Impact of the conversation map tools in patients with type 2 diabetes mellitus
A PRISMA-compliant meta-analysis of randomized controlled trials
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Abstract
Background: Diabetes is one of the leading causes of morbidity and mortality worldwide, and type 2 diabetes is the most common type accounting for 90% of all diabetes cases. Health education is considered as the first choice to control blood glucose levels. We conducted a meta-analysis to assess the effect of health education tool “Conversation Map” in diabetes patients to control blood glucose.

Methods: We searched PubMed, Embase, Cochrane Central Register of Controlled Trials, China Knowledge Resource Integrated Database, and China Science Periodical Database up to December, 2015. We assessed the results using the inverse variance method to pool diabetes relative indicators, and assessed the heterogeneity of the results using I-square.

Results: We collected 22 trials in our meta-analysis, which included 3360 patients. The results showed that the fasting blood-glucose level was significantly reduced in the type 2 diabetes group patients educated with “Conversation Map” when compared to their respective control groups (weighted mean difference [WMD]: \(-2.23, 95\%\) confidence interval [CI]: \(-2.70 to -1.76, P<0.001\)). Also a significant reduction of 2-hour postprandial blood glucose (WMD: \(-1.59, 95\%\) CI: \(-2.27 to -0.92, P<0.001\)) and Hemoglobin A1C levels (WMD: \(-0.63, 95\%\) CI: \(-1.08 to -0.17, P<0.001\)) was also observed when compared to the control groups.

Conclusion: Conversation Map is an effective health education tool for type 2 diabetes, and significantly reduced patients’ blood glucose related index.

Abbreviations: 2hPBG = 2 hours postprandial blood glucose, CIs = confidence intervals, FBG = fasting blood glucose, WMD = weighted mean difference.

Keywords: conversation map, meta-analysis, type 2 diabetes

1. Introduction
The International Diabetes Federation has published a new interactive health education tool for diabetes which is known as “Conversation Map,” and is composed of pictures, dialogue cards, and guidelines. The education model is based on dialogues without any pressure to encourage patients in developing their knowledge to accept diabetes, change their behaviors of daily life, and improve their capacity for self-management. It has been applied to type 2 diabetes patients and has shown promising results. Previous study have proven that “Conversation Map” can control and delay the onset of diabetes and its complications, and have shown better results when compared to other types of education.\textsuperscript{11} Therefore, “Conversation Map” has been more recently considered as the first choice in diabetes health education. Recently, numerous studies have evaluated the effect of “Conversation Map” in patients with type 2 diabetes have already completed. Although there have been a significant increase in the number of clinical trials using “Conversation Map,” some trials suggested the effects of “Conversation Map” education in diabetes patients which are still unclear. To better understand any potential impact of “Conversation Map” in patients with type 2 diabetes, data from these studies needs to be evaluated and combined with data from other countries. In this study, we systematically analyzed the effect of “Conversation Map” for diabetes patients, and provide a better clinical guideline for diabetes education.

2. Methods
2.1. Data sources, search strategies, and study selection
We searched PubMed, Embase, Cochrane Central Register of Controlled Trials, China Knowledge Resource Integrated Database, and China Science Periodical Database using the following keywords:
“Conversation map,” “diabetes,” and “random.” We did not apply any language restrictions and included all relevant articles up to December 2015. We also searched the reference lists of identified trials.

Two reviewers independently identified the eligible reports. Discrepancies were resolved through group discussion. Eligibility criteria included the following requirements: type 2 diabetes patients for treatment; randomized controlled trials; and outcome included at least one blood glucose test. The exclusion criteria included the following: duplicate articles; unrelated research; conference papers; and unclear results. This systematic review adhered to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) Statement and Checklist.[2] Ethics approval was not necessary for this study, as only deidentified pooled data from individual studies were analyzed.

2.2. Data extraction and quality assessment

Two authors compiled data using a predefined information sheet. The following data types were extracted from the included articles: author, year, country, sample size, mean age, glycated hemoglobin (HbA1c) levels, fasting blood glucose (FBG) levels, 2 hours postprandial blood glucose levels, Intervention of Diabetes Conversation Map group data, control group data, outcomes, and follow-up results. Two reviewers independently conducted the risk of design bias assessments on the included studies using the 5-points Jadad Scale,[3] and those with 3 to 5 points which represents high-quality trials. The following outcome parameters were quantitatively evaluated in this review: HbA1c, FBG, and 2 hours postprandial blood glucose.

2.3. Statistical analysis

We used the inverse variance method to pool continuous data and the results were presented as weighted mean difference (WMD) with 95% confidence intervals (CIs). The I² statistics were calculated to evaluate the extent of variability which was attributed to statistical heterogeneity between trials.[4] In the absence of statistical heterogeneity (I² < 50%), we used a fixed-effect model, a random-effect model was used otherwise.[5] Predefined subgroup analyses were performed on country, patients’ mean age, and intervention time. We assessed for publication bias by visually examining the funnel plots and using the Begg-Mazumdar[6] and Egger tests.[7,8] A nonparametric “trim-and-fill” method was used to determine the stability if publication bias was found.[9] Generally, a 2-sided P value less than 0.05 was considered statistically significant, and we analyzed data with Review Manager 5.3.3 (Nordic Cochrane Centre, Rigshospitalet, Denmark) and STATA (Version 12.0 ) (Stata Corp. LP, Lakeway Drive College Station, Texas, USA).

3. Results

Our research returned 68 results after removing duplicates, from which we collected 22 trials in our meta-analysis[10–31] (Fig. 1). All the studies recruited type 2 diabetes patients (Table 1). Two articles did not
Table 1: Baseline characteristics.

| Study                  | Country       | Sample size (DCM/C) | Mean age     | Disease status | \(\text{HbA}_1\text{c} \text{, \% (DCM/C)}\) | FBG, mmol/L \text{(DCM/C)} | 2hPBG \text{(DCM/C)} | DCM\textsuperscript{TM} group | Control group | Reported outcomes | Follow-up duration | Jadad score |
|------------------------|---------------|---------------------|--------------|----------------|-----------------------------------------------|-----------------------------|-----------------------------|---------------------|------------------|-------------------|------------------|-------------|
| Yang 2015\textsuperscript{[17]} | Taiwan        | 237 (121/116)       | 58.99±13.51  | T2DM           | 9.45±1.32/9.70±2.25                            | 10.94±4.36/10.93±4.94      | NA                          | Four–2-hour sessions every week for 12 weeks | Usual care | HbA\textsubscript{c}; FBG | 12 months         | 4            |
| Penalba 2014\textsuperscript{[12]} | Spain         | 310 (148/162)       | 64 (58–68)   | T2DM           | 7.2±1.04/7.3±0.36                              | NA                          | NA                          | Four sessions (3–10 patients per session) with a duly trained facilitator. Each session lasted 2–3 hours, and the interval between sessions did not exceed 2 weeks, with a maximum interval of 6 weeks between the first and last sessions. | Usual care | HbA\textsubscript{c}; ADKnowl score; SDSCA; DES; PAID score; EQ-5D score; VAS of EQ-5D | 6 months         | 3            |
| Reaney 2013\textsuperscript{[13]} | Spain and Germany | 681 (330/351)      | 62.0±9.59    | T2DM           | 7.2±1.11/7.0±1.04                              | NA                          | NA                          | Four CM-based group education sessions (3–10 participants, 2–3 hours each at 1-to 2-week intervals during a 6-week postbaseline period) | Usual care | HbA\textsubscript{c}; ADKnowl score; DES; EQ-5D; PAID | 6 months         | 3            |
| Ning Yuan 2012\textsuperscript{[19]} | China         | 64 (32/32)          | 38–71        | T2DM           | 10.8±2.73/10.4±2.88                             | 13.18±2.70/12.64±2.26      | 15.0±2.93/16.1±2.60       | 1 session 1 hour every 2 weeks for 4 times | Usual care | HbA\textsubscript{c}; FBG; 2hGB | 8 weeks           | 1            |
| Zhong 2011\textsuperscript{[20]}   | China         | 100 (50/50)         | 52.46±6.71   | T2DM           | 8.5±1.2/8.4±1.3                                | 12.3±1.8/12.1±1.7          | 19.5±1.9/18.9±2.0        | 1 session 1 hour every day for 4 times | Usual care | HbA\textsubscript{c}; DSCS | 6 months           | 1            |
| Wang 2011\textsuperscript{[21]}    | China         | 46 (23/23)          | 57.75±7.22   | T2DM           | 7.59±1.73/7.50±1.80                            | 8.72±2.31/8.25±2.14        | 12.34±3.96/11.96±3.85    | 1 session 1–2 hours every week | Usual care | HbA\textsubscript{c}; FBG; 2hGB, DSCS | 12 weeks          | 2            |
| Cheng Yuan 2012\textsuperscript{[22]} | China        | 460 (236/224)       | 50.6±14.7    | T2DM           | 8.5±2.3/8.2±1.8                                | 13.1±3.1/12.8±3.0          | 16.4±4.5/15.8±4.1       | 1 session 1–2 hours every week | Usual care | HbA\textsubscript{c}; FBG; 2hGB, DSCS | 6 months          | 1            |
| Xiao 2011\textsuperscript{[23]}    | China         | 110 (60/50)         | 56.56±8.08   | T2DM           | 9.17±2.45/8.98±2.16                            | NA                          | NA                          | 1 session 1–2 hours every week | Usual care | HbA\textsubscript{c}; FBG; 2hGB, DSCS | 12 weeks          | 2            |
| LingX Li 2011\textsuperscript{[24]} | China         | 46 (23/23)          | 47.78        | T2DM           | 8.9±2.1/8.9±1.9                                | 9.5±2.9/9.3±2.3            | 13.5±3.9/13.8±3.5        | 1 session 1 hour for every month | Usual care | HbA\textsubscript{c}; modified 2SCS | 12 weeks          | 0            |
| Binghui Li 2011\textsuperscript{[25]} | China        | 84 (42/42)          | 50.8±15.01   | T2DM           | 8.5±2.4/8.1±1.9                                | 13.1±3.1/12.8±3.0          | 16.4±4.5/15.8±4.1       | 1 session 1–2 hours every week for 6 months | Usual care | HbA\textsubscript{c}; FBG, 2hGB, DSCS | 6 months          | 1            |
| Maimaiti 2014\textsuperscript{[14]} | China         | 90 (45/45)          | 66.6±4.45    | T2DM           | 8.9±2.1/8.9±1.9                                | 9.36±1.1/1.2±9/           | NA                          | 1 session 1 hour for every week | Usual care | HbA\textsubscript{c}; FBG, 2hGB | 6 months          | 1            |
| Du 2012\textsuperscript{[26]}      | China         | 260 (130/130)       | 54.55±9.86   | T2DM           | 8.9±2.1/8.9±1.9                                | 9.36±1.1/1.2±9/           | NA                          | 1 session 1 hour for every week | Usual care | HbA\textsubscript{c} | 3 months          | 1            |
| Study        | Country   | Sample size (DCM/C) | Mean age | Disease status | HbA1c, % (DCM/C) | FBG, mmol/L (DCM/C) | 2hPBG (DCM/C) | DCM™ group | Control group | Reported outcomes | Follow-up duration | Jadad score |
|-------------|-----------|---------------------|----------|----------------|------------------|-------------------|-----------------|-------------|---------------|-------------------|-------------------|-------------|
| Xu Liu 2013[27] | China     | 100 (50/50)         | 50.91 ± 11.17 | T2DM           | 9.360 ± 1.224    | 8.9 ± 2.1/8.9 ± 1.9 | 13.5 ± 3.9/13.8 ± 3.5 | 1 hour every day for 4 times | Usual care | HbA1c; FBG; 2hGB | 3 months | 1 |
| JianS Liu 2015[25] | China     | 84 (42/42)          | 60.1 ± 10.71  | T2DM           | 8.9 ± 2.1/8.8 ± 1.8 | 16.8 ± 4.5/16.2 ± 4.2 | 9.3 ± 2.3/9.1 ± 2.1 | 1-1.5 hours every week for 8 weeks | Usual care | HbA1c; FBG; 2hGB | 8 weeks | 2 |
| Zheng 2013[28] | China     | 60 (30/30)          | 52.5 ± 2.08   | T2DM           | 8.1 ± 2.7/7.9 ± 3.0 | 12.3 ± 2.1/11.9 ± 3.5 | 16.1 ± 3.3/15.9 ± 3.5 | 70 minutes every time for 3 times every month | Usual care | HbA1c; FBG; 2hGB | NA | 1 |
| Zheng 2011[18] | China     | 120 (60/60)         | 60 (42–78)    | T2DM           | 7.8 ± 3.1/8.2 ± 2.6 | 12.8 ± 2.8/11.7 ± 3.1 | 15.6 ± 4.3/16.3 ± 3.8 | 1-1.5 hours every Sunday for 5 months | Usual care | HbA1c; FBG; 2hGB; DSCS score | 5 months | 1 |
| Zhan 2013[30] | China     | 100 (52/48)         | NA         | T2DM           | 8.41 ± 1.2/8.17 ± 1.13 | 9.92 ± 0.7/9.85 ± 1.13 | 10.05 ± 0.6/10.01 ± 1.4 | 1 session 1–1.5 hours every week | Usual care | HbA1c; FBG; 2hGB | 6 months | 1 |
| Yi 2013[19]   | China     | 122 (61/61)         | 35-70       | T2DM           | 9.8 ± 1.8/9.5 ± 1.59 | 11.0 ± 2.5/10.9 ± 2.35 | 16.12 ± 2.2/17.58 ± 2.36 | 1 hour per week for 8 weeks | Usual care | HbA1c; FBG; 2hGB | 8 weeks | 1 |
| Tang 2012[31] | China     | 60 (30/30)          | 55.61 ± 12.42 | T2DM           | 7.82 ± 2.8/8.35 ± 4.02 | 13.0 ± 3.0/12.9 ± 3.5 | 16.5 ± 4.4/15.9 ± 4.4 | 1 session 2 hours per week | Usual care | HbA1c; FBG; DSCS score | 6 months | 1 |
| Peng 2012[32] | China     | 96 (48/48)          | 48.8 ± 14.54 | T2DM           | 8.3 ± 2.3/8.4 ± 2.4 | 13.0 ± 3.0/12.9 ± 3.5 | 16.5 ± 4.4/15.9 ± 4.4 | 1 session 1–2 hours every week for 6 months | Usual care | HbA1c; FBG; 2hGB; DSCS score | 6 months | 1 |
| Ding 2015[33] | China     | 70 (35/35)          | 52.65 ± 11.46 | T2DM           | 7.59 ± 0.9/7.64 ± 0.72 | 9.51 ± 1.0/9.44 ± 1.34 | 12.13 ± 1.2/12.45 ± 1.26 | 2 sessions 0.5–1 hour every 2 weeks for 3 months | Usual care | HbA1c; FBG; 2hGB; DSCS score | 3 months | 1 |
| Ye 2012[34]   | China     | 60 (30/30)          | NA         | T2DM           | 9.5 ± 1.3/8.4 ± 2.3 | 13.1 ± 2.8/12.2 ± 2.6 | 16.3 ± 3.9/15.1 ± 2.9 | 1 session 1–2 hours every week | Usual care | HbA1c; FBG; 2hGB | 6 months | 1 |

2hPBG = 2 hours postprandial blood glucose, C = control group, DCM = Diabetes Conversation Map™ group, T2DM = type 2 diabetes mellitus.
Effect of conversation map on fasting blood-glucose levels. Figure 2.
rate and mortality, and reduce the consumption of social medical resources.\(^{[13]}\) In this study, we analyzed the heterogeneity of the studies using subgroup analysis of country, the patients’ age and intervention time for the following reasons. First, the patient’s age can have implications on their cognitive ability and compliance; generally, older patients have lower cognitive ability and poor compliance.\(^{[12,15,16]}\) In 2hPBG results, age was a source of heterogeneity, but the results were robust. However, for the HbA1c results, there were more significant results in patients younger than 60 years old. Education intervention time is another influential factor; shorter intervention time may not achieve desired results.\(^{[18]}\) For HbA1c levels, there was no significant difference between groups. In addition, the meta-regression analysis showed no significant correlation between the

| Table 2 | Subgroup analysis of effect of Conversation Map on type 2 diabetes. |
|---------|---------------------------------------------------------------|
| Cancer sites | Group | WMD and 95% CI | P value | Heterogeneity, % | P value for heterogeneity |
| FBG | Country | | | |
| China | | −2.23 (−2.70, −1.76) | <0.001 | 90.7 | <0.001 |
| Europe | | | | |
| Age | ≥60 | −2.69 (−4.52, −0.85) | 0.004 | 89.3 | <0.001 |
| <60 | −2.13 (−2.83, −1.43) | <0.001 | 93.0 | <0.001 |
| Intervention time | ≥12 weeks | −2.06 (−2.68, −1.44) | <0.001 | 93.6 | <0.001 |
| <12 weeks | −1.94 (−2.80, −1.08) | <0.001 | 75.1 | <0.001 |
| 2hPBG | Country | | | |
| China | | −1.59 (−2.27, −0.92) | <0.001 | 83.9 | <0.001 |
| Europe | | | | |
| Age | ≥60 | −2.14 (−2.99, −1.29) | <0.001 | 0.0 | 0.594 |
| <60 | −1.87 (−2.32, −1.42) | <0.001 | 15.3 | 0.314 |
| Intervention time | ≥12 weeks | −1.73 (−2.04, −1.42) | <0.001 | 9.1 | 0.359 |
| <12 weeks | −0.65 (−2.40, 1.10) | 0.467 | 90.5 | <0.001 |
| HbA1c | Country | | | |
| China | | −0.68 (−1.30, −0.07) | 0.029 | 95.4 | <0.001 |
| Europe | | −0.05 (−0.15, 0.06) | 0.400 | 0.0 | 0.352 |
| Age | ≥60 | 0.20 (−0.47, 0.87) | 0.562 | 96.2 | <0.001 |
| <60 | −0.72 (−1.42, −0.02) | 0.045 | 94.1 | <0.001 |
| Intervention time | ≥12 weeks | −1.11 (−2.00, −0.21) | 0.015 | 93.5 | <0.001 |
| <12 weeks | −0.37 (−1.04, 0.29) | 0.269 | 97.0 | <0.001 |

2hPBG = 2 hours postprandial blood glucose, CI = confidence interval, FBG = fasting blood glucose, HbA1c = glycated hemoglobin, WMD = weighted mean difference.

![Figure 3. Effect of conversation map on 2-hour postprandial blood glucose levels.](image)
intervention time and the blood glucose index. Based on the results of this study, we found that 12 weeks of intervention time can produce patients’ interest of health education and can well control the patients’ blood glucose. In our study, the baseline hemoglobin A1c levels ranged 7.2% to 10.8 for the Conversation Map group and 7.0% to 10.4% for the control group, and the mean changes of hemoglobin A1c in Conversation Map group ranged from $-6.9$ to $0.1$, and ranged from $-6.8$ to $0.1$ in the control group. Minor changes were observed in individual studies, but the summary results indicated that the Conversation Map was associated with reduced levels of hemoglobin A1c by 0.63%. Although the size of heterogeneity was not minimized according to the subgroup analysis, we noted that Conversation Map significantly reduced the levels of hemoglobin A1c in patients with a mean age of less than 60 years, whereas no impact observed in patients with a mean age of greater than 60 years. This is due to lower cognitive ability and poor compliance of the older patients. Furthermore, subgroup analysis on the basis of

| Study         | Mean difference (95% CI) | % Weight |
|---------------|-------------------------|----------|
| Zhong         | -0.71 (-1.49, 0.07)     | 4.8      |
| Wang          | -0.40 (-0.87, 0.07)     | 5.3      |
| Xiao          | -0.18 (-0.76, 0.40)     | 5.2      |
| LingX Li      | -0.73 (-1.90, 0.44)     | 4.1      |
| Zhang         | -0.50 (-1.45, 0.45)     | 4.5      |
| Ning Yuan     | -1.28 (-1.75, -0.81)    | 5.3      |
| Zheng Yuan    | -1.30 (-1.64, -0.96)    | 5.5      |
| Du            | -0.70 (-0.94, -0.46)    | 5.6      |
| Tang          | 1.53 (0.49, 2.57)       | 4.4      |
| Peng          | 0.63 (-0.67, 1.93)      | 3.9      |
| Ye            | -1.06 (-1.58, -0.54)    | 5.3      |
| Reaney        | -0.10 (-0.26, 0.06)     | 5.6      |
| Liu           | -3.75 (-4.30, -3.20)    | 5.2      |
| Zheng         | -0.10 (-1.11, 0.91)     | 4.4      |
| Lan           | -0.45 (-1.18, 0.28)     | 4.9      |
| Li             | -2.64 (-3.12, -2.16)    | 5.3      |
| LingX Li      | 0.00 (-0.14, 0.14)      | 5.6      |
| Maimaiti      | -1.40 (-2.13, -0.67)    | 4.9      |
| Liu           | 2.80 (2.22, 3.38)       | 5.2      |
| Ding          | -1.52 (-2.28, -0.76)    | 4.9      |
| Overall       | -0.63 (-1.38, -0.17)    | 100.0    |

Figure 4. Effect of conversation map on Hemoglobin A1C levels.

Figure 5. Funnel plot for FBG, 2hPBG, and HbA1c. 2hPBG = 2 hours postprandial blood glucose, FBG = fasting blood glucose, HbA1c = glycated hemoglobin.
country was performed, and we noted 2 studies\(^{[12,13]}\) conducted in Europe just reported hemoglobin A1c, whereas FBG and 2hPBG were not available. Although there was no significant difference between groups for hemoglobin A1c if the study conducted in Europe, whereas the result might variable due to smaller cohort included in this subset. Finally, although education levels might play an important role for intervention effect; however, the data about education levels in patients were available in few studies; we therefore did not provide the results in specific subpopulations with different education levels.

In this review, objective indicators, such as FBG, 2hPBG, and HbA1c, were used to reflect the patients’ blood glucose control in short and medium term. The subgroup analysis showed the study conducted in Europe, insufficient intervention time (< 12 weeks) or the patients are too old (≥ 60) and hence the Conversation Map education may not achieve the desired effect. The reason for intervention effects according to country have already stated above. Furthermore, these results indicated that the education time should be longer than 12 weeks, and pay more attention to make patient understand when patient’s age was over 60, if necessary intervention time and frequency should be increased.

To the best of the author’s knowledge, this is the first systematic review of “Conversation Map” health education interventions for blood glucose index in diabetes patients, and no relative meta-analysis existed before. However, this research had several limitations. First, we did not have specific individual data for all the trials, thus our statistical analysis could only be performed at the study level. Second, although subgroup analysis was used, there was still heterogeneity presented. Third, the design risks of included studies were relatively high. We suggest a unification of health education methods and patient selection methods with a well-designed randomized double-blind placebo controlled trials to find a more reliable conclusion.

5. Conclusion
Conversation Map is an effective health education tool for type 2 diabetes, and could significantly reduce patients’ blood glucose related index. Further health education tools are needed to prevent and delay the development of type 2 diabetes mellitus in future.

Acknowledgments
The study was supported by Guangdong Medical Scientific Research Fund (No.A20144422). The funders had no role in the study design, data collection and analysis, decision to publish, or preparation of the article.

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