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Effect of video-based health education intervention on insulin therapy among adults with diabetes mellitus in Dhulikhel Hospital: A randomized controlled trial

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Abstract

Introduction: Proper insulin injection technique is essential for glycemic control and preventing complications in diabetes mellitus. This randomized controlled trial aimed to evaluate the effectiveness of a video-based educational intervention on insulin therapy knowledge and self-administration practices among adults with diabetes in Nepal.

Method: We conducted an open-label, two-arm RCT at Dhulikhel Hospital, Nepal, from Aug 2024 to Jul 2025. Eligible adults (≥18 years) with type 1 or type 2 diabetes on insulin therapy were randomized to an intervention group (video-based education plus usual care) or a control group (usual care only). Ethical approval was obtained, and the trial was registered. Outcomes were assessed using structured questionnaires and observational checklists. Analysis was performed in STATA 14.0 using descriptive statistics, chi-square tests, independent t-tests, and logistic regression to calculate adjusted odds ratios (aOR) with 95% confidence intervals (CI).

Result: Of 126 participants enrolled, 94 completed follow-ups (intervention: n=41; control: n=53). The mean insulin injection practice score was significantly higher in the intervention group compared to controls (12.21 vs. 8.69, p<0.001). After adjustment, the intervention group had significantly higher odds of correctly performing several critical steps, including handwashing (OR=5.66, 95% CI: 2.20–14.54), checking insulin clarity (OR=4.72, 95% CI: 1.91–11.62), priming the pen (OR=27.48, 95% CI: 5.99–125.93), and safe needle disposal (OR=2.65, 95% CI: 1.12–6.29).

Conclusion: Video-based education effectively improved practical insulin administration skills. Its integration into standard diabetes education protocols is recommended to enhance treatment safety and efficacy.

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Introduction

The prevalence of diabetes is high, and is expected to increase in developing countries or regions such as China, India, Brazil and Southeast Asia. In these settings, health systems face significant challenges related to limited resources, high patient volumes and shortages of trained healthcare professionals.[1] Diabetes Mellitus (DM) is a chronic condition that requires lifelong management, with insulin therapy being a crucial component for many patients. Proper understanding and adherence to insulin are essential for achieving optimal health outcomes. Patient education plays a vital role in enhancing knowledge, self-management skills, and treatment adherence.[2,3] Video-based health education offers several advantages including accessibility, flexibility and the ability to provide visual demonstrations. It can empower patients to actively participate in their self-care and improve their overall well-being.

Proper injection technique ensures the safe and effective delivery of insulin into the body.[4] This helps minimize the risk of complications such as infections, bruising, discomfort, pain, and incorrect dosage administration.[5,6] Proper injection depth, angle, and site rotation contribute to consistent absorption of insulin, leading to better blood glucose control. This is possible when patients are confident in their ability to administer insulin correctly with the right training and education.[7,8]

Video-based health education has emerged as a promising alternative to traditional teaching methods due to its cost-effectiveness, ability to deliver standardized and visually rich content. It allows repeated viewing, supports low-literacy populations and reduces reliance on continuous healthcare provider involvement—features that are particularly relevant in resource-limited settings. Despite these advantages, evidence on the effectiveness of video-based education especially in hospital-based settings in low- and middle-income countries such as Nepal is limited.[9,10]

Therefore, this study holds significant importance as it addresses the gap in knowledge regarding the effectiveness of video-based health education in supporting insulin therapy for DM patients. Its findings will have implications for optimizing patient education strategies, enhancing treatment adherence, and ultimately improving the quality of life for individuals living with DM.

Method

This was an open-label two-arm randomized trial conducted at Dhulikhel Hospital, Nepal, from Aug 2024 to Jul 2025. The sample size was calculated based on a previous study,[11] requiring 126 participants (63 per arm) to achieve 80% power with a 5% significance level and 20% attrition rate. We randomized participants in a 1:1 ratio to either a video-based health education plus usual care group (intervention) or a usual care only group (control) using block randomization (block size of ten). Allocation was concealed using sequentially numbered opaque sealed envelopes. Diabetic nurses identified eligible adults (≥18 years) diagnosed with DM and on insulin therapy who owned a smartphone; patients with learning difficulties, hearing or visual impairment, or hand tremors were excluded. After obtaining written consent, baseline characteristics were collected. Details of recruitment in CONSORT flow diagram, Figure 1

Both groups received usual standard diabetic care, including a health education session and demonstration of insulin injection technique using a sandbag model. The intervention group additionally received a 10-minute video-based education program guided by the Health Belief Model.[12] The video, prepared in Nepali with English subtitles, provided comprehensive information on insulin therapy and demonstrated the correct administration technique.[13,14] It was delivered electronically via instant messaging platforms (e.g., Viber, WhatsApp, Gmail). Knowledge and practice were assessed through face-to-face interviews using structured questionnaires and checklists.[14,15]

Data were analyzed using STATA 14.0. Descriptive statistics summarized participant characteristics. Chi-square tests, t-tests, and

ANOVA were used for group comparisons. Logistic regression models assessed associations between the intervention and outcomes, reporting odds ratios (OR) with 95% confidence intervals (CI). Statistical significance was set at $p<0.05$, and an intent-to-treat analysis was conducted. Ethical approval was obtained from the Nepal Health Research Council (Reg. No. 737-2023), and the trial was registered at ClinicalTrials.gov (NCT06435598).

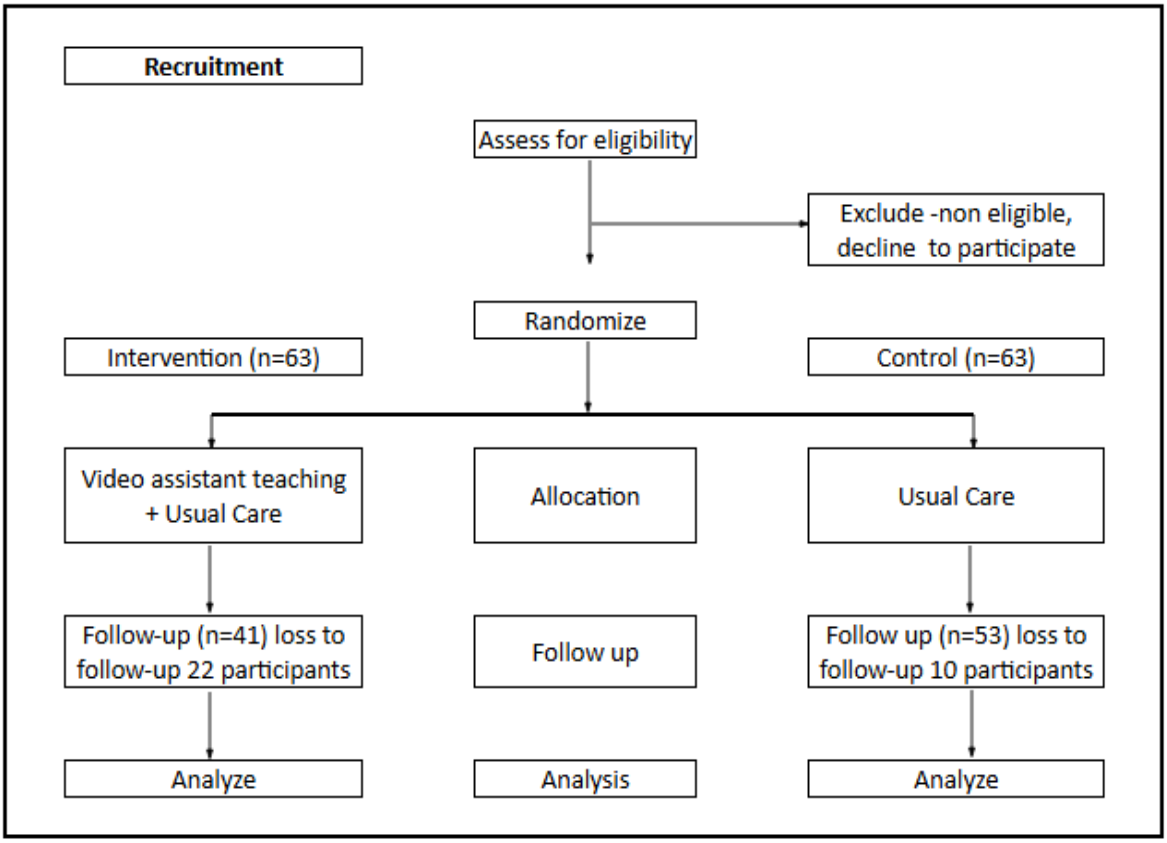

Figure 1. Details of recruitment, CONSORT flow diagram.

Result

A total of 126 participants were randomized into two groups (63 per group), the CONSORT flow diagram for recruitment of participant and follow-up, Figure 1. After accounting for loss to follow-up (10 in the control group and 22 in the intervention group), data from 94 participants (usual care: n=53; intervention: n=41) were analyzed. The mean age of participants was comparable between the usual care group (47.98±13.84 years) and the intervention group (50.14±12.83 years). Most participants were male (58.5% vs. 63.4%) and from hilly regions (94.3% vs. 87.8%). Most had type II diabetes (86.8% vs. 95.1%), Table 1, Table 2.

The mean insulin injection practice score was significantly higher in the intervention group (12.21) compared to the control group (8.69), Figure 2.

There were no significant differences between the groups regarding knowledge-related items, Table 3. However, logistic regression analysis showed that the intervention group had significantly higher odds of correctly performing multiple injection steps, including handwashing (OR=5.66, 95% CI: 2.20–14.54), checking insulin clarity (OR=4.72, 95% CI: 1.91–11.62), priming the pen (OR=27.48, 95% CI: 5.99–125.93), and proper needle disposal (OR=2.65, 95% CI: 1.12–6.29), Table 4.

Insulin practice score was only significantly associated with distance to the health institution (p=0.003), not with other socio-demographic factors, Table 5..

Table 1. Socio-demographic information of adults with diabetes on insulin therapy, n=94

Variables	Usual Care (n=53)	Intervention (n=41)
Age, years, mean±SD	47.98±13.84	50.14±12.83
Median (Min-Max)	53(18-74)	50(21-83)
IQR	39-58	41-59
Gender, n(%)		
Male	31(58.5)	26(63.4)
Female	22(41.5)	15(36.6)
Education level, n(%)		
Illiterate	16(30.2)	7(17.1)
Basic	15(28.3)	19(46.3)
Higher level	7(13.2)	7(17.1)
Secondary level	15(28.3)	8(19.5)
Geographic region, n(%)		
Hilly	50(94.3)	36(87.8)
Terai	3(5.7)	5(12.2)
Distance from home to health institution, n(%)		
≤1km	19(35.8)	13(31.7)
2–3km	8(15.1)	4(9.8)
4–5km	1(1.9)	8(19.5)
>5km	25(47.2)	16(39.0)
Economic status, n(%)		
Have most important things but few luxury goods	23(43.4)	19(46.3)
Money for extra things like holidays and luxury goods	7(13.2)	7(17.1)
Money for clothes and food but short on many other things	21(39.6)	14(34.2)
Not enough money for basic things	2(3.8)	1(2.4)

SD, standard deviation; IQR, interquartile range

Table 2. Diabetes-related characteristics of adults with diabetes on insulin therapy, n=94

Variables	Usual Care (n=53)	Intervention (n=41)
Diabetes type, n(%)		
Type I	7(13.2)	2(4.9)
Type II	46(86.8)	39(95.1)
Access to glucometer at home, n(%)		
Yes	21(40.4)	25(62.5)
No	31(59.6)	15(37.5)

Table 3. Logistic regression analysis of knowledge regarding insulin therapy among participants

Variables	Usual care, n(%) (n=53)	Intervention, n(%) (n=41)	OR	95% CI	p-value
Knowledge most frequent site of injection	52(98.1)	39(95.1)	0.37	0.32–4.28	0.43
Knowledge rotation of the injection site	48(90.6)	34(82.9)	0.50	0.15–1.72	0.28
Knowledge change of Injection	28(52.9)	21(51.2)	1.65	0.68–40.1	0.27
Knowledge regarding practice of lipohypotrophy	48(90.6)	37(90.2)	1.03	0.26–4.13	0.96
Knowledge regarding the practice of the injection lump	47(88.7)	34(82.9)	1.61	0.49–5.22	0.43
Knowledge regarding the practice of painful injection	35(66.0)	28(68.3)	0.90	0.38–2.15	0.81

OR, odds ratio; CI, confidence interval; Logistic regression. significance set at p<0.05.

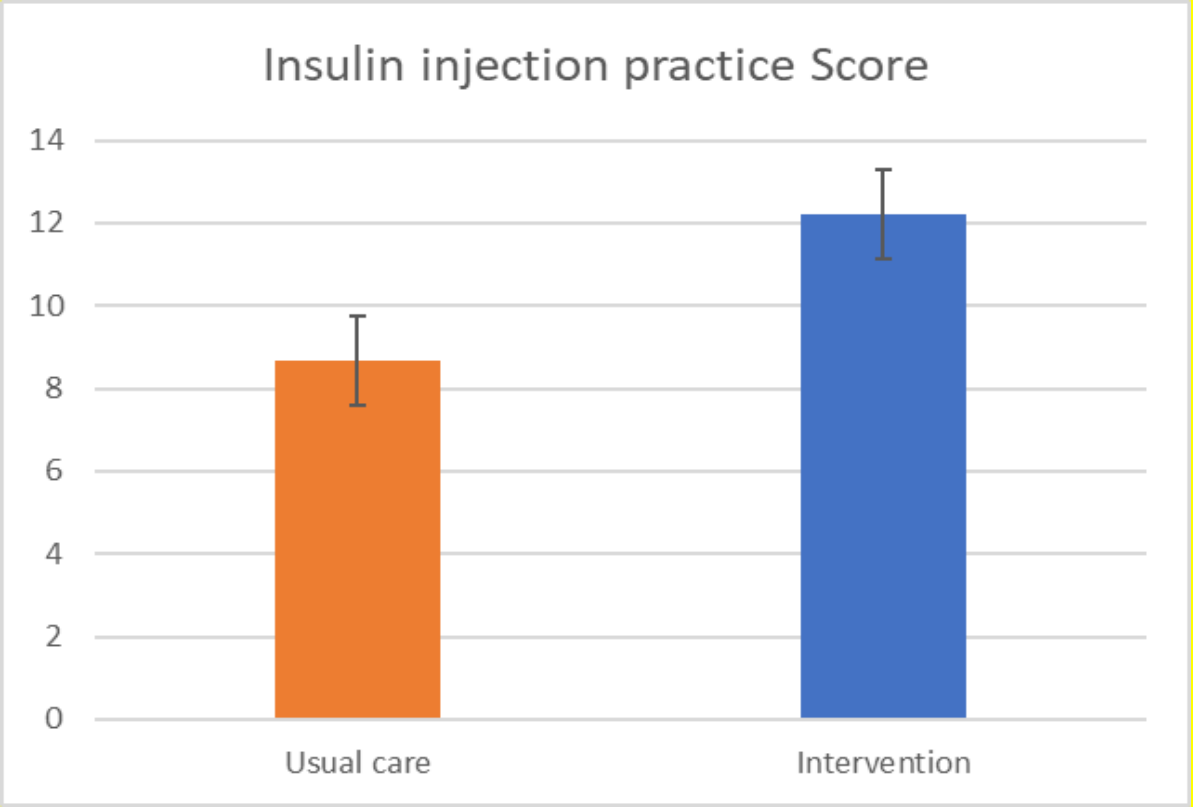

Figure 2. The mean insulin injection practice score in intervention group (12.21) vs. control group (8.69), n=94

Table 4. Logistic regression analysis of insulin injection practice among participants

Variables	Usual care, n(%) (n=53)	Intervention, n(%) (n=41)	OR	95% CI	p-value
Prepares article for insulin	39(73.6)	38(92.7)	4.54	1.20–17.09	0.025
Check expiry date of insulin	9(17.0)	14(34.2)	2.53	0.96–6.65	0.05
Perform Handwashing	9(16.9)	22(53.7)	5.66	2.20–14.54	<0.001
Check if insulin is cloudy	33(62.3)	34(82.9)	4.72	1.91–11.62	0.001
Inspects change in insulin pen	21(39.6)	31(75.6)	2.94	1.09–7.89	0.032
Takes pen needle, removes protective paper covering	30(56.6)	38(92.7)	9.71	2.67–35.45	0.001
Primes insulin pen to remove any air trapped	31(58.5)	39(95.1)	27.48	5.99–125.93	<0.001
Holds insulin pen needle pointing straight up	37(69.8)	37(90.2)	4.00	1.22–13.10	0.02
Lightly tap insulin pen for few time	18(34.0)	32(78.1)	6.9	2.7–15.6	<0.001
Press push button until dial turns zero	32(60.4)	39(95.1)	12.8	2.79–58.7	0.001
Repeats process if insulin drop does not appear from needle	23(43.4)	39(95.1)	25.43	5.56–116.44	<0.001
Select appropriate site and clean the site by using alcohol swab	44(83.0)	38(92.7)	2.59	0.65–10.27	0.17
Makes skin lift	36(67.9)	37(90.2)	4.4	1.34–14.24	0.014
Discards needle in container	14(26.4)	20(48.8)	2.65	1.12–6.29	0.027

Table 5. Association between socio-demographic variables and insulin therapy practice score

Variables	Insulin therapy score, Mean±SD	p-value
Age, years, mean±SD		
Median (Min-Max)	12.7±4.9	0.012*
IQR	15.45±4.5	
Gender, n(%)		
Male	14.56±5.0	0.58*
Female	15.10±4.3	
Education level, n(%)		
Illiterate	16.1±3.7	0.07#
Basic	15.05±4.8	
Higher level	15.4±3.5	
Secondary level	12.6±5.5	
Geographic region, n(%)		
Hilly	14.8±4.7	0.98#
Terai	14.7±5.4	
Distance from home to health institution, n(%)		
≤1km	16.7±3.6	0.003#
2–3km	15.7±4.2	
4–5km	15.9±3.9	
>5km	12.9±5.1	
Economic status, n(%)		
Have most important things but few luxury goods	15.1±5.0	0.61#
Money for extra things like holidays and luxury goods	13.3±4.9	
Money for clothes and food but short on many other things	14.9±4.3	
Not enough money for basic things	16.0±6.1	

*Independent t-test; #One-way ANOVA.

Discussion

Our study conducted among DM patients demonstrated a mean age of 47.9±13.8 in the intervention group and 50.1±12.8 in the control group, which is similar to studies conducted in African countries.[16,17] Similarly, the majority of participants were male and from a hilly region. This can be due to the location of the hospital. Most of the participants in our study were diagnosed with type 2 diabetes.

While assessing the insulin injection practice score, the mean score was comparatively higher in the intervention group as compared to the control. This shows that our intervention was effective in improving the injection practice. In comparison to the control group, our study demonstrated a considerable improvement in intervention practice in almost every measurable area of insulin administration, which is similar to the findings from other studies conducted in similar settings. Various studies have confirmed the effectiveness of video teaching for procedural and self-management skills in chronic diseases like diabetes, and the better results in the intervention group are in line with these findings.[18–21]

However, in the present study, no significant differences were observed between control and intervention regarding knowledge of insulin therapy. This contrasts with the findings conducted in Russia[22] and Brazil.[23] This may be due to differences in baseline education levels, healthcare delivery systems, and the nature of the interventions employed. In the Russian and Brazilian studies, participants had greater prior exposure to structured diabetes education through well-established diabetes care programs and multidisciplinary teams including pharmacists, endocrinologists, and diabetes educators. Additionally, they included comprehensive, repeated, and individualized educational components focusing explicitly on insulin-related knowledge, whereas the current intervention primarily emphasized practical skill

development through video-assisted demonstration.[22,23]

While assessing each component in insulin injection practice, participants in the intervention group had higher odds of preparing articles, performing hand washing, and checking insulin levels. This demonstrates that the video-based intervention can improve the practice regarding insulin injection techniques, and participants are more likely to adopt healthy practices. The findings are similar to those conducted in Japan, China, and India.[18,24,25] Various studies have shown that education, irrespective of its form (video-based or web-based), is effective in improving insulin injection practice among diabetic patients.[11,26] Video-based intervention with repeatable demonstration and systematic evaluation proves to be effective, especially in teaching psychomotor skills and enhancing self-efficacy.[20,27] Findings from our study also support these results, where we observed a high odds ratio for complex injection practices like priming the pen and repeating the process if no insulin appears. Compared to traditional audio-focused education, combined education including both audio and visual instructions is proven to be effective for adapting healthy insulin practices as it lessens the cognitive load on the learner and improves memory recall and retention. These important findings are explained by the scientific underpinnings of multimedia education.[28]

While assessing the relationship between socio-demographic characteristics and insulin practice score, participants aged more than 40 years were likely to have better insulin practice scores, which is similar to a study conducted in Africa, where a positive correlation was observed between age and medicine adherence and self-care.[29] Similarly, participants living at a closer distance to the health facility had a better insulin score. People living near health institutions can have easy access to resources, which can improve their practice score. However, no significant relationship was observed between insulin practice score and gender, education status, and economic status.

Limitations of this study may be that only newly diagnosed diabetes patients were included; therefore, baseline knowledge and practice were not assessed prior to the intervention, limiting the ability to measure change over time attributable to video education. The analysis compared outcomes between intervention and control groups without evaluating baseline-to-endline changes. As the study was conducted at a single center, the generalizability of the findings may be limited. Furthermore, high and uneven attrition between study groups may have affected internal validity, reducing confidence in attributing observed differences in knowledge and practice solely to the video-based educational intervention.

Despite these limitations, this study adds evidence that video-based health education is an effective tool for improving insulin administration practices among adults with diabetes in a resource-limited hospital setting. Therefore, it is recommended that such video-based educational modules be integrated into routine diabetes management programs in Nepal to enhance patient self-care and promote safe insulin use. In low-resource settings like Nepal, where the burden of diabetes is on an increasing trend, providing effective, innovative educational interventions is both efficient and cost-effective for managing and controlling diabetes.

Conclusion

The video-based education intervention group showed significantly improved practice in insulin administration compared to the usual care group. Participants receiving the intervention were significantly more likely to correctly perform essential steps, including handwashing, priming the pen to remove air, and checking insulin clarity. Key handling practices such as proper injection technique and safe needle disposal were also markedly better in the intervention group. The results demonstrate the intervention's effectiveness in promoting correct and safe insulin pen use. Therefore, video-based education should be integrated as a standard component of diabetes care to enhance insulin administration skills.

Author contribution

Concept design: SM, SS, JN, BS, KDP; Data acquisition: SM, SR, SSK; Data analysis and interpretation: SM, SS, JN; Drafting: SM, SS, BS, JN; Revision: SM, SS, BS; Final approval of the version to be published: SM, SS, BS, KDP, SR, SSK; Agreement to be accountable for all aspects of the work: SM, SS, BS, KDP.

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Conflict of interest

None

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Supplementary material

Data and supplementary material that support the findings of this study are available from the corresponding author upon reasonable request.

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