居家運動訓練之介入，是否可輔助糖尿病患者血糖的控制?

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報告日期：110/3/23

簡介–背景

糖尿病（DM）是一種慢性代謝性疾病。

- 中風
- 腎病變
- 視網膜病變
- 心血管疾病
- 神經病變
- 足部病變

代謝症候群

- 好膽固醇太低
- 三酸甘油脂過高
- 腰腹脂肪多
- 胰島素阻抗
- 血壓高


規律運動
均衡
健康飲食
按醫囑
用藥

以病人為中心的整合性糖尿病照護

➢2018糖尿病臨床照護指引-體能活動

臨床建議	證據等級	臨床建議強度
所有成年人，尤其第二型糖尿病人，應避免久坐的生活型態	高	強烈建議
規律的運動，可以改善第二型糖尿病人的血糖控制、幫助體重控制、降低藥物用量、減少未來失能	高	強烈建議
糖尿病前期病人，建議每天至少從事60分鐘以上中度或強度有氧運動，包括每週三次高強度肌肉及骨骼強化運動	高	強烈建議

以病人為中心的整合性糖尿病照護

➢2018糖尿病臨床照護指引-體能活動

臨床建議	證據等級	臨床建議強度
無其他合併症的禁忌，糖尿病病人每週應從事150分鐘中度身體活動，不要連續兩天不運動。每週2-3次阻力運動，兩次阻力運動至少間隔一天。	高	強烈建議
針對較年輕或體能較佳的病人，可採高強度劇烈運動或高強度間歇運動，時間可縮短至每週至少75分鐘。	中	中等建議
糖尿病較年長者，每週建議從事2-3次能改善柔軟度、平衡感及肌耐力之運動，如：瑜珈、太極等。	中	中等建議

11A病房常見疾病

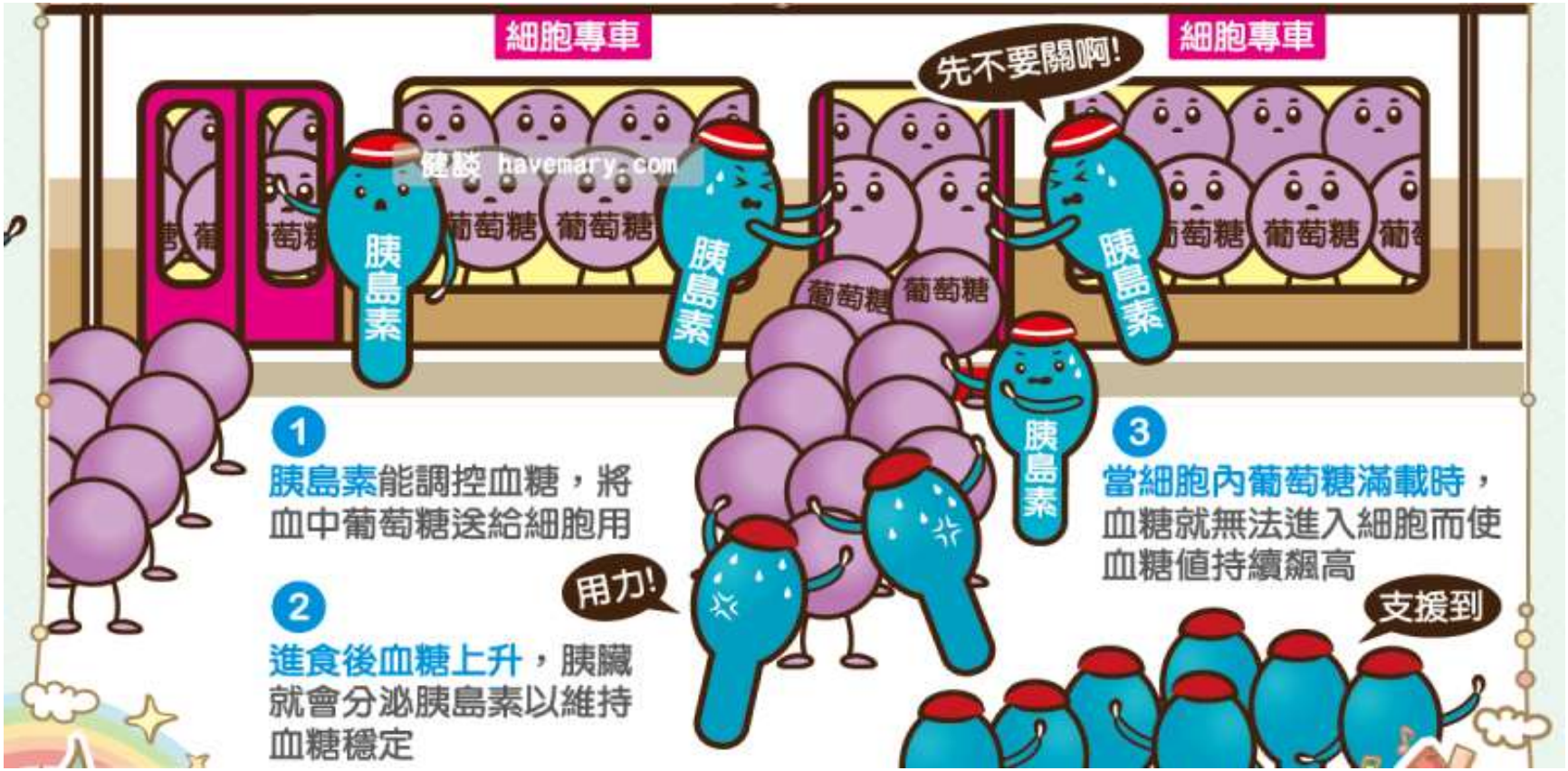
年度	106年	107年	108 年	109 年	110 年1-2月
1	肺炎（105） 11.2%	肺炎（90） 8.3%	肺炎（160） 13.8%	糖尿病(392) 18.6%	糖尿病(54) 29.7%
2	腸胃道出血 (58) 6.2%	腸胃道出血 (75) 6.9%	泌尿道感染 (125) 10.8%	泌尿道感染 (169) 9.0%	泌尿道感染 (13) 7.1%
3	泌尿道感染 (54) 5.8%	泌尿道感染 (74) 6.8%	腸胃道出血 (86) 7.4%	蜂窩性組織炎 (70) 2.6%	慢性腎衰竭 (12) 6.6%
4	蜂窩性組織炎 (37) 4.0%	糖尿病(60) 5.5%	糖尿病(54) 4.7%	肺炎(68) 3.8%	腸胃道出血 (12) 6.6%
5	腸道感染 (20) 2.1%	蜂窩性組織炎 (42) 1.9%	蜂窩性組織炎 (47) 4.0%	腸胃道出血 (66) 6.4%	蜂窩性組織炎 (10) 5.5%

現況

糖尿病全人照護著重藥物、飲食，目前本院住院病人尚未提供運動相關認知指導

本院糖尿病疾病護理標準規範目前沒有運動指導相關內容

簡介-胰島素阻抗(Insulin Resistance；IR)



細胞能代謝糖量有限，胰島素激增無法使血糖回穩，
大量葡萄糖與胰島素留在血中即爲胰島素抗阻

HOMA-IR=（空腹血糖值(mg/dL) ×胰島素分泌量(μU/ mL)）÷405

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Review

Exercise and insulin resistance in type 2 diabetes mellitus: A systematic review and meta-analysis

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Appraisal Tool [統合分析 Meta-Analysis]

- 步驟1:探討研究的問題為何?(PICO)

步驟2:研究的品質為何?(內在效度)(FAITH)

步驟3:研究結果之意義為何?(效益)

Appraisal sheets(FAITH)

- Appraisal Tool
  - [統合分析 Meta-analysis]
  - 步驟1：研究探討的問題為何（PICO）
  - 步驟2：研究的品質如何（內在效度）
  - 步驟3：研究結果之意義為何（效益）

步驟1:系統性文獻回顧探討的問題為何？

研究族群／問題 (Population/ Problem)：

- Type 2 diabetes mellitus

介入措施 (Intervention)：

- Exercise (Aerobic exercise、Resistance exercise)

比較 (Comparison)：

- No physical exercise

結果 (Outcomes)：

- blood glucose improve (control)

Appraisal sheets(FAITH)

- Appraisal Tool
  - [統合分析 Meta-analysis]
  - 步驟1：研究探討的問題為何（PICO）
  - 步驟2：研究的品質如何（內在效度）
  - 步驟3：研究結果之意義為何（效益）

F—研究是否找到所有的相關證據？

良好的文獻搜尋至少應包括二個主要的資料庫(如：Medline, Cochrane考科藍實證醫學資料庫, EMBASE 等)，並且加上文獻引用檢索(參考文獻中相關研究、Web of Science, Scopus或Google Scholar)、試驗登錄資料等。文獻搜尋應不只限於英文，並且應同時使用 MeSH字串及一般檢索詞彙(text words)。

P99

2. 主題與方法

- This study was carried out in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement for quality of reporting meta-analysis. Studies were identified by an electronic search and hand search. **We searched the databases MEDLINE via PubMed, CINHAL, Scopus and Web of Science, and the Cochrane Central Register of Controlled Trials. We also used Google Scholar to find out additional full-text articles from the earliest record to June 2017**. The search strategy combined terms related to aerobic exercise training, strength training, and IR. Specifically, **the keywords used were "strength training, weight training, resistance training, progressive training, progressive resistance, weightlifting; or aerobic exercise, endurance exercise, aerobic training, endurance training, cardio training, exercise, physical endurance, physical exertion; and insulin sensitivity, IR, tolerance test, oral glucose tolerance test (OGTT), insulin tolerance test (ITT)"**. The review included studies that compared the effectiveness of a structured exercise intervention with a control group that received no physical exercise to find out the effect on different outcome measures of interest.

F—研究是否找到所有的相關證據？

2.1. 研究選擇(納入)

- Studies were included in the systematic review with meta-analysis if they were of T2DM in people 18 years or older and the exercise training intervention involving aerobic exercise (continuous, intermittent, or high-intensity interval training), progressive RI, or both. Studies had to investigate the primary outcome insulin resistance, including fasting insulin (FI), homeostatic model assessment for insulin resistance (Homa-IR), fasting blood sugar (FBS), glycated hemoglobin (Hba_{1c}) or body mass index (BMI). Homa-IR was calculated as fasting insulin (ulU/L) × fasting glucose (nmol/L)/22.5 [5].

2.2. 數據提取和計算

- Data were extracted on the participant characteristics age, sex, BMI, exercise intervention (mode of exercise, exercise frequency, intensity, duration, and intervention duration and measures of insulin sensitivity independently by 2 researchers (ASK, SG), with disagreements resolved by discussion with 2 investigators (AGM, BAS) (Table 1).

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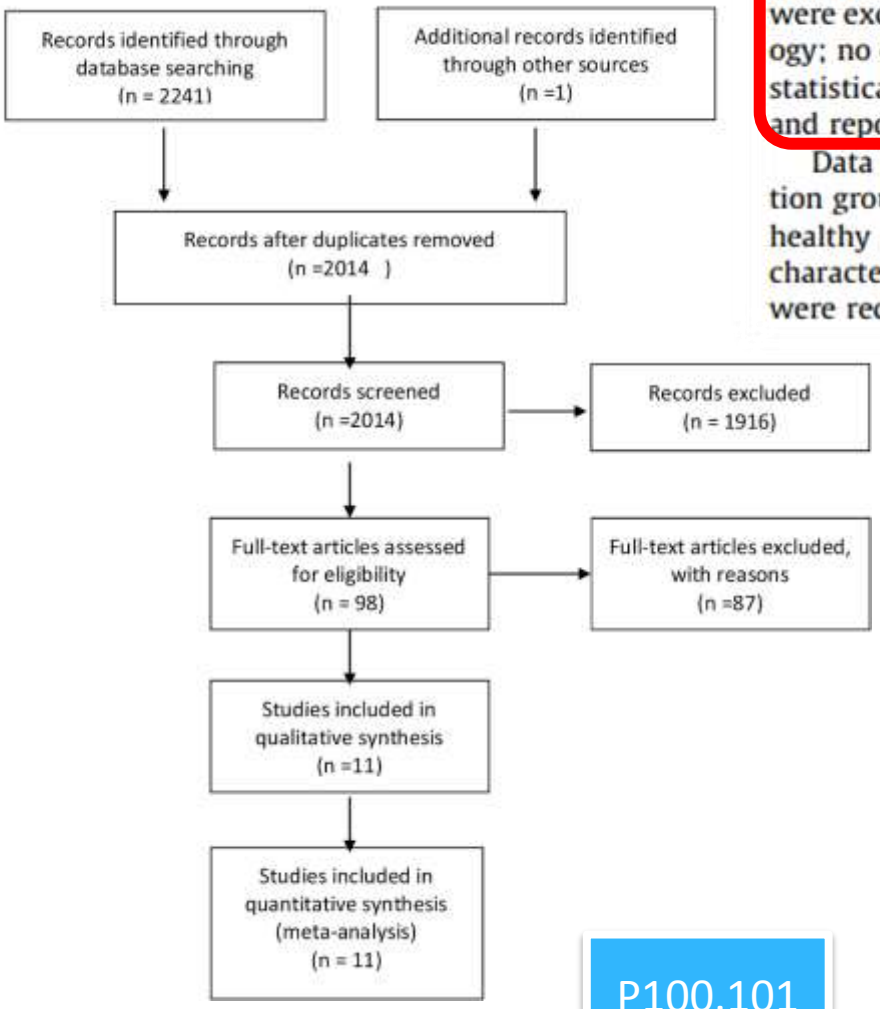
PRISMA

3.1結果

From the electronic database search, 2242 articles were identified; 98 full-text articles were eligible for full-text review and 11 articles were included in the final review (Fig. 1). Articles were excluded because of inappropriate title and study methodology; no control group; improper study design, outcome measure, statistical analysis, and tools used in the study; inappropriate data; and report written in other than the English language.

Data for 846 participants were analyzed: 440 in the intervention group, and 406 in the control group. People with T2DM and healthy age-matched controls were included. The descriptive characteristics of participants are in Table 1. Most participants were recruited from hospital and outpatient settings.



P100.101

說明：文獻搜尋應同時使用 MeSH字串及一般檢索詞彙，但內文並未提及，而且排除只納入英文的文獻可能造成文獻流失

P99. 樣本數846例, 干預組440名, 對照組406名

Table 1
Demographic data for studies in the systematic review.

Author name	Year	Journal	Type of study	Sample size	Type of intervention		Duration of intervention
					Intervention group	Control group	
Katsui et al.	2001	Diabetes care	Non-RCT	55	Aerobic training and diet	No group	6 weeks
Short et al.	2003	Diabetes	RCT	90	Aerobic control and exercise program	Flexibility exercises	16 weeks
O'Donovan et al.	2005	Eur J Appl Physiol	RCT	67	High and moderate intensity exercise	No exercise	24 weeks
Lazarevic et al.	2006	Diabetes Metab	RCT	30	Structured and supervised aerobic exercise program	No exercise	6 months
Michishita et al.	2008	Diabetes Res Clin Pract	Non-RCT	30	Submaximal exercise testing – NGT, IGT, DM	No group	12 weeks
Misra et al.	2008	Diabetes Care	Non-RCT	30	Supervised Progressive resistance exercise training protocol	No group	12 weeks
Jorge et al.	2011	Metabolism	RCT	48	Aerobic, resistance, and combined exercise training	No exercise	12 weeks
El-Kader et al.	2011	Journal Adv Res	Non-RCT	40	Aerobic and resistance exercise training	No group	3 months
Geirsdottir et al.	2012	Journal Gerontol	RCT	237	Resistance exercise program	Healthy older group	12 weeks
Mavros et al.	2013	Diabetes Care	RCT	103	High-intensity progressive resistance training	Sham	12 months
Motahari-Tabari et al.	2015	Global J Health Science	RCT	53	Aerobic exercise	No group	8 weeks

RCT, randomized controlled trial; DM, diabetes mellitus; NGT, normal glucose tolerance; IGT, impaired glucose tolerance.

A－文獻是否經過嚴格評讀?

應根據不同臨床問題的文章類型，選擇適合的評讀工具，並說明每篇研究的品質(如針對治療型的臨床問題，選用隨機分配、盲法、及完整追蹤的研究類型)。

P100

2.3 偏見風險評估

- Two researchers (ASK, AGM) assessed the methodological quality of the included studies with blinding by using a modified Downs and Black checklist recommended by the Cochrane Handbook for Systematic Reviews of Interventions. (Table 2).

2.4 統計分析

- We adopted a random-effects model for the meta-analysis because we anticipated considerable heterogeneity among the studies.

I—文獻是否只納入具良好效度的文章?

僅進行文獻判讀是不足夠，系統性文獻回顧只納入至少要有一項研究結果是極小偏誤的試驗。

P100

Table 2
Downs and Black checklist for methodological quality of studies.

Downs and Black questions	Katsui et al. (2001)	Short et al. (2003)	O'Donovan et al. (2005)	Lazarevic et al. (2006)	Michishita (2008)	Misra et al. (2008)	Jorge et al. (2011)	El-Kader (2011)	Geirsdottir (2012)	Mavros et al. (2013)	Motahari-Tabari et al. (2015)
1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
6	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
7	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
8	N	N	Y	Y	Y	N	Y	N	N	N	N
9	N	N	Y	N	N	N	N	N	N	N	N
10	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
11	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
12	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
13	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
14	N	Y	Y	N	UTD	Y	N	N	UTD	Y	N
15	N	Y	Y	N	UTD	Y	N	N	UTD	Y	Y
16	UTD	Y	Y	N	UTD	Y	N	N	N	Y	N
17	Y	Y	Y	Y	UTD	Y	Y	N	N	UTD	N
18	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
19	UTD	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
20	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
21	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
22	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
23	N	Y	Y	Y	Y	UTD	Y	UTD	Y	Y	Y
24	Y	Y	Y	Y	UTD	N	Y	N	Y	Y	Y
25	UTD	Y	Y	Y	N	N	Y	N	Y	Y	Y
26	UTD	UTD	Y	Y	UTD	UTD	Y	UTD	Y	Y	Y
27	N	N	N	N	N	N	N	N	N	N	N
Total Score	16	22	26	22	18	20	22	16	20	23	21

UTD: unable to determine.

問題涉及報告質量（10），外部效度（3），內部效度（偏差和混淆）（13）和統計檢定力（1）。

Downs and Black checklist簡介

Item	Criteria	Possible Answers
Reporting		
1	*Is the hypothesis/aim/objective of the study clearly described?*	Yes = 1 No = 0
2	*Are the main outcomes to be measured clearly described in the Introduction or Methods section?* If the main outcomes are first mentioned in the Results section, the question should be answered no.	Yes = 1 No = 0
3	*Are the characteristics of the patients included in the study clearly described?* In cohort studies and trials, inclusion and/or exclusion criteria should be given. In case-control studies, a case-definition and the source for controls should be given.	Yes = 1 No = 0
4	*Are the interventions of interest clearly described?* Treatments and placebo (where relevant) that are to be compared should be clearly described.	Yes = 1 No = 0
5	*Are the distributions of principal confounders in each group of subjects to be compared clearly described?* A list of principal confounders is provided.	Yes = 2 Partially = 1 No = 0
6	*Are the main findings of the study clearly described?* Simple outcome data (including denominators and numerators) should be reported for all major findings so that the reader can check the major analyses and conclusions. (This question does not cover statistical tests which are considered below).	Yes = 1 No = 0
7	*Does the study provide estimates of the random variability in the data for the main outcomes?* In non-normally distributed data the interquartile range of results should be reported. In normally distributed data the standard error, standard deviation or confidence intervals should be reported. If the distribution of the data is not described, it must be assumed that the estimates used were appropriate and the question should be answered yes.	Yes = 1 No = 0
8	*Have all important adverse events that may be a consequence of the intervention been reported?* This should be answered yes if the study demonstrates that there was a comprehensive attempt to measure adverse events. (A list of possible adverse events is provided).	Yes = 1 No = 0
9	*Have the characteristics of patients lost to follow-up been described?* This should be answered yes where there were no losses to follow-up or where losses to follow-up were so small that findings would be unaffected by their inclusion. This should be answered no where a study does not report the number of patients lost to follow-up.	Yes = 1 No = 0
10	*Have actual probability values been reported (e.g. 0.035 rather than <0.05) for the main outcomes except where the probability value is less than 0.001?*	Yes = 1 No = 0
External validity		
11	*Were the subjects asked to participate in the study representative of the entire population from which they were recruited?* The study must identify the source population for patients and describe how the patients were selected. Patients would be representative if they comprised the entire source population, an unselected sample of consecutive patients, or a random sample. Random sampling is only feasible where a list of all members of the relevant population exists. Where a study does not report the proportion of the source population from which the patients are derived, the question should be answered as unable to determine.	Yes = 1 No = 0 Unable to determine = 0
12	*[illegible] population from which they were recruited?* The proportion of those asked who agreed should be stated. Validation that the sample was representative would include demonstrating that the distribution of the main confounding factors was the same in the study sample and the source population.	Yes = 1 No = 0 Unable to determine = 0
13	*Were the staff, places, and facilities where the patients were treated, representative of the treatment the majority of patients receive?* For the question to be answered yes the study should demonstrate that the intervention was representative of that in use in the source population. The question should be answered no if, for example, the intervention was undertaken in a specialist centre unrepresentative of the hospitals most of the source population would attend.	Yes = 1 No = 0 Unable to determine = 0
Internal validity - bias		
14	*Was an attempt made to blind study subjects to the intervention they have received?* For studies where the patients would have no way of knowing which intervention they received, this should be answered yes.	Yes = 1 No = 0 Unable to determine = 0
15	*Was an attempt made to blind those measuring the main outcomes of the intervention?*	Yes = 1 No = 0 Unable to determine = 0
16	*If any of the results of the study were based on "data dredging", was this made clear?* Any analyses that had not been planned at the outset of the study should be clearly indicated. If no retrospective unplanned subgroup analyses were reported, then answer yes.	Yes = 1 No = 0 Unable to determine = 0
17	*In trials and cohort studies, do the analyses adjust for different lengths of follow-up of patients, or in case-control studies, is the time period between the intervention and outcome the same for cases and controls?* Where follow-up was the same for all study patients the answer should be yes. If different lengths of follow-up were adjusted for by, for example, survival analysis the answer should be yes. Studies where differences in follow-up are ignored should be answered no.	Yes = 1 No = 0 Unable to determine = 0
18	*Were the statistical tests used to assess the main outcomes appropriate?* The statistical techniques used must be appropriate to the data. For example nonparametric methods should be used for small sample sizes. Where little statistical analysis has been undertaken but where there is no evidence of bias, the question should be answered yes. If the distribution of the data (normal or not) is not described it must be assumed that the estimates used were appropriate and the question should be answered yes.	Yes = 1 No = 0 Unable to determine = 0
19	*Was compliance with the intervention/s reliable?* Where there was non-compliance with the allocated treatment or where there was contamination of one group, the question should be answered no. For studies where the effect of any misclassification was likely to bias any association to the null, the question should be answered yes.	Yes = 1 No = 0 Unable to determine = 0
20	*Were the main outcome measures used accurate (valid and reliable)?* For studies where the outcome measures are clearly described, the question should be answered yes. For studies which refer to other work or that demonstrates the outcome measures are accurate, the question should be answered as yes.	Yes = 1 No = 0 Unable to determine = 0
Internal validity - confounding (selection bias)		
21	*Were the patients in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited from the same population?* For example, patients for all comparison groups should be selected from the same hospital. The question should be answered unable to determine for cohort and case-control studies where there is no information	Yes = 1 No = 0 Unable to determine = 0
	concerning the source of patients included in the study.	
22	*Were study subjects in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited over the same period of time?* For a study which does not specify the time period over which patients were recruited, the question should be answered as unable to determine.	Yes = 1 No = 0 Unable to determine = 0
23	*Were study subjects randomized to intervention groups?* Studies which state that subjects were randomized should be answered yes except where method of randomization would not ensure random allocation. For example alternate allocation would score no because it is predictable.	Yes = 1 No = 0 Unable to determine = 0
24	*Was the randomized intervention assignment concealed from both patients and health care staff until recruitment was complete and irreversible?* All non-randomized studies should be answered no. If assignment was concealed from patients but not from staff, it should be answered no.	Yes = 1 No = 0 Unable to determine = 0
25	*Was there adequate adjustment for confounding in the analyses from which the main findings were drawn?* This question should be answered no for trials if the main conclusions of the study were based on analyses of treatment rather than intention to treat; the distribution of known confounders in the different treatment groups was not described; or the distribution of known confounders differed between the treatment groups but was not taken into account in the analyses. In non-randomized studies if the effect of the main confounders was not investigated or confounding was demonstrated but no adjustment was made in the final analyses the question should be answered as no.	Yes = 1 No = 0 Unable to determine = 0
26	*Were losses of patients to follow-up taken into account?* If the numbers of patients lost to follow-up are not reported, the question should be answered as unable to determine. If the proportion lost to follow-up was too small to affect the main findings, the question should be answered yes.	Yes = 1 No = 0 Unable to determine = 0
Power		
27*	*Did the study have sufficient power to detect a clinically important effect where the probability value for a difference being due to chance is less than 5%?* Sample sizes have been calculated to detect a difference of x% and y%.	Yes = 1 No = 0 Unable to determine = 0

The modified version which we employed in this study therefore has a maximum score of 28 Each paper was assigned a grade of "excellent" (24–28 points), "good"(19–23 points), "fair" (14–18 points) or "poor" (<14 points).

T-作者是否以表格和圖表總結試驗結果?

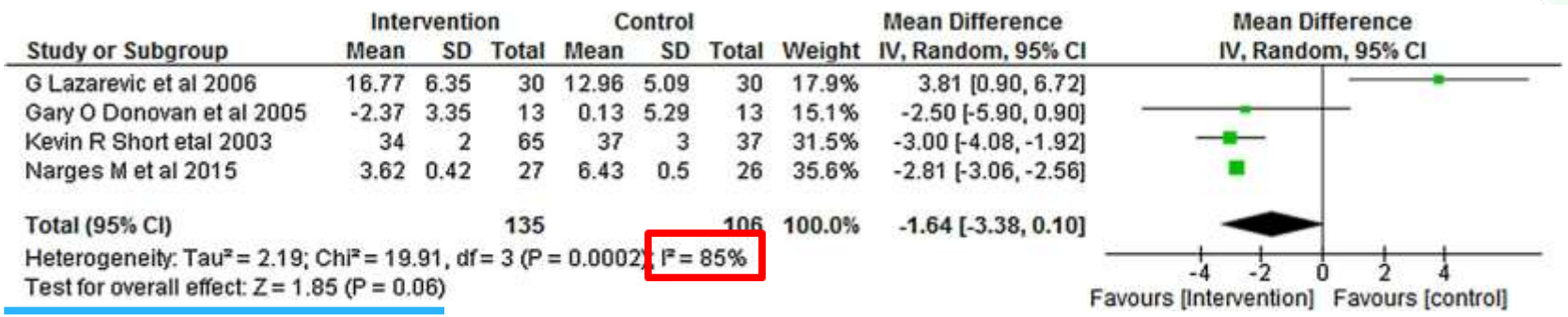


Fig. 2. Forest plot for analysis of fasting insulin level.

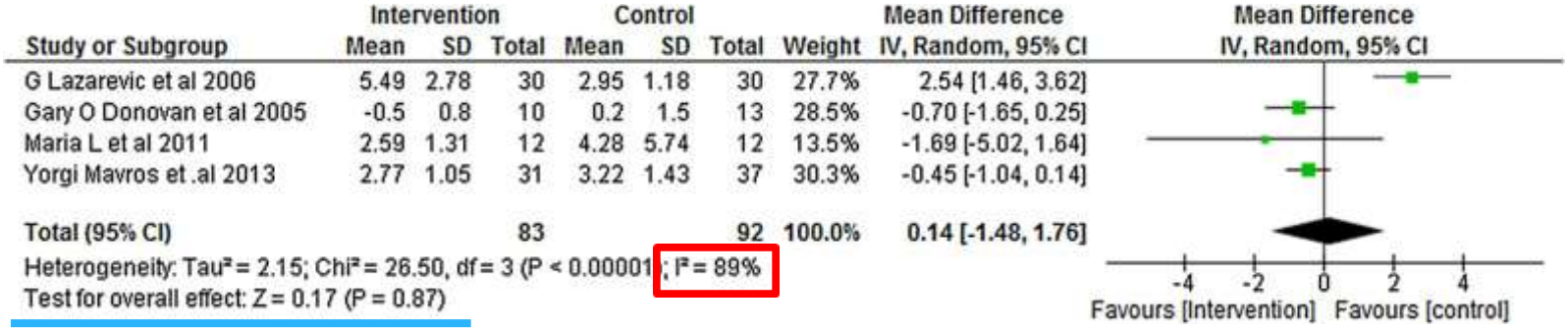


Fig. 3. Forest plot for analysis of homeostatic model assessment for insulin resistance.

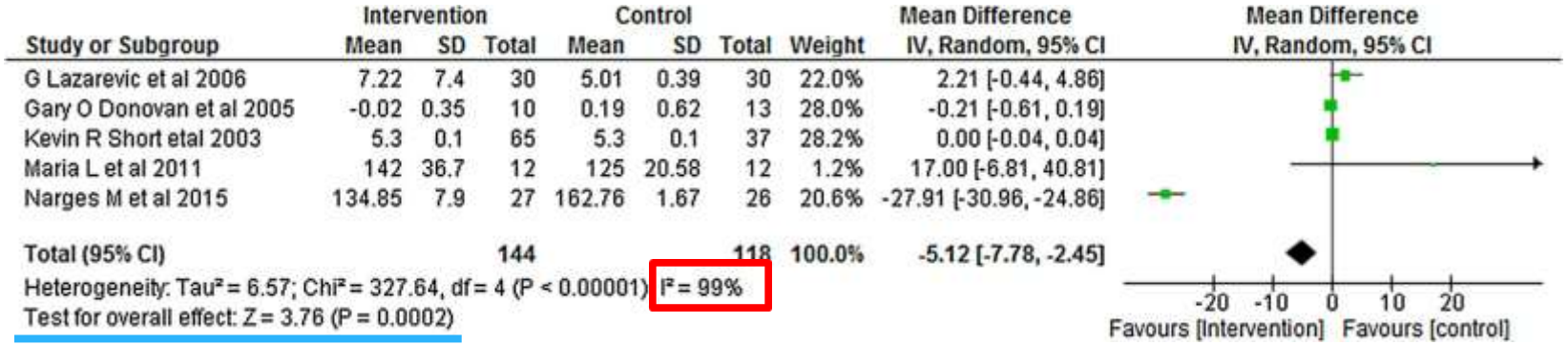


Fig. 4. Forest plot for analysis of fasting blood sugar.

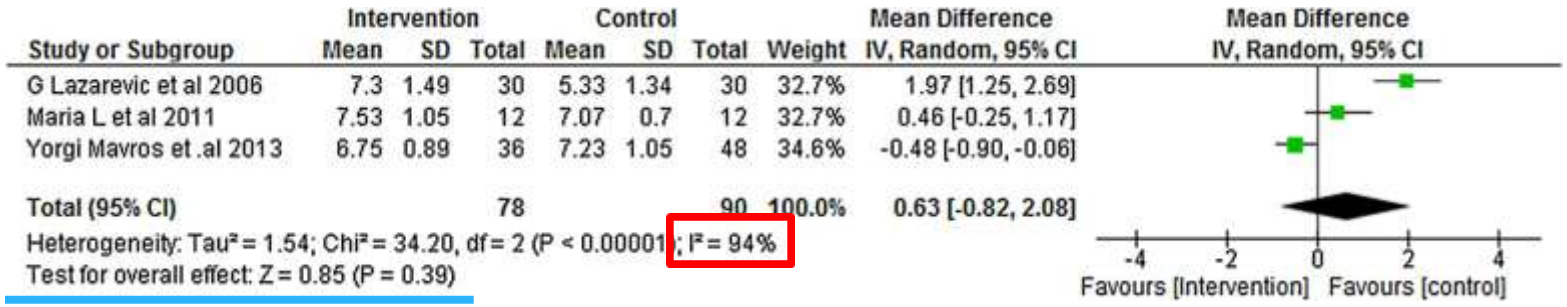


Fig. 5. Forest plot for analysis of glycated hemoglobin.

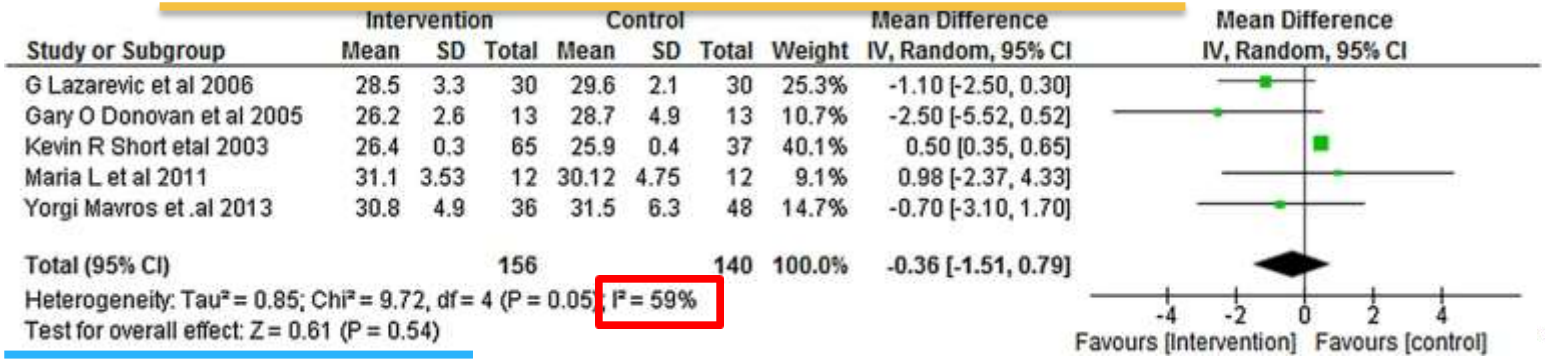


Fig. 6. Forest plot for analysis of body mass index.

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H-試驗的結果是否相近-異質性?

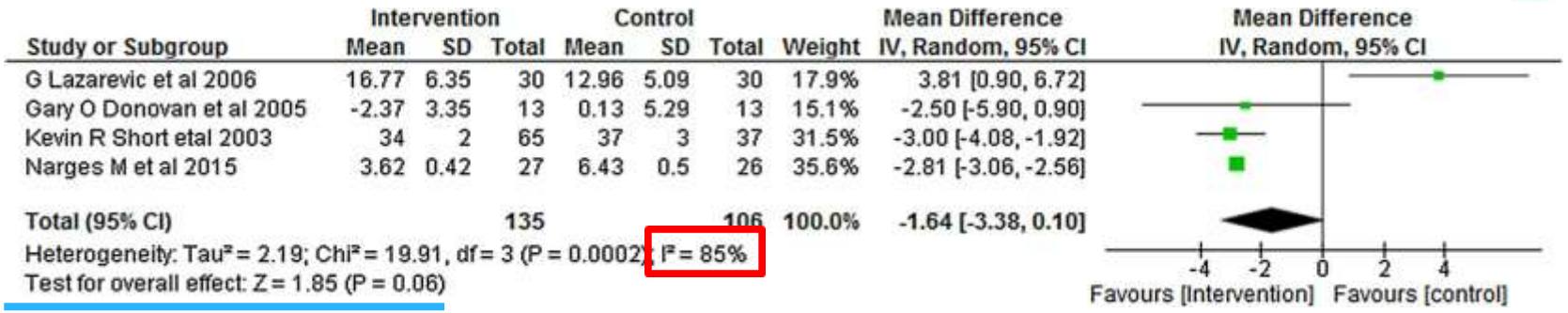

Fig. 2. Forest plot for analysis of fasting insulin level.

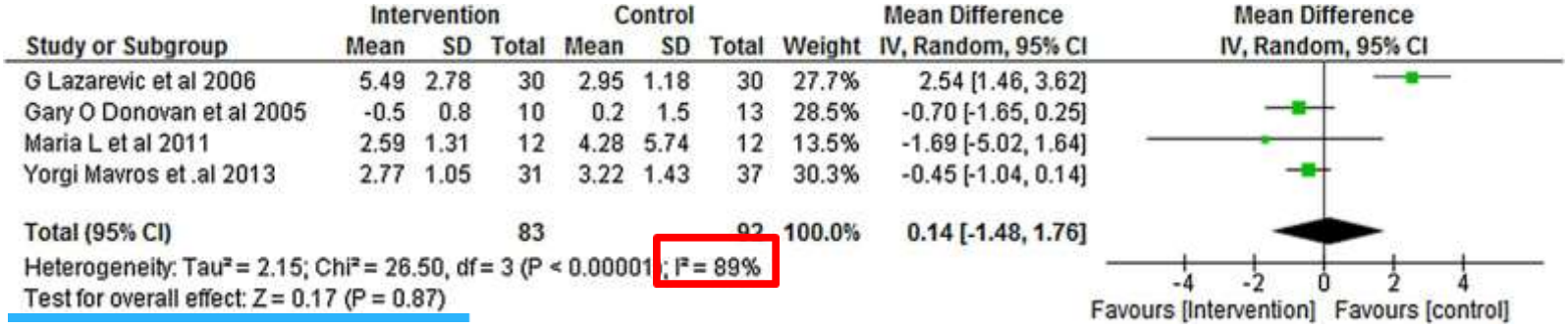

Fig. 3. Forest plot for analysis of homeostatic model assessment for insulin resistance.

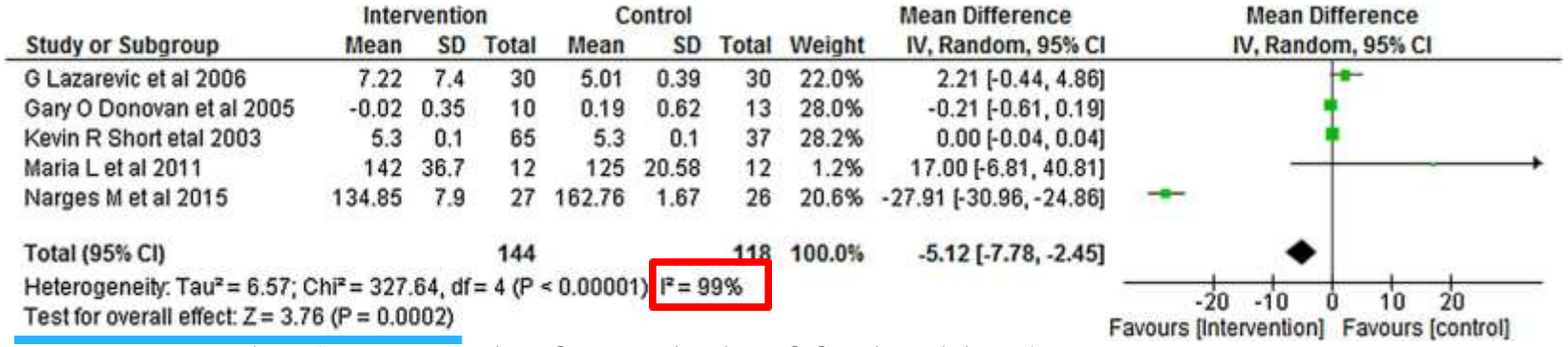

Fig. 4. Forest plot for analysis of fasting blood sugar.

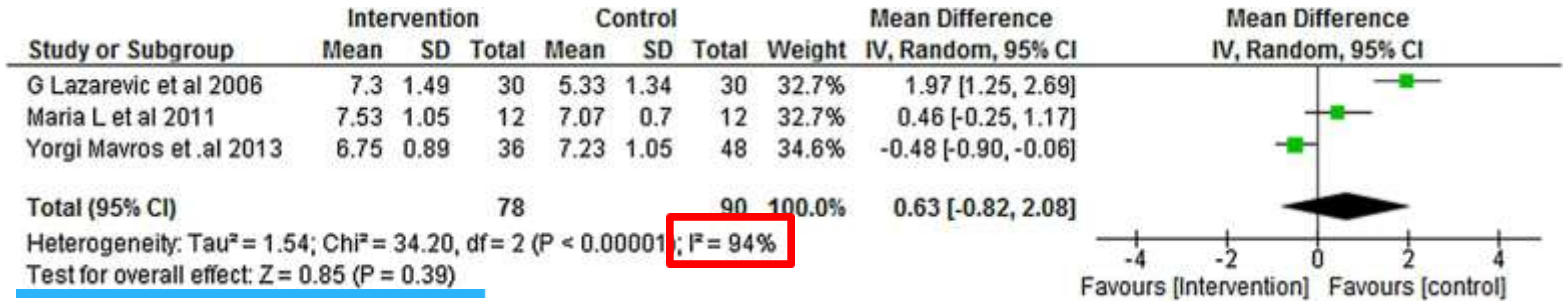

Fig. 5. Forest plot for analysis of glycated hemoglobin.

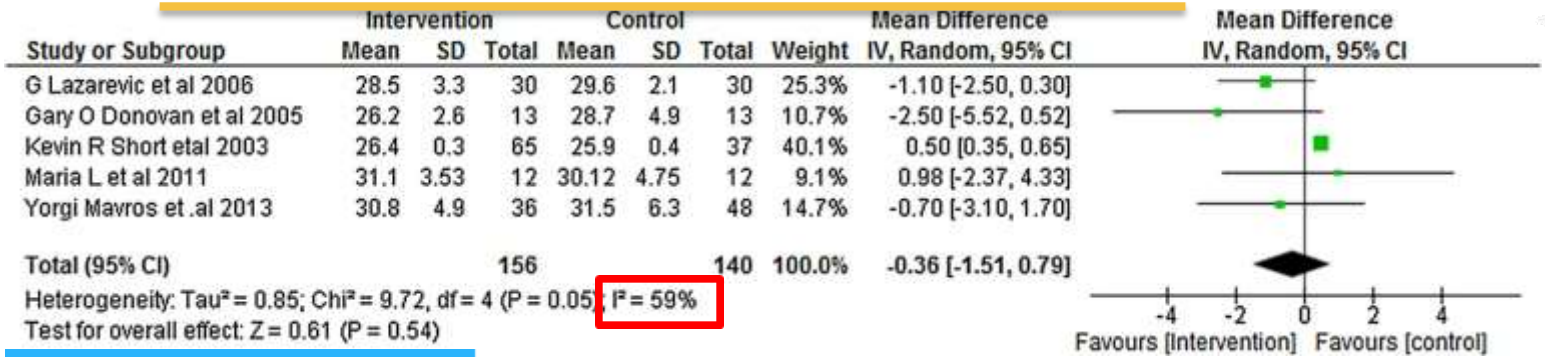

Fig. 6. Forest plot for analysis of body mass index.

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評讀總表

系統性文獻回顧的品質		
研究是否找到(Find) 所有的相關證據？	評讀結果	不清楚
文獻是否經過嚴格評讀(Appraisal)？	評讀結果	不清楚
是否只納入(Included)具良好效度的文章？	評讀結果	是
作者是否以表格和圖表「總結」(Total up) 試驗結果？	評讀結果	是
試驗的結果是否相近－異質性(Heterogeneity)？	評讀結果	是

Appraisal sheets(FAITH)

- Appraisal Tool
  - [統合分析 Meta-analysis]
  - 步驟1：研究探討的問題為何（PICO）
  - 步驟2：研究的品質如何（內在效度）
  - 步驟3：研究結果之意義為何（效益）

結論

- 研究納入846名參與者，干預組為440人，對照組為406人。
- 研究結果顯示，結構性運動訓練計劃之介入，對type 2糖尿病者的**空腹胰島素（fasting insulin level）**，沒有顯著差異(P=0.06)。
- 研究結果顯示，結構性運動訓練計劃之介入，對type 2糖尿病者的**胰島素阻抗(Insulin resistance)**，沒有顯著差異(P=0.87)。
- 研究結果顯示，結構性運動訓練計劃之介入，對type 2糖尿病者的**空腹血糖(fasting blood sugar)**，有**中等強度的效果(P=0.0002)**。

結論

- 研究結果的顯示，結構性運動訓練計劃之介入，對type 2糖尿病者的**糖化血紅蛋白(glycated hemoglobin)**，沒有顯著差異(P=0.39)。

- 研究結果的顯示，結構性運動訓練計劃之介入，對type 2糖尿病者的**體重指數(body mass index)**，沒有顯著差異(P=0.39)。

- 綜整上述結果來看，運動訓練對於**提昇type 2糖尿病者的血糖控制**，為一個有效的介入措施。

結論

- 針對重要PICO問題的結果指標，均個別以平均差異、p值及I^2值呈現試驗是否具有異質性，整體而言，結果異質性高，內文提及在當前的分析中，用於確定空腹胰島素的方法因研究而異。許多人沒有評估腹部脂肪百分比，這可能是與胰島素阻抗和葡萄糖水平相關的強烈獨立因素。此外，運動處方的差異（類型，強度，持續時間，頻率和干預時間）導致異質性。

結論

- **有氧運動**對於糖尿病人是有幫助的，如：中等強度的運動包括：快走、慢跑、爬山等。
- **步行**是最安全、簡便、易於堅持的一種方式，被認為是老年糖尿病患者（尤其是體質較差者）的首選運動項目。
- 糖尿病患者也可結合自己的興趣愛好、實際病情、體力狀況、環境條件等具體情況，因地制宜地選擇適合自己的運動形態。
- 運動必須遵守的3個原則:循序漸進、量力而行，以及持之以恆。

限制與建議

- 納入的研究文章**樣本數很小**。
- 需要有**足夠樣本數**的研究和**隨機對照**試驗，以提供具有統計意義的結果。

糖尿病人運動處方之建議

艾蜜莉(2018，3月14日)．這樣運動更健康，給第二型糖尿病患的大補帖．
https://heho.com.tw/archives/9625

能依系統性文獻回顧之結論回答T2D患者的問題嗎?

- 是否同意將居家運動訓練，納入本院糖尿病患者血糖控制的常規護理措施?

同意：31 票

仍有疑慮 : 3票

不同意：1票

thank you for your attention