

## INTENSIFYING LIFESTYLE MANAGEMENT IN TYPE 2 DIABETES MELLITUS

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### ABSTRACT

**Lifestyle management (LSM) is a fundamental aspect of Type 2 diabetes mellitus (T2DM) management. Intensifying LSM beyond basic nutritional and exercise advice has been challenging for most doctors as LSM in diabetes is complex. To help navigate through the complexity of LSM in diabetes care, this article introduces an acronym DESMM as an easy-to-remember guide that encompasses most if not all the components of diabetes LSM. DESMM stands for Diet, Exercise, Support/Stress, Monitoring and Medicine. DESMM offers a structured guidance to enable consistent evaluation of the lifestyle of the patient with the intention of intensifying LSM.**

**Keywords: Lifestyle Management; Type 2 Diabetes;**

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### INTRODUCTION

Lifestyle management (LSM) is a fundamental aspect of Type 2 diabetes mellitus (T2DM) management. Intensifying LSM beyond basic nutritional and exercise advice has been challenging for most doctors as LSM in diabetes is complex. It includes diabetes self-management education and support (DSMES), medical nutrition therapy (MNT), physical activity, smoking cessation counselling, and psychosocial care.<sup>1</sup> DSMES is the ongoing process of facilitating the knowledge, skills, and ability necessary for diabetes self-care as well as activities that assist a person in implementing and sustaining the behaviours needed to manage his or her condition on an ongoing basis, beyond or outside of formal self-management training.<sup>2</sup> MNT goes beyond dietary counselling to include nutritional diagnostic and therapy for diabetes management.<sup>3</sup> Complex environmental, social, behavioural, and emotional factors, known as psychosocial factors, influence living with diabetes and achieving satisfactory medical outcomes and psychological well-being. LSM thus includes routine monitoring and screening for diabetes distress, depression, anxiety, eating issues, cognitive impairment and appropriate levels of social and family support, as well as health literacy and numeracy that impede implementation of care.<sup>4</sup>

To help navigate through the complexity of LSM in diabetes care described above, this article introduces an acronym DESMM as an easy-to-remember guide that encompasses most

if not all the components of diabetes LSM. DESMM stands for Diet, Exercise, Support/Stress, Monitoring and Medicine. The sequencing of the components of LSM is deliberate with 'S' in the centre emphasizing the need to consider the burden of treatment placed on the person living with diabetes and to adopt a patient-centric approach. To provide a better essence of DESMM, besides elaborating on each component, 3 case studies will be used to describe how this approach works in practice. These 3 patients are: Mr X, a 47-year-old IT manager, newly diagnosed with DM who presented with 3 weeks history of polyuria, polydipsia and loss of weight of 7 kg; Madam Ho, a 67-year-old housewife with 5 years of diabetes and recently diagnosed with diabetic eye disease and Mr PW, a 54-year-old Chief Financial Officer, with more than 25 years of diabetes whose control deteriorated after being posted to Laos 4 years ago. Simple tools that can be used to intensify efforts in LSM will also be introduced under each component.

### D - Diet

Dietary management is a major component of LSM. Since T2DM is caused by insulin resistance and insulin secretory dysfunction, dietary interventions are made to reduce insulin resistance and enhance the action of insulin. Aside from the obvious increases in caloric intake, nutrient composition, specifically increased amounts of dietary fat and saturated fat are important in determining the development of obesity, insulin resistance,  $\beta$ -cell dysfunction and glucose intolerance.<sup>5</sup> Increase intake of dietary fibre not only is beneficial to patients with T2DM for its cardiovascular effects, it has also been shown to improve insulin sensitivity.<sup>6</sup> The amount rather than type of carbohydrate and available insulin is the primary determinant of postprandial glycemia. Monitoring carbohydrate intake, whether by carbohydrate counting or experience-based estimation, remains a key strategy in achieving glycemic control. Portion control should be recommended for weight loss and maintenance. There is no ideal percentage of calories from carbohydrate, protein, and fat for all people with diabetes; therefore, macronutrient distribution should be based on individualised assessment of current eating patterns, preferences, and metabolic goals.<sup>7</sup> The patient's preferences have to be kept in mind when recommending interventions as the level of adherence to dietary changes is influenced by his/her prevalent eating habits, health beliefs, cultural, ethnic practices and activity status. Many dietary strategies have been promoted for weight management but the dietary intervention that is flexible, individualised and adapted according to the patient's dietary preferences would lead to better adherence to dietary prescriptions.<sup>8</sup> Medical nutrition therapy provided by the dietitian is especially helpful for those on insulin therapy who desire a flexible eating pattern, those overweight or obese who desire more intensive weight management, vegetarians who may need vitamin and mineral supplementation and those with

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poor intake or picky eaters who are at risk of malnutrition.

Obtaining an informative diet history is a key necessity in LSM. A prerequisite to obtaining diet history would be a basic nutritional knowledge about portion or serving sizes, dietary fat and saturated fat in meals and carbohydrates (CHO) in meals. Portion of food refers to the amount of food the person eats and is usually described as large or small whilst serving sizes are measured amount of food or beverage. One portion of food may contain multiple servings. Dietary fat and saturated fat are commonly found in dairy foods, meats such as fatty cuts of beef, lamb and pork, skin on chicken, processed meat, lard, palm oil, coconut oil, fatty snack foods, deep-fried foods, cakes, biscuits, pastries and pies. CHO are identified in cereals and grains (which includes wheat, oats, rice, corn, barley), fruits, starchy vegetables, dairy products, legumes (beans) and sugars. CHO portions can be quantified using 15g of CHO as one portion; common examples of one portion of CHO would be 1 slice of bread, 1 cup (250ml) of milk, 1 medium size apple, 1 quarter bowl of rice, an egg-sized portion of potato.

The time-of-day approach to diet history taking is easy to understand and apply and is sensitive to the patient's preferences. It provides the description of the patient's meal pattern from the time the patient wakes up to the end of the day.<sup>9</sup> The description includes the frequency of eating and the content of the meals such that the patient's macronutrient needs versus intake, the consistency of meals, the amount and consistency of carbohydrate intake, and the general quality of the patient's diet can be evaluated. This approach is especially useful to account for the differences in meal pattern for patients who do not have a fixed routine such as patients on dialysis and shift workers. For shift workers, the meals can be described as first meal upon waking, second meal and last meal before sleep while for patients on dialysis, meals can be described separately for dialysis and non-dialysis days.

**Table 1: Illustration of how the time-of-day approach works**

Meal	Mr X	Madam Ho	Mr PW
Breakfast	6 – 7am Choices: McDonald's full breakfast, roti prata, chee cheong fun, big pau	8 – 9am Choices: Meepok dry, fishball noodle  Black coffee with less sugar	6.45am Hotel: Continental buffet spread with several portions of orange juice, porridge and bread 9am Worksites: Rice – large portion with deep-fried side dishes
Lunch	12 Noon – 1pm Choices: Bak-kut-teh with rice (1 bowl) and you tiao, char kway teow	1 -2 pm Choices: Bread (3 – 5 pieces), rice (1 bowl) with vegetable and meat, chicken rice, instant noodles, porridge	12 Noon Hotel: Menu – fried rice, noodle soup, rice with dishes 2 – 4pm Worksites: Rice – large portion with deep-fried side dishes
Dinner	6 pm onwards Elaborate dinners in Chinese or Italian restaurants	6 – 8pm Home cooked: Rice (1 bowl), with dishes: vegetable and meats	6pm Hotel: Menu – Bento set 7-8pm Worksites: Rice – large portion with deep-fried side dishes
Supper	10pm: Beer sessions: 2 mugs; at least 2 – 3 times a week	-	9 – 10pm Hotel: Oatmeal or biscuits
Others	Coffee or tea 3 times a day; 100 plus 1-2 times a week	A few cups of fresh fruit juices a day Snacks: buns, kueh, chestnuts	Snacks on biscuits and sweets to avoid hypoglycaemia
Weight (kg) /BMI (kgm <sup>2</sup> )	75.2 (26.7)	71.3 (26.8)	91.6 (32.4)
Activity	Jogs only occasionally	Household chores and marketing	Brisk walks only when back in Singapore

The review of their diets allowed the 3 patients to identify not just their unhealthy eating habits, but also highlighted their own capabilities for adopting healthier ones. All the 3 patients had a session with the dietitian who helped them to fine-tune their own efforts. Both Mr X and Mr PW made measures to reduce their total calories and fat intake and increase fibre in their diet. The common dietary changes made were reducing eating out occasions and taking more self-prepared or home-made meals. Both switched to having sandwiches for breakfast and were consuming more vegetables, whole fruits and whole grains. Mr X also reduced his consumption of beer. Mr PW exchanged biscuits for starchy vegetables (sweet potatoes or yam) and supplemented with liquid formula if he could not manage to get a balanced meal.

With an understanding of the estimated energy and CHO composition as illustrated by some items from Madam Ho's diet as shown in Table 2 below, the patient can better grasp the CHO content in his/her diet and learn to make exchanges to reduce risk of over consumption.

**Table 2: Illustration of estimated energy and CHO in Madam Ho's diet**

Meal	Estimated Energy (kcal)	Carbohydrate g (15g Portion)
Minced pork mushroom Noodles, dry, 1 serving	511	57 (3.8)
Chicken rice, 1 serving	635	84 (5.6)
Bread, 1 piece	84	15 (1)
Rice, 1 bowl	280	62.2 (4.2)
Apple, 1 cup	113	28.25 (1.9)

Source: <https://focos.hpb.gov.sg/eservices/ENCF/>

Madam Ho was easily taking 6 to 8 extra portions of CHO from juices alone. She heard about the benefits of fruits and was taking both fruits and fruit juices liberally. With the knowledge of portion size, she reduced the portions of her snacks and beverages and lost 3 kg of her initial weight. With just dietary changes, Mr PW managed to shed 6 kg (6.6% of initial weight) within 1 month of presentation. He continued to lose another 3 more kilogram and achieved 10% weight loss after he started to exercise regularly.

**E- Exercise**

The benefits of exercise or physical activity (PA) for patients with T2DM goes beyond improving cardiovascular outcomes. Just as dietary interventions are targeted at reducing insulin resistance and increasing insulin action, exercise is promoted for these same reasons. Glucose uptake by the muscle is mediated via 2 pathways.<sup>10</sup> At rest and postprandial, glucose uptake by muscle is insulin-dependent and serves primarily to replenish muscle glycogen stores. During exercise, the muscular contractions themselves increase glucose uptake by the muscle. Glucose transport into the muscle is accomplished via GLUT (glucose transporter) proteins, with GLUT 4 being the main isoform in the muscle modulated by both insulin and contractions. Both aerobic and resistance exercises increase the abundance of GLUT and insulin sensitivity. After a recent bout of exercise, individuals can experience a decrease in BG levels during mild and moderate intensity exercise for 2 – 72 hours afterward. BG reductions are related to the duration and intensity of the exercise, pre-exercise control and state of

physical training. Any intensity of PA will enhance glucose uptake but the effect is longer if the PA is more prolonged or intense. A combination of both aerobic and resistance exercise is superior to either type of exercise taken alone in improving glycemic control.

In LSM, the use of the “FITT” (frequency, intensity, time, type) formula provides a consistent record of the level of exercise or PA the patient is engaging in and can thus be used to gradually increase exercise capacity to maximum benefits with minimum risks towards the recommended goals.<sup>11</sup> Exercise capacity can be increased gradually looking into improving on these 4 aspects of prescribing exercise. Frequency can be gradually increased from once a week to at least 3 days per week. The Talk test is an easier alternative to assessing percentage increase in heart rate to gauge intensity. With low intensity PA, the individual is able to talk effortlessly; moderate intensity - able to talk with some slight effort; high intensity - talking is very difficult or impossible. Time or duration of PA can be increased gradually until it is at least 150 minutes a week. For very sedentary low-fitness individuals, 10 to 15 minutes of PA is usually advised initially with graduated increased in duration (about 10%) each succeeding session. Exercises are generally classified to aerobic, resistance, flexibility and balance. Aerobic exercise involves repeated and continuous movement of large muscle groups and includes activities such as walking, cycling, jogging, and swimming. Resistance (strength) training includes exercises with free weights, weight machines, body weight, or elastic resistance bands. Flexibility exercises improve range of motion around joints. Balance exercises benefit gait and prevent falls. Activities like tai chi and yoga combine flexibility, balance, and resistance activities. The very sedentary low-fitness individuals can start with light stretching or conditioning exercises. Activities such as occupational, household, and many daily tasks are typically performed in the most efficient manner possible. These physical activities are done with little regard to physical fitness and are often structured with conservation of energy expenditure as a goal. The performance of some work tasks may be planned and structured in a less efficient manner to develop muscular strength or to "burn up" calories. Tasks regularly performed in this manner are considered exercise.<sup>12</sup>

**Table 3: FITT to assess baseline physical activity for 3 patients**

Exercise	Mr X	Madam Ho	Mr PW
Frequency	Less than once a week	Daily	2 times a day over the weekend only when in Singapore every 3 months
Intensity	Moderate	Low	Moderate
Time (minute)	30 – 45	Small bouts of less than 20 min	60
Type	Aerobic- jog	PA: Household chores – mainly cooking dinner, marketing	Aerobic – brisk walk

Both gentlemen subsequently increased their frequency of exercise: Mr X started brisk walking after breakfast once a week for 3 months before increasing to twice a week. Mr PW started on the treadmill in the hotel after dinner and by the end of a month, was able to maintain 1 hour of exercise every day. Madam Ho tried the stationary bike but did not persevere. She had her fear of falling off the bike and of worsening her retinopathy. To increase her PA level and not cause too much

disruption to her routine, some of the suggestions given to Madam Ho was to take a longer route to the market, climb stairs rather than use the lift or to stop by the neighbourhood fitness corner.

**M - Monitoring**

Monitoring of outcomes is important to evaluate the progress of LSM. Besides regular visits to the doctor to monitor HbA1c, diabetes-related complications and co-morbidities like obesity, hypertension and hyperlipidemia, self-management and monitoring is part and parcel of diabetes management. Self-monitoring of blood glucose (SMBG) plays a very important role in ensuring effective and safe implementation of LSM, especially during the initiation and intensification of the dietary and exercise interventions for both insulin and non-insulin treated patients with Type 2 DM. It provides immediate feedback and data that enable people with diabetes to assess how their food choices, physical activity levels, and medications affect their blood glucose control. SMBG results can aid people with diabetes in evaluating their current diabetes management efforts by either reinforcing or calling into question their lifestyle choices. SMBG is thus only of value if patient uses the data obtained in lifestyle decision-making.<sup>13</sup>

Doctors must be prepared to invest time and effort to provide self-management education and timely feedback on the SMBG data obtained by the patient.

To acquire competence and confidence in SMBG, 2 skills sets are required: operational and interpretive.<sup>13</sup> The patient has to learn to operate a glucose meter, ensure accuracy and to document SMBG data and be able to appropriately interpreting SMBG data by knowing BG targets and appropriate frequency and timing of tests. Targets should be individualised but an easy way to remember targets would be ‘4-7-11’: not less than 4, less than 7 before meals and less than 11 after meals. The frequency and timing of SMBG is determined by several factors that include willingness to perform SMBG, level of diabetes control, medication regimen, lifestyle and daily schedule with regard to activity, food, and work, physical ability to check blood glucose, ability to problem-solve and take action, financial limitations and comorbid condition.<sup>13</sup> Structured SMBG is an approach in which blood glucose data are gathered according to a defined regimen (frequency and timing), interpreted, and then utilized to make appropriate pharmacologic and/or lifestyle adjustments.<sup>14</sup> The 3-, 5- and 7-point regimens and the staggered-frequency regimen are considered meal-based testing schemes. The 3-point testing regimen provides information about glucose control in the fasting state and around the largest meal of the day. The goal of these regimens is to discover the effect of food consumed on the rise in blood glucose after specific mealtimes. To ensure safety from risk of hypoglycaemia, testing before bedtime, especially after strenuous or prolonged exercise, during illness and before driving are warranted for some individuals.

Pattern management in decision making involves both patients and providers performing a systematic review and analysis of the

patients' recorded blood glucose (BG) levels. Some available meters and software programs provide automated pattern detection. Regardless of how patterns are detected, the goal is to proactively make changes in lifestyle or the therapeutic regimen to resolve consistent patterns of high or low blood glucose and attain blood glucose targets. The use of newer technology like the flash continuous glucose monitoring system can also be explored for patients who may be suspected of having nocturnal hypoglycaemia, hypoglycaemia unawareness or are not so willing to do frequent finger-pricking SMBG.

Table 4 below shows how LSM is done with SMBG.

**Table 4: Recommendation of LSM based on SMBG**

SMBG	Obtaining records	Interpretation	Recommendation
Mr X	3-point regimen at least 3 times a week – FBG and premeal BG; when experiencing hypoglycaemia	Hypoglycaemia before lunch several hours after jogging	Proper hypoglycemia management. Reduce dose of insulin at lunch time. Continue to monitor for exercise-induced hypoglycemia
Madam Ho	3-point regimen 2 times a week – FBG and paired readings for lunch or dinner	Premeal BG and post meal BG above targets (6 out of 10 readings)	To take more of the meals that provide better results and modify those that do not.
Mr PW	3-point regimen daily – FBG and paired at dinner, when experiencing hypoglycemia	Bedtime hypoglycaemia after post-dinner exercise	Proper hypoglycemia management. Reduce dose of insulin at dinner. Continue to monitor for exercise-induced hypoglycaemia.

All the 3 patients were motivated to monitor their progress regularly for different reasons: Mr X to relieve his symptoms and to recover as soon as possible to return to work; Madam Ho to improve her diabetic eye disease and Mr PW to regain his previous optimal status. SMBG allowed them to participate actively in lifestyle decision making and stay motivated to continue to make and sustain lifestyle changes in diet and exercise. Mr X and Mr PW witnessed the potent effect regular exercise had on their glycemic levels. Both experienced exercise-induced hypoglycaemia within days of starting exercise and had to take steps to reduce their medications.

**M - Medicines**

One of the main goals of LSM is to achieve optimal glycemic control without or with minimal need for medications. The ultimate goal of any diabetes management would be to achieve complete or partial remission of diabetes. Remission is defined as achieving glycemia below the diabetic range in the absence of active pharmacologic (anti-hyperglycemic medications, immunosuppressive medications) or surgical (ongoing procedures such as repeated replacements of endoluminal devices) therapy. A remission can be characterized as partial or complete. Partial remission is sub-diabetic hyperglycemia (HbA1c not diagnostic of diabetes [ $<6.5\%$ ], FBG 5.6–6.9 mmol/l) of at least 1 year's duration in the absence of active pharmacologic therapy or ongoing procedures. Complete remission is a return to “normal” measures of glucose metabolism (HbA1c in the normal range, FBG 5.6 mmol/l) of at least 1 year's duration in the absence of active pharmacologic therapy or ongoing procedures.<sup>15</sup>

Look AHEAD (Action for Health in Diabetes)<sup>16</sup> and Diabetes Remission Clinical Trial (DiRECT)<sup>17</sup> are recent trials that have shown that intensive LSM can bring about diabetes remission. The Look AHEAD study perhaps the largest randomized controlled trial of an intensive lifestyle intervention among adults with type 2 diabetes to date found as many as 11.5% of lifestyle intervention participants had partial or complete remission within the first year of intervention and 7% had partial or complete remission after 4 years; these rates were 3 to 6 times those of participants in the diabetes support and education condition. Perhaps more important, rates of any remission were notably higher (15%–21%) among persons with substantial weight loss or fitness change, shorter duration of diabetes, or a lower HbA1c level at entry and those not using insulin.<sup>16</sup>

Table 5 below shows the progress the 3 patients made with regards to medicines.

**Table 5: Progress of the 3 patients after LSM**

	At presentation		After LSM	
	Medicines	HbA <sub>1c</sub> (%)	Medicines	HbA <sub>1c</sub> (%)
Mr X	Premixed insulin (30/70) 12 units at lunch Gliclazide 80mg bd Metformin 500mg bd	10.0	Metformin 500 mg tds	5.8
Madam Ho	Janumet (50/500) Glipizide 5mg bd Metformin 500mg on	9.9	No change	6.8
Mr PW	Premixed insulin (30/70) 18 units at breakfast and 16U units at dinner Metformin 850mg tds	10.1	Metformin 850m tds	5.6

Studies have shown that, when implemented early in the course of type 2 diabetes mellitus, treatment with intensive insulin therapy for 2-3 weeks can induce a glycaemic remission.<sup>18</sup> Mr X presented initially with high glucose levels and with LSM and early initiation of insulin, he soon achieved optimal control and was managed with only monotherapy. Mr PW was also weaned off insulin therapy through LSM despite having been on insulin therapy for 10 years. Though none of them achieved remission, their burden of medications were much reduced. If they are not able to maintain LSM and lose some control over their diabetes, instead of insulin or insulin secretagogues, the newer groups of medicines that assist in weight management and have low risk of hypoglycaemia like Sodium–Glucose Co-Transporter (SGLT-1 and 2) Inhibitors, Dipeptidyl peptidase-4 (DPP-4) inhibitors and Glucagon-like peptide 1 (GLP-1) receptor agonist or GLP-1 analogues may be considered.

**S – Support**

DSM is physically, intellectually, emotionally and socially demanding. While LSM may be considered the cornerstone of diabetes management, making lifestyle changes can be hard work for patients with diabetes. This work involves not only acquiring new skills and knowledge to handle practical and cognitive tasks such as SMBG, preparing meals (sometimes separately from the rest of the family), management of hypoglycaemia, management of sick day and exercising, it also involves socio-emotional tasks such as coping with feeling about

diabetes (including anger and frustration), explaining to family, friends and work colleagues about diabetes, negotiating access to healthcare and obtaining resources for self-management.<sup>19</sup> Suboptimal self-management may be due to functional limitations (e.g., blindness, problems with dexterity, low health literacy and numeracy), lack of appropriate diabetes education, forgetting and disruption in routines, or psychosocial barriers, such as inadequate family and/or social support, misinformation or inaccurate beliefs about illness and treatment, emotional distress/depressive symptoms, or deficits in problem-solving or coping skills. Therefore, individual needs should be evaluated so that interventions can be tailored to the problem. Using a non-judgmental approach that normalizes periodic lapses in self-management may help minimize patients' resistance to reporting problems with self-management.<sup>4</sup>

Access to support and stress management is thus central for the adherence to and successful implementation of LSM in diabetes care. LSM must be designed using person-centred care practices, in collaboration with the patient, focusing on and supporting the patient's priorities and values<sup>2</sup>. The doctor takes the responsibility of both technical expert and a supportive interpersonal role and attempts to strike a mutual long-term relationship with the patient. Each consultation follows on from the next. With time, the doctor gains the trust and or confidence such that he begins to know the patient's personalities, social and physical environments, his/her biography and relationships. As the doctor improves on his time management skills, each consultative is more effective and he/she gets a better insight into the patient's needs.<sup>20</sup> Informed lifestyle and informed decision-making are facilitated using clear health communication principles, using plain language, avoiding jargon, making information culturally relevant, using language and literacy appropriate education materials, and using interpreter services when indicated. Evidence-based communication strategies such as collaborative goal setting, action planning, motivational interviewing, shared decision making, cognitive behavioural therapy, problem-solving, self-efficacy enhancement, teach-back, and relapse-prevention strategies are also employed.<sup>4</sup>

Emotional support and social connectedness are significantly associated with increased adherence to recommended healthful eating regimen and physical activity levels.<sup>21</sup> Strategies to engage patients in ongoing support include internal or external group meetings (connection to community and peer groups both online or locally), ongoing medication management, continuing education, resources to support new or adjustments to existing behaviour change goal setting, physical activity programs, weight loss support, smoking cessation, and psychosocial support, among others.<sup>4</sup> A simple aid to assessing contributory psychosocial factors and stress management is a quick checklist on the 'S' factors of support/stress – social, spiritual, "\$", sick day, steroids, smoking, sexual dysfunction.

The 3 patients had good coping skills with supportive social network from their family, friends and colleagues. The LSM of Mr PW's diabetes was significantly affected by the disruption of his social support structure when he left for Laos. He regained

his control after a review of LSM and re-establishing his support structure in Laos. Mr X's work nature made it difficult for him to sustain LSM as he travelled frequently and beer drinking sessions with friends was his way of distressing after work. LSM would be an ongoing effort to help personalise his care to incorporate his preferences and needs and still maintain optimal control. Similarly intensifying LSM for Madam Ho would be a continuing effort to reframing her perception of exercise and engaging the support of her family.

In conclusion, the implementation of LSM in a patient with diabetes can be complex and challenging. DESMM offers a structured guidance to enable consistent evaluation of the lifestyle of the patient with the intention of intensifying LSM.

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### REFERENCES

1. American Diabetes Association. 4. Lifestyle management: Standards of medical care in diabetes—2018. *Diabetes Care*. 2018 Jan 1;41(Supplement 1):S38-50.
2. Beck J, Greenwood DA, Blanton L, Bollinger ST, Butcher MK, Condon JE, Cypress M, Faulkner P, Fischl AH, Francis T, Kolb LE. 2017 National Standards for Diabetes Self-Management Education and Support. *The Diabetes Educator*. 2018 Feb;44(1):35-50.
3. Morris SF, Wylie-Rosett J. Medical nutrition therapy: a key to diabetes management and prevention. *Clinical diabetes*. 2010 Jan 1;28(1):12-8.
4. Young-Hyman D, De Groot M, Hill-Briggs F, Gonzalez JS, Hood K, Peyrot M. Psychosocial care for people with diabetes: a position statement of the American Diabetes Association. *Diabetes Care*. 2016 Dec 1;39(12):2126-40.
5. Kahn SE, Cooper ME, Del Prato S. Pathophysiology and treatment of type 2 diabetes: perspectives on the past, present, and future. *The Lancet*. 2014 Mar 22;383(9922):1068-83.
6. Chen C, Zeng Y, Xu J, Zheng H, Liu J, Fan R, Zhu W, Yuan L, Qin Y, Chen S, Zhou Y. Therapeutic effects of soluble dietary fiber consumption on type 2 diabetes mellitus. *Experimental and therapeutic medicine*. 2016 Aug 1;12(2):1232-42.
7. Evert AB, Boucher JL, Cypress M, Dunbar SA, Franz MJ, Mayer-Davis EJ, Neumiller JJ, Nwankwo R, Verdi CL, Urbanski P, Yancy WS. Nutrition therapy recommendations for the management of adults with diabetes. *Diabetes Care*. 2013 Nov;36(11):3821-42.
8. Gibson AA, Sainsbury A. Strategies to improve adherence to dietary weight loss interventions in research and real-world settings. *Behavioral Sciences*. 2017 Jul 11;7(3):44.
9. Leech RM, Worsley A, Timperio A, McNaughton SA. Understanding meal patterns: definitions, methodology and impact on nutrient intake and diet quality. *Nutrition research reviews*. 2015 Jun;28(1):1-21.
10. Colberg SR, Sigal RJ, Yardley JE, Riddell MC, Dunstan DW, Dempsey PC, Horton ES, Castorino K, Tate DF. Physical activity/exercise and diabetes: a position statement of the American Diabetes Association. *Diabetes Care*. 2016 Nov 1;39(11):2065-79.
11. Zhao C, Chia J, Teh KC, Goh LG. Prescribing Exercise. A handbook for medical practitioners. Joint publication of the Singapore Medical Association and the Singapore Sports Council. Eds. August 2003. Singapore
12. Caspersen CJ, Powell KE, Christenson GM. Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public health reports*. 1985 Mar;100(2):126.

13. Austin MM. The two skill sets of self-monitoring of blood glucose education: the operational and the interpretive. *Diabetes Spectrum*. 2013 May 1;26(2):83-90.
14. Gracia TR, de la Torre Lobo NG, Hervada AD, Pascual AL. Structured SMBG in early management of T2DM: Contributions from the St Carlos study. *World journal of diabetes*. 2014 Aug 15;5(4):471.
15. Buse JB, Caprio S, Cefalu WT, Ceriello A, Del Prato S, Inzucchi SE, McLaughlin S, Phillips GL, Robertson RP, Rubino F, Kahn R. How do we define cure of diabetes?. *Diabetes care*. 2009 Nov 1;32(11):2133-5.
16. Gregg EW, Chen H, Wagenknecht LE, Clark JM, Delahanty LM, Bantle J, Pownall HJ, Johnson KC, Safford MM, Kitabchi AE, Pi-Sunyer FX. Association of an intensive lifestyle intervention with remission of type 2 diabetes. *Jama*. 2012 Dec 19;308(23):2489-96.
17. Lean ME, Leslie WS, Barnes AC, Brosnahan N, Thom G, McCombie L, Peters C, Zhyzhneuskaya S, Al-Mrabeh A, Hollingsworth KG, Rodrigues AM. Primary care-led weight management for remission of type 2 diabetes (DiRECT): an open-label, cluster-randomised trial. *The Lancet*. 2018 Feb 10;391(10120):541-51.
18. Kramer CK, Zinman B, Retnakaran R. Short-term intensive insulin therapy in type 2 diabetes mellitus: a systematic review and meta-analysis. *The lancet Diabetes & endocrinology*. 2013 Sep 1;1(1):28-34.
19. Hinder S, Greenhalgh T. "This does my head in". Ethnographic study of self-management by people with diabetes. *BMC health services research*. 2012 Dec;12(1):83.
20. Kaba R, Sooriakumaran P. The evolution of the doctor-patient relationship. *International Journal of Surgery*. 2007 Feb 1;5(1):57-65.
21. Rosland AM, Piette JD, Lyles CR, Parker MM, Moffet HH, Adler NE, Schillinger D, Karter AJ. Social support and lifestyle vs. medical diabetes self-management in the diabetes study of Northern California (DISTANCE). *Annals of Behavioral Medicine*. 2014 May 3;48(3):438-47.

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### LEARNING POINTS

- **LSM must be designed using person-centred care practices, in collaboration with the patient, focusing on and supporting the patient's priorities and values.**
  - **LSM involves proper assessment of the patient's lifestyle.**
  - **LSM can reduce the burden of medical therapy.**
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