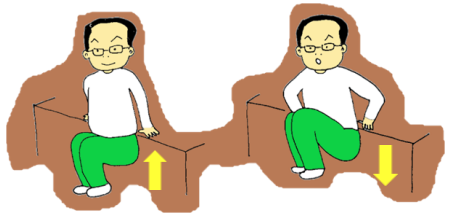
Press Up (chest, shoulders and triceps)



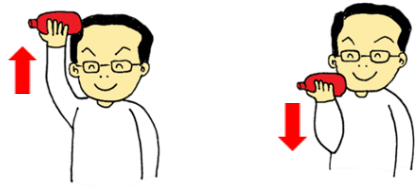
Squat (thighs and hips)



Lunge (thighs and hips)



Dipping (chest, shoulders and triceps)



Lifting a water bottle can strengthen your muscles in a leisurely manner

Flexibility & balance

- 2–3 times/week for older adults with diabetes
- Yoga and tai chi may be included based on individual preferences to increase flexibility, muscular strength, and balance





Consideration	Precautions
T2DM patients are advised to only begin light activity if BG >16.7 mmol/L , asymptomatic and properly hydrated [17]	**T1DM** patient, vigorous activity should be avoided during ketosis[14]
Type 1: ● performing resistance exercise before aerobic exercise has a positive effect on glycemic stability and can reduce the duration and severity of hypoglycemia after exercise[33] ● morning exercise confers a lower risk of late-onset hypoglycemia than afternoon exercise and improves metabolic control on the subsequent day[12] **Type 2**: ● Insulin users: - advise to add carbohydrate up to 15g of CHO if pre-exercise glucose level are <5.5 mmol/L[6] - consume 5-30g of CHO during and within 30 min after exhaustive, glycogen-depleting exercise will lower hypoglycemia risk and allow for more efficient restoration of muscle glycogen[6,19] - Medication dosage adjustments such as insulin, β-blockers, some diuretics, and statins[7] to prevent exercise-associated hypoglycemia may be required	

Special precautions and contraindications

Nonoptimal BG control	Recommend
Hyperglycemia	
Hypoglycemia	**T2DM** patients if not using insulin or insulin secretagogues are unlikely to experience hypoglycemia related to PA[7]

General Guidance on How to increase Physical Activity

- Gradual progression of intensity of aerobic exercise and resistance exercise to minimize the risk of injury and to enhance compliance
- Assess patients' age and previous physical activity levels
- Generally start with relatively moderate-intensity aerobic activity and resistance exercise. Avoid relatively vigorous-intensity activity, such as running

Adults with a low level of fitness	May need to start with light activity, or a mix of light-to moderate-intensity activity
The elderly and obese patients	Take longer time for adaptation and may require slower progression

The recommended sequence of progression of aerobic exercise[10]

Increasing Duration:
E.g. increase duration of exercise session by 5 - 10 mins every 1 - 2 weeks over the first 4 - 6 weeks.

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Increasing Frequency and Intensity:
E.g. increase frequency and intensity of exercise session as tolerated over the next 4 - 8 months

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The individual should be monitored for **any adverse effects** of the increased volume, and downward adjustments should be made if the exercise is not well tolerated.

General Guidance on How to increase Physical Activity

Rate of progression of resistance exercise

- An initial increase in the number of repetition is recommended before an increase in load
- Early in training, each session of resistance exercise should minimally include 5-10 exercises and involve completion of 10-15 repetitions to near fatigue per set, progressing over time to heavier weights (or resistance) that can be lifted only 8-10 times
- A minimum of one set of repetitions to near fatigue for each exercise, but as many as 3 to 4 sets, is recommended for optimal strength gains







Special precautions and contraindications

- Nonoptimal BG control
  - Hyperglycemia
  - Hypoglycemia
- Nerve disease
  - Autonomic neuropathy
  - Peripheral neuropathy
- Eye disease
  - Mild nonproliferative retinopathy (NPDR)
  - Moderate to severe NPDR
  - Unstable proliferative retinopathy
  - Cataract
- Kidney disease
  - Microalbuminuria
  - Overt nephropathy
  - End-stage renal disease
- Cardiovascular disease
  - Coronary artery disease
  - Exertional angina
  - Hypertension
  - Myocardial infarction
  - Stroke
  - Congestive heart failure
  - Peripheral artery disease