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ORIGINAL ARTICLE

Effect of patient education through a social network in young patients with type 1 diabetes in a Sub-Saharan context

Suzanne Sap[1,2] | Ernest Kondo[1] | Eugene Sobngwi[1,3] | Ritha Mbono[4] | Sandra Tatah[1] | Mesmin Dehayem[3] | Paul O. Koki[1,2] | Jean C. Mbanya[1,3]

[1]Faculty of Medicine and Biomedical Sciences, Department of Pediatrics, University of Yaounde I, Yaounde, Cameroon

[2]Department of General Pediatrics, Division of Pediatric Endocrinology and Diabetology, Mother and Child Center of Yaounde, Yaounde, Cameroon

[3]Department of Internal Medicine, Division of National Center of Obesity, Central Hospital of Yaounde, Yaounde, Cameroon

[4]Department of Pediatrics, Regional Hospital of Edea, Edea, Cameroon

Correspondence
Suzanne Sap, Faculty of Medicine and Biomedical Sciences, Department of Pediatrics, University of Yaounde I, PO Box 25121, Yaounde, Cameroon.
Email: suzysap@gmail.com

Background: Patient education is essential in management of type 1 diabetes (T1D).

Objective: To evaluate the short-term impact of patient education through WhatsApp on the knowledge of the disease and glycemic control of adolescents and young adults living with T1D in a resource-limited setting.

Methods: A double arm non-randomized clinical trial was carried out in two clinics for diabetes in Cameroon, over a period of 2 months. The intervention consisted in providing four sessions of patient education through WhatsApp to an intervention group compared to a control group with their classic follow-up. We evaluate their knowledge on diabetes, acute events, and glycemic control, before and after intervention.

Results: We recruited 54 patients of which 25 subjects and 29 controls. Median age was 19 (17-20) and 19 (17-21) years for the intervention and control group, respectively. There was a significant improvement of knowledge on diabetes in the intervention group from 13/20 to 16/20 ($P < 0.01$) after 2 months, compared to a slight decrease in control group (from 11.6/20 to 11.3/20 ($P = 0.33$). The mean proportion of acute complications decreased from 28% to 16% ($P = 0.46$) in the intervention group, and increased from 7% to 34%, $P = 0.01$ in the control group. There was no improvement in glycosylated hemoglobin level in both groups.

Conclusion: Patient education through social network helped to improve knowledge on T1D and to reduce acute complications without an improvement of glycemic control after 2 months.

KEYWORDS

adolescent, diabetes, patient education, social network

1 | BACKGROUND

Management of childhood and adolescent non-communicable diseases, such as diabetes remains difficult, especially because of long-term monitoring, patient adherence, and compliance to treatment.[1–3] Patient education helps the client to acquire or maintain the skills they need to better manage their life with their illness[4] and achieve their life plans.

The use of social networks is prevalent in the world, such as WhatsApp (WhatsApp Inc., Menlo Park, California) with more than 1.2 billion users in January 2017.[5,6] Some authors have demonstrated the ability of diabetic patients to strengthen self-care skills through forums, to build peer-to-peer relationships, and to become empowered in managing their disease.[7] Knowing that teenagers and young adults are the biggest consumers of social networks,[8] we investigated the short-term impact of patient education through a social network tool that is widespread in their daily lives. Thus, the purpose of the present work was to evaluate knowledge, glycemic control, and frequency of acute complications after patient education through a social network in a group of adolescents with diabetes.

2 | PATIENTS AND METHODS

2.1 | Patients

We conducted a non-randomized controlled clinical trial with two parallel arms in two urban diabetic children's clinics from 1 December 2016 to 31 May 2017: the diabetes clinic of Regional Hospital

Bafoussam (West Region) and the one of the Yaounde Central Hospital (Centre Region) in Cameroon. We included two groups of adolescents and young adults living with type 1 diabetes (T1D) aged 13 to 26 years, having a smartphone with internet access and followed for at least 6 months in the Changing Diabetes in Children Clinic (CDiC)[9] of their region. Participants over 21 years of age gave their informed consent while adolescents aged 13 to 20 gave their consent in addition to the informed consent of the parent or guardian. Participants were free to withdraw at any time from the study. All patients had already participated in at least one classic education session in their center. Our sampling was consecutive for all those with a smartphone and the minimum size of our sample was 15 patients per arm according to calculations Whitley and Ball.[10] The expected difference between groups was derived from Thielen et al[11] in absence of local data, for a *P*-value <5% and a power of 80%.

We excluded patients with other forms of diabetes and patients with T1D, but with a known comorbidity that may influence the occurrence of acute complications or alter the measurement of glycemic control by glycosylated hemoglobin (HbA1c), such as sickle cell disease.

2.2 | Methods

We collected from patients' clinical information, such as age, sex, duration of diabetes, and insulin requirements. We also collected data on acute events reported in patients' health booklet for 2 months prior to intervention. Based on glycemia self-reported by patients in their booklet, we recorded all hypoglycemia (less than 3.9 mmol/L), hyperglycemia (greater than 11 mmol) associated with ketonuria. Hyperglycemia without urinalysis was not considered. From hospital patient file, we recorded all episodes of ketoacidosis (hyperglycemia >11 mmol/L associated with ketonuria, signs of dehydration and/or reduction of level of consciousness).[11–13] One patient may have had more than one acute event. The events were totaled for each group and divided by number of patients in the group. We did this for 2 months after intervention for both groups.

We assessed patients' knowledge on diabetes through a modified Revised Brief Diabetes DK.[13,14]

After that, patients were examined and anthropometric parameters taken: height was measured in the standing position to the nearest 0.1 cm using a Leicester Height Measure MK II stadiometer, and weight was measured in light underwear using a Tanita BC-351 scale to the nearest 0.01 kg. The body mass index (BMI) was then calculated (weight/height^2).

One patient in two was allocated to one arm of our study and the principles of education through social networks were then presented to those of the group "intervention" while those of the group "control" continued with the usual follow-up of the clinic. Those who did not give their consent were replaced. We could not guarantee the lack of communication between the patients of the two groups. Two medical doctors (a senior pediatric endocrinologist and a general practitioner) participated in the two patient groups. The nurse in charge of patient education of each clinic was inserted in the group of her clinic.

For each patient, the HbA1c was collected twice, 12 weeks apart on EDTA tubes and then analyzed by high-performance liquid chromatography on a BIO-RAD D-10 automaton.

The intervention lasted 4 weeks with a weekly session of 60 to 90 minutes in the form of focus group derived from the ISPAD 2014 guidelines.[15]

All participants were reminded twice (the day before and 4 hours before), about the time of the session. The education session consisted of a focus group.[16] Open questions around the topic were asked by the medical team on the forum and participants were invited to answer or give an opinion. The opportunity was given to all participants to give their opinion, even a contradictory one, on questions asked. They were also invited to ask questions or clarifications on any confusing items. Disagreements between participants were reconciled through discussion or arbitration by the medical team. Based on answers obtained, a summary was made by the medical team with correct information at the end of each session. Then, participants were invited to the next session and the next was topic given.

The first week we discussed "definition of diabetes, insulin, blood glucose objectives, HbA1C" and the second of "short- and long-term complications." The third, we shared on "the use of insulin and self-monitoring of glycemia" and the last, we discussed about "diet of a person with diabetes." Outside the education sessions, the forum remained active during business hours and we answered questions asked, and advised where needed.

Two months after the intervention, the knowledge questionnaire was re-administered, the anthropometric parameters were re-taken, the insulin requirements assessed, as well as reported occurrence of acute complication (hypoglycemia, ketosis, or ketoacidosis), and HbA1c was re-measured.

2.3 | Statistical analysis

Data for normally distributed continuous variables are presented as mean (±SD) and data for non-normally distributed continuous variables as median (interquartile range). Categorical variables are presented as percentage, proportion or frequency. Differences in categorical variables between the two groups were tested by the χ^2 test or Fisher's exact test, when appropriate. Differences in the continuous variables were compared by a Student's *t*-test or the Mann-Whitney test when appropriate. The statistical significance was set at 5%. All these statistical tests were performed by SPSS 20.0 software for Windows (SPSS Inc. Chicago, Illinois).

2.4 | Ethics

The CDIC project received approval from the National Ethics Committee of Cameroon (Authorization No 271/CNE/SE/2011) to carry out research from data obtained in the project and a written informed consent form was signed by parents or guardians prior to enrolment, authorizing the use of data obtained for research. This specific study also received an ethical approval from the faculty of medicine and biomedical sciences of the Yaoundé I University, and was approved by the CDIC project steering committee.

3 | RESULTS

A total of 106 patients were approached for the study, 73 were included. We excluded 18, and 15 refused to participate. At the end, 25 and 29 were analyzed in "intervention" and "control" group, respectively. Our results are presented according to the recommendations of *Consolidated Standards of Reporting Trials guidelines* (CONSORT) 2010[17] (Figure 1).

3.1 | General characteristics of the study population

The median age was 19 (17-20) years in "intervention" group and 19 (17-21) years in the controls. Among our patients, 56% of "intervention" group and 51.7% of the controls were male. They were all students. The median duration of diabetes was four[2–6] years in both study groups (Table 1).

3.2 | Data before intervention

Median weight was 63.9 [55.5-70.0] kg in the "intervention" group and 63.5 [53.5-70.0] kg in controls. The median BMI was 23.3 [21.6-24.9] kg/m^2 in the intervention group vs 23.7 [20.8-25.2] kg/m^2 in controls. The median daily insulin dose was 0.8 [0.6-1.1] IU/kg/day in "intervention" group vs 0.9 [0.7-1.2] IU/kg/day in controls.

At baseline, median HbA1c [expressed in % (mmol/mol)] was 9.2 (77) [7.7 (61)-10.1(87)] in the "intervention" group vs 9.1 (76) [7.9 (63)-10.5(91)] in controls. The proportions of "intervention" group and controls with HbA1C less than 7.5% (58 mmol/mol) were 20.0% in the "intervention" group and 17.2% in controls, while 80% of the "intervention" group and 83.8% of controls had an HbA1c greater than 7.5% (58 mmol/mol).

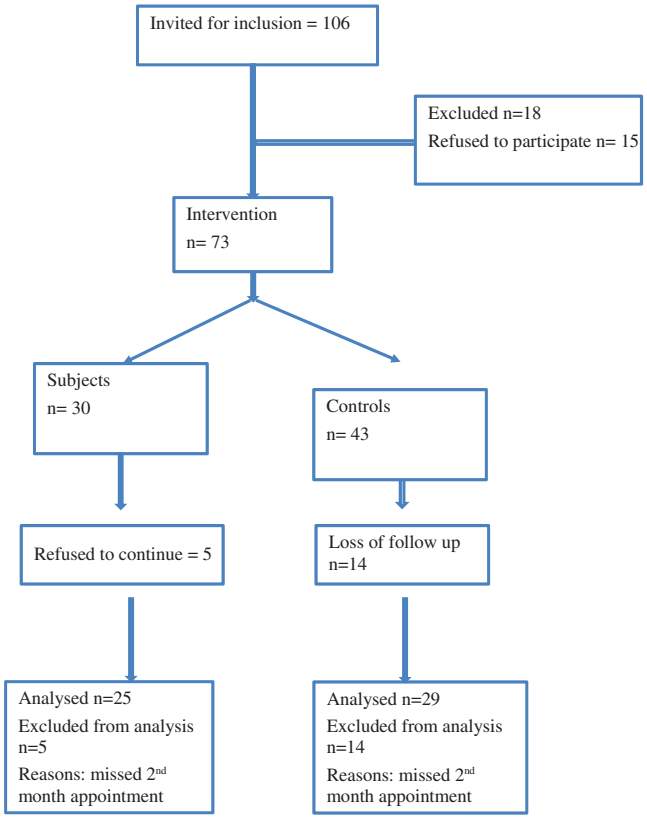

FIGURE 1 Flow chart of the study

TABLE 1 General characteristics of the study population

Item	Intervention group N = 25	Controls N = 29	*P*
Age in years, median (inter-quartile range [IQR])	19 (17-20)	19 (17-21)	0.68
Sex, n (%)			
Male/female	14 (56.0)/ 11 (44.0)	15 (51.7)/ 14 (48.3)	0.75
Level of education, n (%)			
Primary school	0 (0.0)	2 (6.9)	0.29
Secondary first cycle	10 (40.0)	15 (51.7)	
Secondary second cycle	11 (44.0)	7 (24.2)	
University	4 (16.0)	5 (17.2)	
Duration of diabetes in years, median (IQR)	4 [2-6]	4 [2-6]	0.74

The knowledge of their disease, scored out of 20, was 13.0 in "intervention" group and 11.6 in controls. Acute complications were reported by 28% of patients in "intervention" group and 7% in controls during 2 months preceding the beginning of the intervention. Hypoglycemia and ketosis without acidosis were the main acute complications reported. (Table 2).

3.3 | Data 2 months after the intervention

In the intervention group, the median weight decreased from 63.9 to 63.7 kg resulting in a change in median BMI from 23.3 to 23.2 kg/m^2. Their median HbA1c increased from 9.2% (77 mmol/mol) to 10.1% (87 mmol/mol) with the same number of people, with HbA1c less than 7.5% (58 mmol/mol) (20%). The median daily insulin dose decreased slightly from 52.1 to 51.6 IU but, based on weight, remained at 0.8 IU/kg/day. All these variations were not statistically significant (Table 2).

In controls, the median weight increased from 63.5 to 63.8 kg and BMI increased from 23.7 to 23.8 kg/m^2. Their median HbA1c increased from 9.1% (76 mmol/mol) (7.9%-10.5%) to 10.1% (87 mmol/mol) (8.2%-11.9%). Six patients in this group (21%), had HbA1c < 7.5% (58 mmol/mol). There was an increase in the daily insulin dose from 56.7 to 56.9 IU (0.9 IU/kg/day) but $P > 0.05$.

TABLE 2 Comparison between the two groups

Item	Intervention group	Control	*P*
Δ HbA1c (%)	+0.9%	+1%	0.99
HbA1C, Δn			
<7.5%	0	+1	0.95
≥7.5%	0	−1	—
Δ Weight (kg)	−0.2	+0.3	0.69
Δ BMI (kg/m^2)	−0.1	−0.1	0.88
Δ Insulin/day (UI)	−0.5	+0.2	0.18
Δ Insulin/kg (UI)	0	0	0.28

Δ, difference before intervention and 2 months after the end of intervention.
Data are expressed in median (interquartile range) and n (percentage).
*Difference in the group; **difference between intervention and controls.

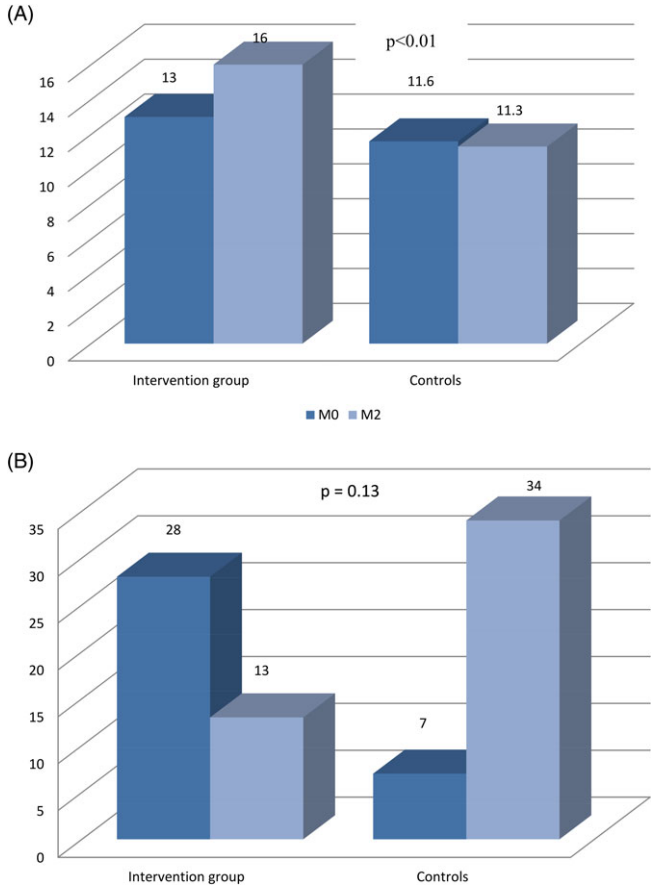

FIGURE 2 A, Variation of knowledge before and after intervention in subject group and comparison with control group ($P < 0.01$). B, Variations of declared acute complication before and after intervention and between both groups ($P = 0.13$)

Indeed, knowledge about their disease improved significantly in the intervention group from 13 to 16/20 ($P < 0.01$, t test). (Figure 2A). On the other hand, it decreased in the controls ($P = 0.5$, t test). The incidence of acute complications decreased from 28% to 16% ($P = 0.34$) in the intervention group but increased in controls from 7% to 34% ($P = 0.01$). The comparison between the two groups did not show a statistically significant difference at the end of intervention ($P = 0.13$, χ^2) (Figure 2B).

4 | DISCUSSION

Our study aimed to evaluate the impact of patient education through WhatsApp social network on the knowledge and glycemic control of adolescent and young adults with T1D.

4.1 | Limitations

Android phones were not provided to patients, we recruited only those with their own phones: this might have caused selection bias. This also explains the small size of our sample. The glycemic control was evaluated shortly after intervention and interactions between the two groups remained possible. Acute complications were calculated mainly based on self-monitoring of patients. The acute events may be underestimated for patients with a poor self-monitoring, as this result was not adjusted to the number of home blood glucose tests done in each group.

However, this is one of the first evaluations of such method in resource-limited conditions where access to well-trained personnel and healthcare facilities remain a challenge.

4.2 | Main features

Both groups were comparable in age, sex, and level of education. A significant improvement in knowledge averages was found in the intervention group 2 months after the intervention. This allowed us to see the benefit of patient education by WhatsApp in the group receiving the intervention, unlike the control group where knowledge was kept at the same threshold as at the beginning. These results are similar to the literature.[17–20] It's important to notice that compliance of participation to classic patient education in control group was not evaluated. The maintenance or decrease in their knowledge on disease may be explained by their irregularity to classic education session. But even in absence of a participant during session through social network, the discussion was kept in the smartphone and may appear when the patient is connected.

Number of participants in each arm was 25 and 29, respectively for intervention group and control. The missing of second month appointment in spite of phone calls shows difficulty of classic follow-up of these patients. The number of missed participants was higher in control group. This may reflect a benefit of the regular activity on the social network, maintaining a kind of awareness of participants.

4.3 | Glycemic control

The daily dose of insulin, weight, and BMI were not significantly reduced in intervention group. The decrease in the daily amount of insulin may reflect acquisition of dose adjustment abilities in this group. HbA1c increased in both study groups, with a significant increase among controls. Drion et al[18] in 2015 in the Netherlands had also found an elevation of HbA1c in both groups: 61 to 63 mmol/mol (11.16%-11.34%) in intervention group, and 62 to 63 mmol/mol (10.98%-11.34%) in controls, 3 months after the use of an application to improve the quality of life of T1D patients. These results are different from those of Bin-Abbas et al[19] in Saudi Arabia who found a significant decrease in HbA1c in their study. In the latter, evaluation of glycemic control was made from 4 months after intervention and above. It is shown that such intervention has slight effect on glycemic control[21] unlike effect of other type of patient education (diabetes camps) more expensive.[20] But long-term effect needs to be evaluated in our context.

4.4 | Acute complications

A slight decrease in the frequency of acute complications was found in the intervention group 2 months after intervention, unlike controls who showed a significant increase in the average rate of complications. This may be related to the improvement of knowledge, ability to face acute situations and peer to peer sharing of experience. This differs from the Bin-Abbas et al results in Saudi Arabia which did not find

a decrease in the frequency of acute complications.[19] However other studies have reported a reduction of acute complications.[18,21]

5 | CONCLUSION

Our study indicates that patient education through a social network has a positive impact on knowledge on diabetes and reduction of acute complications in young patients living with T1D in sub-Saharan Africa. In the short-term, there is no positive effect on glycemic control but further studies on long-term effect need to be done, especially in the context of low physical access to health care facilities.

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AUTHOR CONTRIBUTIONS

S.S., E.K., E.S., D.M., J.C.M., and P.O.K. designed and setting the study. E.K., S.S., S.T., and R.M. contributed in data collection. S.S., E.K., S.T., R.M. involved in bibliographic research and E.K., S.S., R.M. performed statistical analysis.

ORCID

Suzanne Sap https://orcid.org/0000-0002-2061-6393

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