Do "Nurse Interventions" Positively Impact both Behavioral and Clinical Outcomes in Patients with Diabetes?

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Background

- Diabetes mellitus (DM) affects nearly 424.9 million adults worldwide, estimated to rise to over 628.6 million by 2040.[1]
- Even more alarming is that many patients are not reaching recommended HbA1c target levels.[2]
- Research has shown that nurses and other allied health professionals can be instrumental in good diabetes management.[3-5]
- Educational programs have been shown to increase use of primary and preventive services and lower use of acute, inpatient hospital services. Patients who participate in diabetes education are also more likely to follow best practice treatment recommendations.[6]

Research Hypothesis and Objective

- Objective: to examine applications and interventions used by nurses to improve clinical and behavioral outcomes in diabetes.
- Hypothesis: interventions such as diabetes education delivered by nurses and diabetes educators improve patient outcomes.

Methods

- A PICO(TSS)-based standardized review protocol to define eligibility criteria for search and screening (Table 1).

Table 1. Methods - PICO(TSS) criteria, search, extraction and analysis details

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Population	Adults with type 1 or type 2 diabetes mellitus
Interventions	Any nursing interventions, including but not limited to: • Support Programs • Pilot Programs • Telemedicine/mHealth/digital health-facilitated nursing interventions • Diabetes self-management programs
Comparators	Any
Outcomes	Efficacy/effectiveness for adherence: • Adherence • Drug Utilization • Quality of Life • Compliance • Persistence • Initiation • Acceptance • HbA1c Safety: • Hypoglycemia
Timing (of outcomes)	Any
Setting/context	Any
Study design	• Randomized controlled trials • Non-randomized controlled trials • Observational studies
Search	• Medline (PubMed), Embase (OVID), and CENTRAL (Wiley) • Conducted September 2017 • Language (English) • Subject (human) limits applied
Data extraction	• Digital Outcome Conversion (DOC) Data version 2.0 software platform (Doctor Evidence, LLC, Santa Monica, CA, USA) • Doctor Evidence universal electronic extraction form, based on a standardized data configuration protocol • Dual extractions with quality control and oversight • All terms for characteristics and outcomes were collected as reported and synonyms were "bound" before analysis using the DOC Ontology System
Analysis	• Pair-wise meta-analysis comparing nurse interventions to standard of care for glycemic control, hypoglycemia, and patient-reported outcomes (PROs) • Analyses using the DOC Data 2.0 advanced web-based platform, stratified by type of intervention • Qualitative review of patient engagement outcomes

Definitions:

- "Nurse:" Registered Nurses (RN), Licensed Vocational Nurses (LVN), Nurse Practitioners (NP), or Certified Diabetes Educators (CDE). Physicians, physicians assistants, and pharmacists, unless defined as certified diabetes educators, were excluded.
- General diabetes education programs: informal self-management or disease education delivery to patients that did not follow a structured or validated program.
- Specialized diabetes programs: tailored programs by governing agencies or countries in order to improve diabetic outcomes (e.g., Diabetes Self-Management Education).
- Digital health technology programs: any intervention delivered by a "nurse" that used mobile or web-based technology to guide educational programs or record patient data for monitoring.
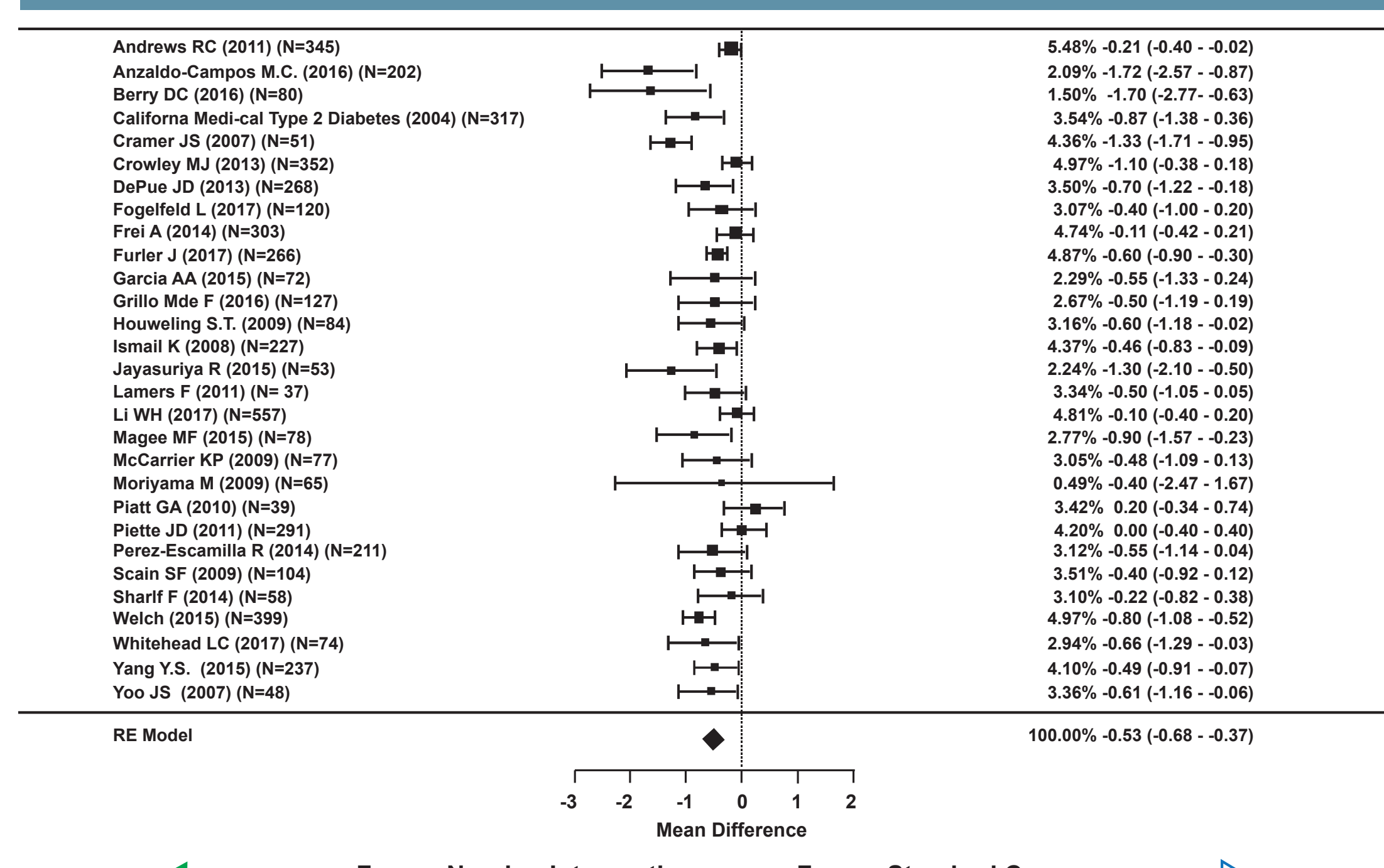
Results

HbA1c Results:

Figure 1. HbA1c levels – Nurse delivered general diabetes education interventions vs. standard care
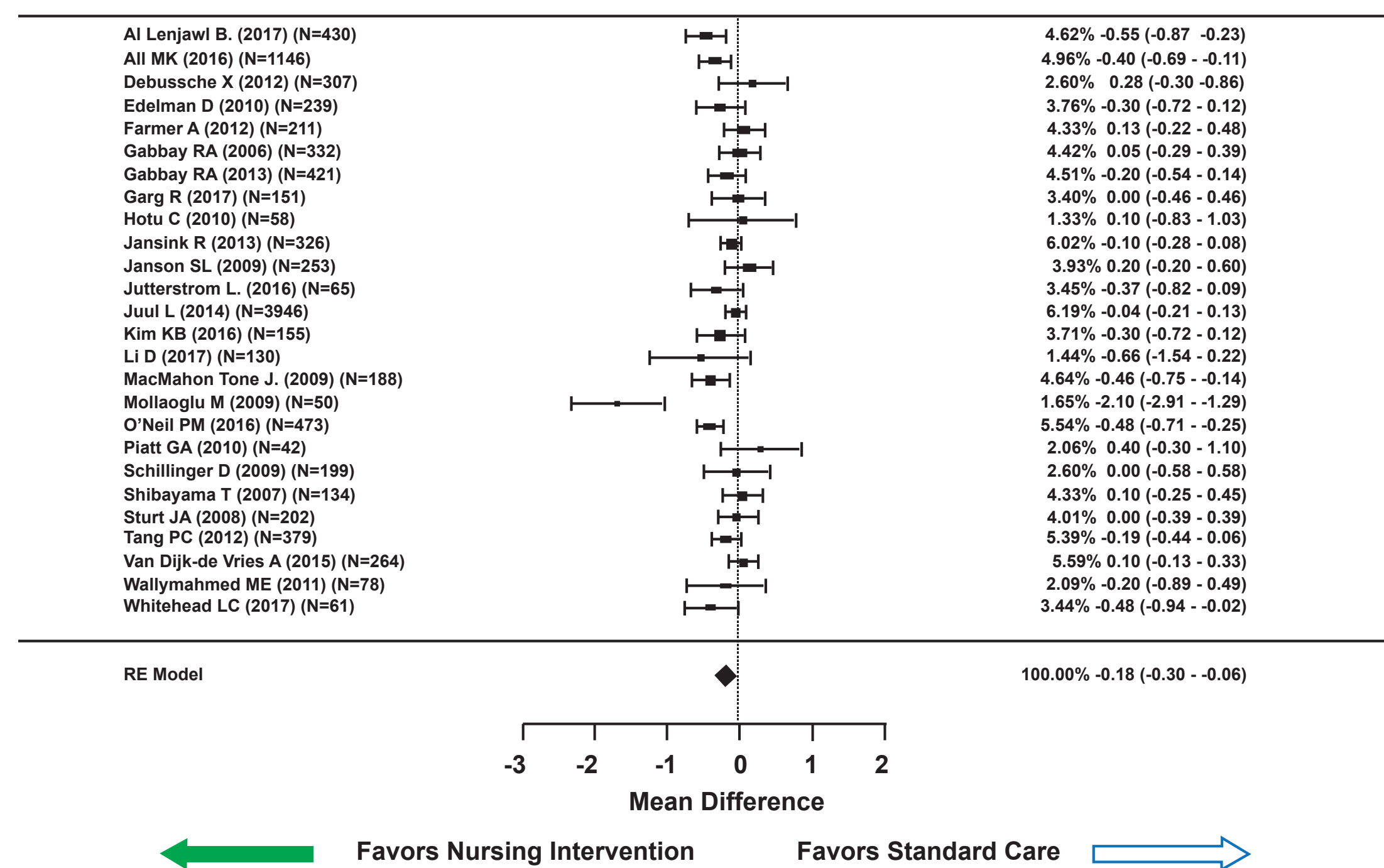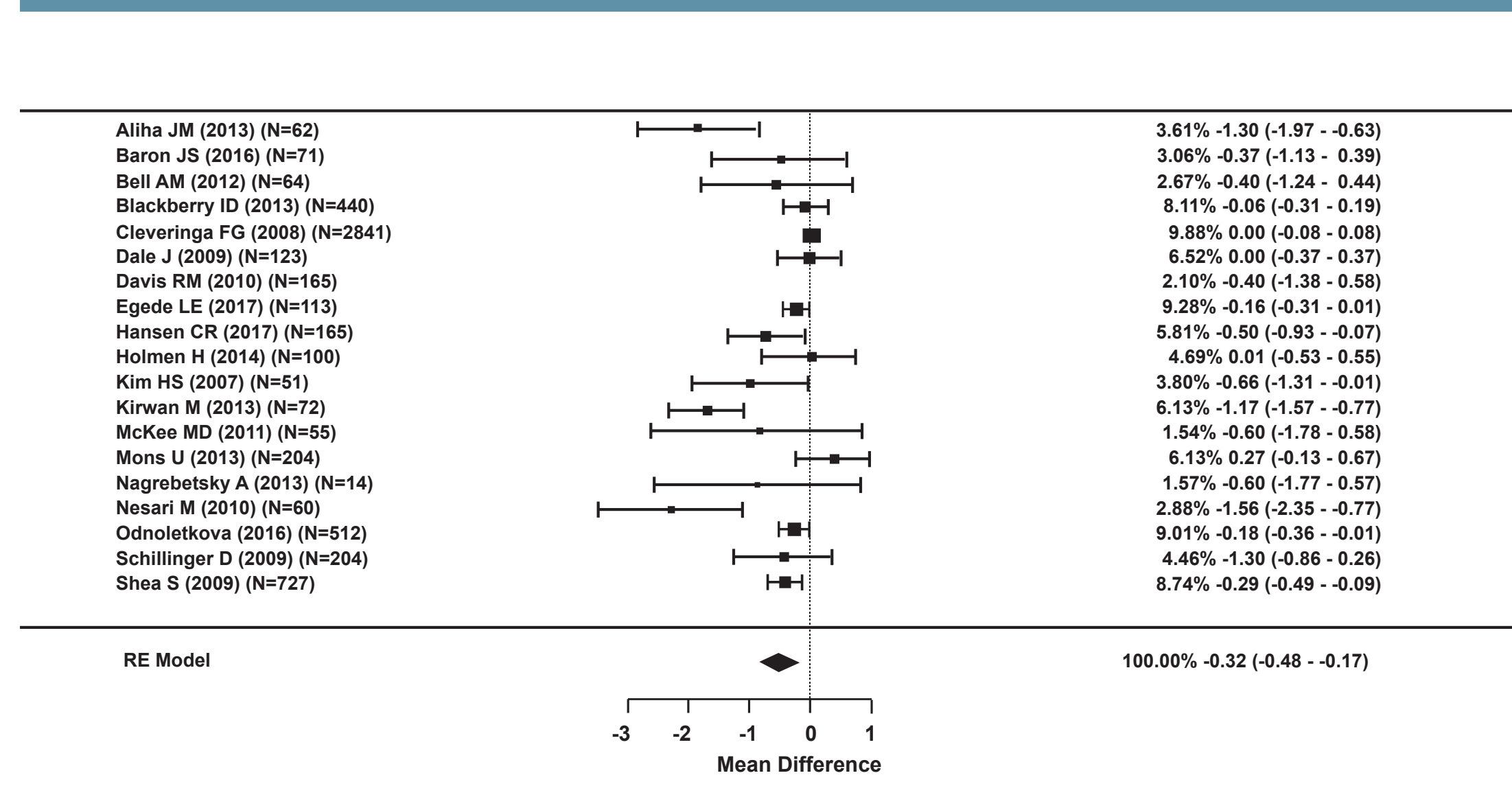
- Based on evidence from 26 studies with 10,270 patients, there was a statistically significant difference in HbA1c levels in patients who received a nurse-delivered general education intervention compared to those receiving standard care [MD: -0.18% 95% CI (-0.30, -0.06)], at an average of 1.45 years follow-up.

Figure 2. HbA1c levels – Nurse delivered special diabetes education interventions vs. standard care

- Based on evidence from 29 studies with 5,142 patients, there was a statistically significant difference in HbA1c in patients who received a nurse-delivered specialized diabetes education intervention compared to those receiving standard care [MD: -0.53 95% CI (-0.68, -0.37)], at an average of 1-year follow-up.

Figure 3. HbA1c levels – Nurse delivered health technology interventions vs standard care

- Based on evidence from 19 studies with 6,043 patients, there was a statistically significant difference in HbA1c in patients who received a nurse-delivered digital health application intervention compared to those receiving standard care [MD: -0.32 95% CI (-0.48, -0.17)], at an average of 1.43 years follow-up.

Figure 4. HbA1c level meta-analysis results by follow-up time – Nurse delivered diabetes education interventions vs. standard care
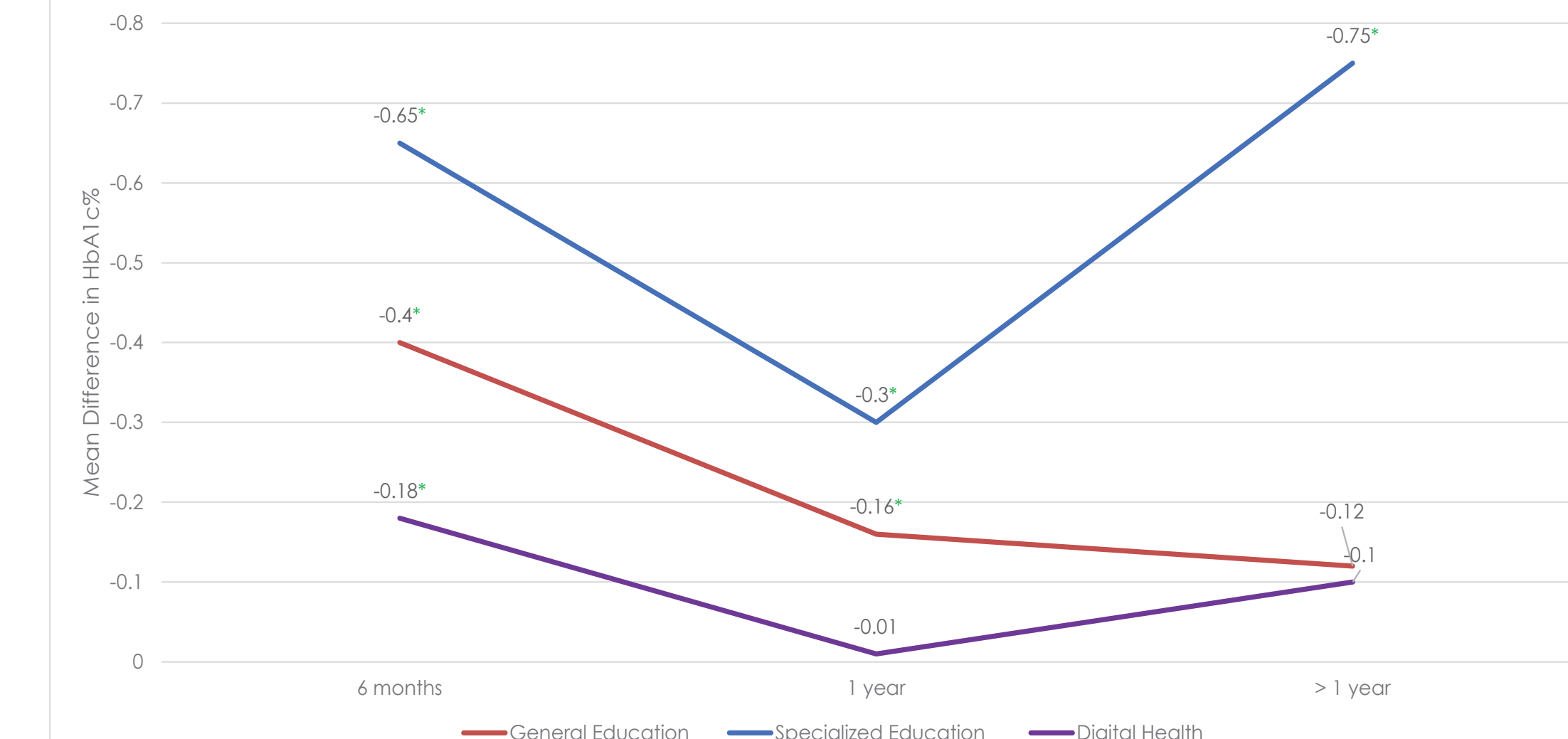
- The results suggest an overall trend in the treatment effect of nurse delivered general education and digital health application programs by follow-up time. The difference in HbA1c levels is both larger and statistically significant at 6 months follow-up and gets smaller and loses statistical significance as follow-up increases. This may indicate an issue with adherence to the intervention as time passes.
- There was no trend towards a smaller difference in HbA1c levels based on follow-up time for specialized diabetes education programs. At all 3 follow-up times the mean difference in HbA1c remained statistically significant.
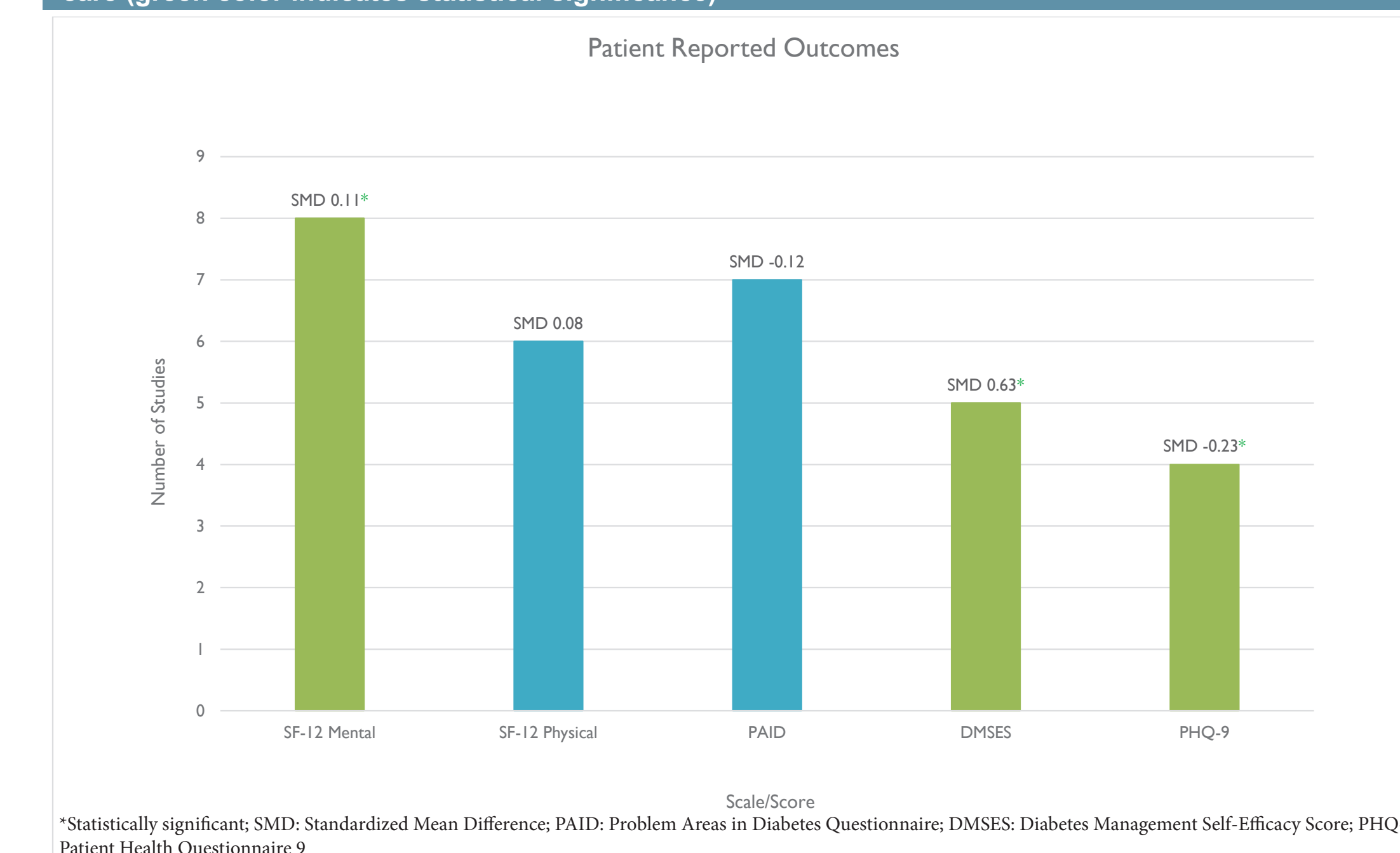

Figure 5. Meta-Analysis Results of Achievement of target HbA1c level < 7% – Nurse interventions vs. standard care

*Statistically significant
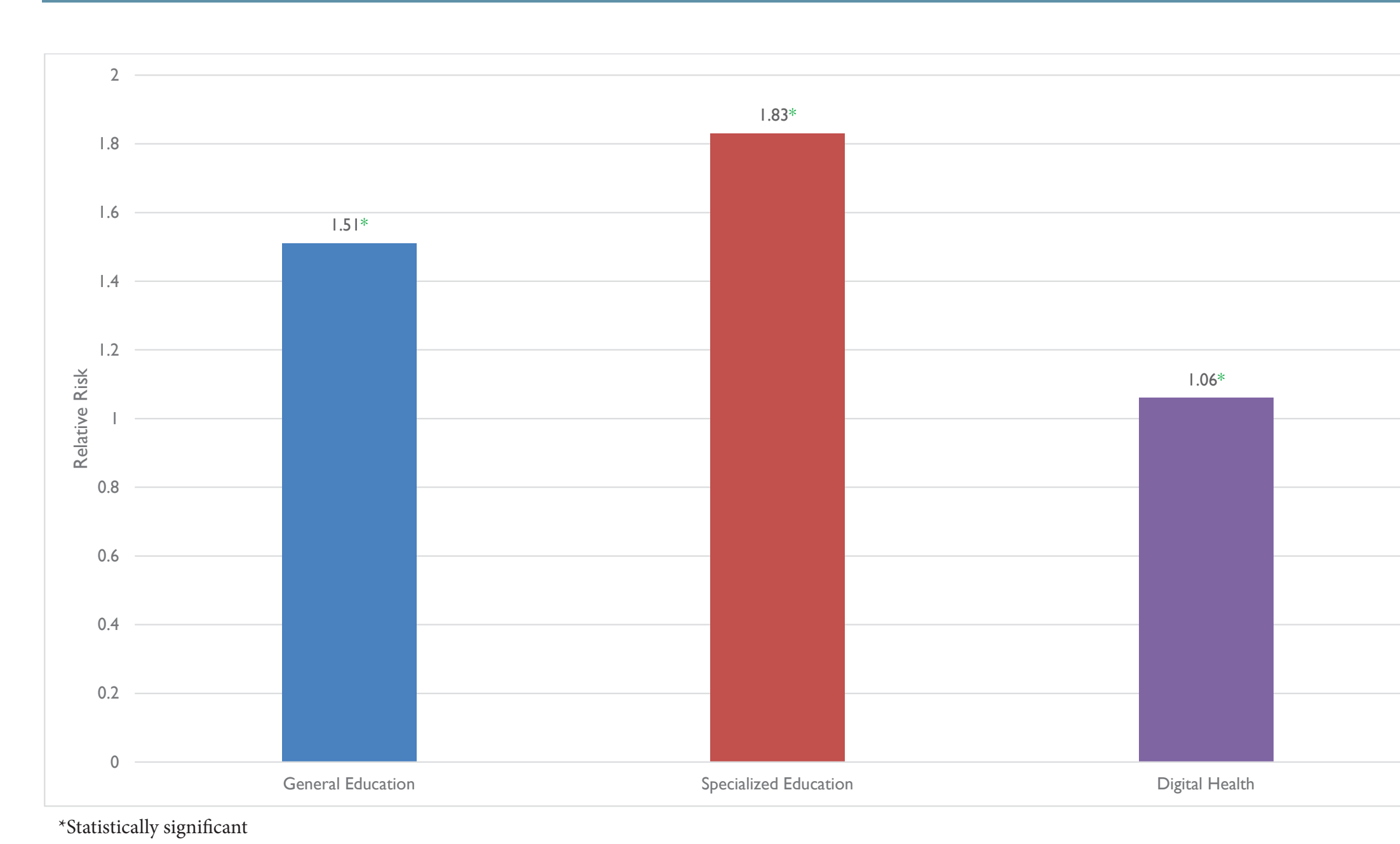
- Reaching target HbA1c (< 7 or ≤ 7%) levels was statistically significantly more likely in patients who received any nurse intervention compared to standard care. Specialized diabetes education showed the greatest impact, consistent with HbA1c level results.

Patient-Reported Outcomes Results:

Figure 6. Patient reported outcome meta-analysis results - All nurse delivered interventions vs. standard care (green color indicates statistical significance)

*Statistically significant; SMD: Standardized Mean Difference; PAID: Problem Areas in Diabetes Questionnaire; DMSES: Diabetes Management Self-Efficacy Score; PHQ: Patient Health Questionnaire 9

- All PROs favored nurse interventions over standard care. Statistically significant (+) differences in favor of nurse interventions: Short Form-12 (SF-12) Mental Component Score, Patient Health Questionnaire (PHQ-9) score, and Diabetes Management Self-Efficacy Score (DMSES).

Figure 7. Study reported favorability of nurse interventions vs. standard care
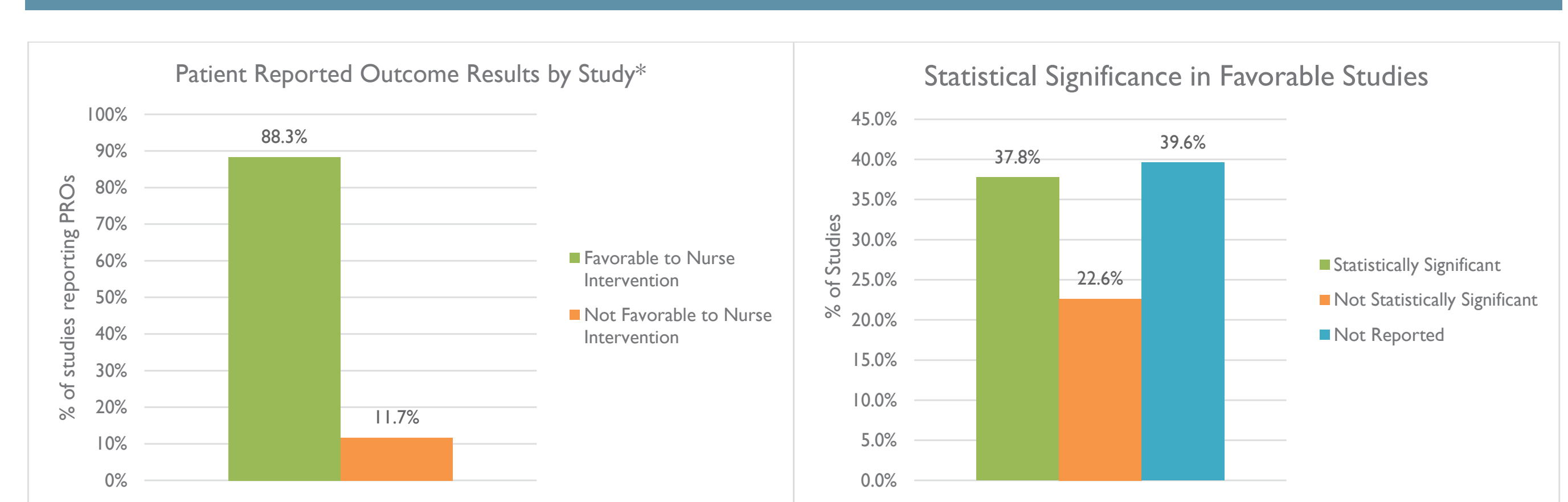
- Over 88% of the studies reported favorability of ≥1 PRO to the nurse intervention, and more than 1/3 were statistically significant.

Limitations

- Definitions of a "nurse" varied with many studies not providing specific definitions. Nurse delivery was therefore grouped broadly and differences in education, training, and credentialing may have contributed to variation in the results.
- Education programs varied across studies, making it difficult to assess how much delivery by the nurse impacted the outcomes versus the education program itself. Additional research comparing delivery by different practitioners is warranted.
- Study follow-up time was generally <1 year which made assessment of adherence to programs difficult. Additional research with longer-term follow-up would be useful to address adherence to programs.
- Hypoglycemia was underreported and lacked standardized definitions even when reported. Therefore, it was not possible to determine the true impact of nurse interventions on hypoglycemia. In studies that did report hypoglycemia, the event was reported more frequently in the nurse delivered intervention group. This may indicate better reporting from the patients due to more open communication with the nurse.

Implications for Healthcare Practitioners

- Nurse/Diabetes Educator delivered interventions resulted in improved outcomes for all methods of education delivery.
- Nurse/Diabetes Educators as influencers go beyond determining treatments or therapies. Their influence positively impacts both clinical and behavioral outcomes.
- Diabetes Self-Management Training/Specialized Diabetes Education is the gold standard for improving outcomes in people with diabetes.
- Diabetes Self-Management Training/Specialized Diabetes Education showed a greater impact in improving clinical and behavioral outcomes when baseline HbA1C was higher.
- Clinical and behavioral outcomes decrease (worsen) over time except in the Specialized Diabetes Education Programs.
- More research addressing hypoglycemia with standardized definitions must be conducted to permit robust analyses.
- Digital health is a promising methodology for ongoing engagement and maintaining long-term clinical and behavioral outcomes. Combining or integrating Diabetes Self-Management Training with a digital component can improve outcomes in the long term.

References

Please refer to supplemental materials for full reference list

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