

Article

The Effectiveness of Primary and Secondary Communication in Early Prevention Efforts for Diabetes Mellitus Among Students of Citra Bangsa Mandiri Christian High School

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Abstract

Background: Data from the Kupang City Health Office indicates that diabetes is among the top 10 most prevalent diseases in Kupang City, with a continuous increase since 2020, reaching 5,371 cases in 2022. These data highlight the importance of early diabetes prevention efforts. Prevention can be achieved by increasing knowledge individually and in groups through health education using primary communication, or direct face-to-face counseling, and secondary communication, or face-to-face counseling using the online platform Google Meet. **Objectives:** This study aimed to analyze the effectiveness of primary versus secondary communication in increasing the knowledge of students at Citra Bangsa Mandiri Christian High School regarding early prevention efforts for Diabetes Mellitus. **Methods:** This research employed a Quasi-Experimental design with a pre-post test two-group design, where students' knowledge levels were measured using questionnaires with a sample of 228 students from Citra Bangsa Mandiri Christian High School. Data analysis involved the Kolmogorov-Smirnov normality test and the Mann-Whitney U test for difference analysis. **Results:** The analysis results showed a significant difference in knowledge between the intervention groups and the control group, with a p-value of 0.000 ($p < 0.05$). **Conclusions:** The conclusion is that primary communication was more effective than secondary communication in increasing the knowledge of students at Citra Bangsa Mandiri Christian High School regarding early prevention efforts for diabetes mellitus. Based on these findings, primary communication needs to be prioritized in efforts to increase knowledge. Secondary communication should be used under specific conditions.

Keywords: *Primary and secondary communication, early prevention, diabetes mellitus*

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1. Introduction

Diabetes mellitus (DM), caused by the inability of the pancreas to produce insulin and leading to hyperglycemia, is a global and national health concern. Data from the Ministry of Health [1] places DM as one of the main focuses in the 2020-2024 Strategic Plan, given its significant impact on morbidity and mortality. The prevalence of DM continues to rise, including in Kupang City which recorded 5371 cases in 2022, up from 2020 and in the top 10 disease categories [2]. More worryingly, data from Riskesdas in the 2018 [3] shows an increase in risk factors for diabetes in children aged ≥ 15 years, from 10.8% in 2013 to 18.8% in 2018, some of whom are still in school. Obesity, which is often associated with excessive fast food consumption and lack of physical activity [4,5], is one of the main risk factors, and its prevalence is also high in school-aged children [3]. Family socioeconomic conditions also play a role, with children from middle- to upper-income families tending to have higher purchasing power for unhealthy foods [4].

Given the high incidence of DM and the increased risk in adolescence, early preventive interventions are crucial. Increasing knowledge through effective

communication plays an important role in this effort [6]. In general, there are two types of communication processes: primary (face-to-face) and secondary (face-to-face through media, such as online platforms). The utilization of technology in health, including online platforms such as Google Meet that were popular during the Covid-19 pandemic, offers the potential to reach targets more widely and efficiently [7]. However, the effectiveness of primary and secondary communication in improving knowledge, especially regarding DM prevention in adolescents, is still debatable with inconsistent research results.

The purpose of this study was to determine the effectiveness of primary and secondary communication in efforts to prevent early diabetes mellitus in students of Citra Bangsa Mandiri Christian High School. The results of this study will contribute to the development of intervention strategies that are more targeted and effective in increasing adolescents' knowledge about early prevention of Diabetes Mellitus, so as to reduce the incidence rate and improve the quality of life of young people in Kupang City.

2. Materials and Methods

2.1 Study Design and Setting

This research is a type of quantitative research with a research design using a quasi-experimental design two group pretest posttest design. This research was conducted for a month in February-March 2025 at Citra Bangsa Mandiri Christian High School.

2.2 Population and Sampling

The population of Citra Bangsa Mandiri Christian High School students was 563 people. The sample size calculation using the Krejcie & Morgan formula (1970) [8] obtained 228 people. The sampling technique in this study used non-probability sampling where the sample was taken not randomly. Furthermore, the researcher conducted a sampling technique with quota sampling by determining the number of quotas based on levels to ensure representation of each generation.

2.3 Data Collection

The data collection technique is in the form of a questionnaire containing questions and will be answered by respondents to obtain information related to student knowledge in efforts to prevent early diabetes mellitus. The data collected will be processed with the help of electronic equipment in the form of a computer using the SPSS program.

2.4 Variables and Operational Definitions

The independent variables in this study are primary and secondary communication, the dependent variable is the knowledge of students of Citra Bangsa Mandiri Christian High School in an effort to prevent early diabetes mellitus, while age, class, gender of the child, and family history of diabetes mellitus as external variables that will be observed and also analyzed. The operational definition of the variable "knowledge" is to see changes in the knowledge of Citra Bangsa Mandiri Christian High School students in efforts to prevent early diabetes mellitus with objective criteria, Very Poor if the score is 0-20, Poor if the score is 21-40, Fair if the score is 41-60, Good if the score is 61-80, Very Good if the score is 81-100 (Widoyoko, 2016: 242).

2.5 Data Analysis

Univariate and bivariate analysis were used to determine the effectiveness of the primary and secondary communication process by comparing knowledge scores before and after providing health education. normality test using Kolmogorov Smirnov test and statistical difference test using Mann-Whitney U.

2.6 Ethical Considerations

This research has been approved by the Research Ethics Committee of the Faculty of Public Health, Nusa Cendana University with No. 000458/KEPK FKM UNDANA/2025.

3. Results

3.1. Characteristics of Respondents

Table 1. shows the distribution of respondent characteristics of Citra Bangsa Mandiri Christian High School. Of the total 228 respondents, based on gender, 123 students (53.9%) were male and 105 students (46.1%) were female. Based on age characteristics, 100 students (43.9%) were in the age range of 16-17 years. 78 students (34.2%) were 18-19 years old, and 50 students (21.9%) were 14-15 years old.

Table 1. General Characteristics of Respondents of Citra Bangsa Mandiri Christian High School

Characteristics	Primary Communication Group		Secondary Communications Group		Control Group		Total	
	n=76	%	n=76	%	n=76	%	n=228	%
Gender								
Male:	39	51.3	40	52.6	44	57.9	123	53.9
Female:	37	48.7	36	47.4	32	42.1	105	46.1
Total	76	100	76	100	76	100	228	100
Age								
14-15 years:	22	28.9	15	19.7	13	17.1	50	21.9
16-17 years:	30	39.5	35	46.1	35	46.1	100	43.9
18-19 years:	24	31.6	26	34.2	28	36.8	78	34.2
Total	76	100	76	100	76	100	228	100
Grade								
10 th grade:	25	32.9	21	27.6	16	21.1	62	27.2
11 th grade:	19	25	32	42.1	35	46.1	86	37.7
12 th grade:	32	42.1	23	30.3	25	32.8	80	35.1
Total	76	100	76	100	76	100	228	100
History of Diabetes								
Yes:	18	23.7	24	31.6	12	15.8	54	23.7
No:	58	76.3	52	68.4	64	84.2	174	76.3
Total	76	100	76	100	76	100	228	100

Source: Primary data, February 2025

Grade 11 accounted for the most respondents with 86 students (37.7%), followed by grade 12 with 80 students (35.1%), and grade 10 with 62 students (27.2%). 174 students (76.3%) stated that they did not have a family history of diabetes.

3.2. Efektivitas Komunikasi Primer dan Sekunder dalam Upaya Pencegahan Dini Diabetes Melitus di Kalangan Siswa SMA Kristen Citra Bangsa Mandiri

3.2.1. Knowledge of Citra Bangsa Mandiri Christian High School Students Before Health Education

Table 2. Frequency Distribution of Intervention and Control Group Respondents Based on the Level of Knowledge of Citra Bangsa Mandiri Christian High School Students in Efforts to Prevent Early Diabetes Mellitus Disease in Pre-Test Measurements

Level of Knowledge	Pre-test						Total	
	Primary Communication		Secondary Communications		Control			
	n	%	n	%	n	%	n	%
Very poor	8	10.5	7	9.2	5	6.6	20	8.8
Poor	40	52.6	46	60.5	53	69.7	139	61
Fair	21	27.6	20	26.3	14	18.4	55	24.1
Good	7	9.2	3	3.9	4	5.3	14	6.1
Excellent	0	0	0	0	0	0	0	0
Total	76	100	76	100	76	100	228	100

Source: Primary data, February 2025

Based on table 2. above shows that the pre-test in a sample of 228 students as many as 139 students (61%) have a level of knowledge that is Poor, 55 students (24.1%) have Fair Knowledge, 20 students (8.8%) have Very Poor Knowledge, 14 students (6.1%) have Good Knowledge. There were no respondents who had a very good level of knowledge regarding efforts to prevent early diabetes mellitus. Pre-test in the primary

communication group 40 students (52.6%), secondary communication 46 students (60.5%), and control group 53 students (69.7%) had a Poor of knowledge.

3.2.2. Knowledge of Citra Bangsa Mandiri Christian High School Students After Health Education

Table 3. Frequency distribution of intervention and control group respondents based on the level of knowledge of Citra Bangsa Mandiri Christian High School students in efforts to prevent early diabetes mellitus in the post-test measurement.

Level of Knowledge	Post-test						Total	
	Primary Communication		Secondary Communication		Control			
	n	%	n	%	n	%	n	%
Very poor	0	0	0	0	5	6.6	5	2.2
Poor	0	0	0	0	53	69.7	53	23.2
Fair	0	0	3	3.9	14	18.4	17	7.5
Good	1	1.3	28	36.8	4	5.3	33	14.5
Excellent	75	98.7	45	59.2	0	0	120	52.6
Total	76	100	76	100	76	100	228	100

Source: Primary data, February 2025

Based on table 3. above, there is a change in the level of knowledge. Of the total 228 respondents, 120 students (52.6%) had Excellent Knowledge, 53 students (23.2%) had Poor Knowledge, 33 students (14.5%) had Good Knowledge, 17 students (7.5%) had Fair Knowledge, and 5 students (2.2%) had Very Poor Knowledge regarding efforts to prevent early diabetes mellitus. In the primary communication group, the knowledge level of 75 students (98.7%) became Excellent, 1 student (1.3%) had Good Knowledge. In the secondary communication group, 45 students (59.2%) had Excellent Knowledge, 28 students (36.8%) had Good Knowledge, and 3 students (3.9%) had Fair Knowledge. In the control group, there was no change in the level of knowledge after the pre-test, as many as 53 students (69.7%) have a level of knowledge that is Poor.

3.3 Analysis of the Effectiveness of Primary and Secondary Communication in Early Prevention Efforts for Diabetes Mellitus Among Students of Citra Bangsa Mandiri Christian High School

Bivariate analysis in this study was conducted to determine the effectiveness or influence of independent variables (primary communication and secondary communication) on the dependent variable (student knowledge) in efforts to prevent early diabetes mellitus. The collected data were tested for normality using the Kolmogorov Smirnov test. The normality test results in table 4 show a significance value (p-value) <0.05, meaning that the data is not normally distributed.

Table 4. Normality test results using Kolmogorov-Smirnov

	Uji Normalitas Kolmogorov-Smirnov					
	Primary Communication		Secondary Communication		Control	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Statistic	0.158	0.291	0.112	0.215	0.233	0.233
df	76	76	76	76	76	76
Sig.	0.000	0.000	0.020	0.000	0.000	0.000

Source: Primary data, February 2025

Based on the results of the normality test, the data were then tested using the Mann-Whitney U test to analyze the effectiveness of primary and secondary communication in efforts to prevent early diabetes mellitus at Citra Bangsa Mandiri Christian High School as shown in table 5 below.

Table 5. The results of the analysis of the effectiveness of primary and secondary communication in efforts to prevent early diabetes mellitus at Citra Bangsa Mandiri Christian High School.

Comparison between groups	Pre-test		Post-Test		Gain Score	
	Mean Rank	p-value	Mean Rank	p-value	Mean Rank	p-value
Primary Communication	77.84	0.706	114.49	0.000	114.5	0.000
Control	75.16		38.51		38.5	

Secondary Communication	73.61	0.415	113.7	0.000	114.5	0.000
Control	79.39		39.3		38.5	
Primary Communication	81.22	0.184	94.51	0.000	87.52	0.002
Secondary Communication	71.78		58.49		65.48	

Source: Primary data, February 2025

Before counseling, the level of knowledge about early prevention of Diabetes Mellitus between primary, secondary, and control communication groups did not differ significantly ($p > 0.05$). However, after counseling, there was a significant increase in knowledge in the primary and secondary groups compared to the control ($p < 0.05$). Because there is a significant increase in knowledge between the intervention group (primary and secondary) and the control group, it can be said that the primary and secondary communication process is influential in efforts to prevent early diabetes mellitus at Citra Bangsa Mandiri Christian High School.

4. Discussion

4.1. Measurement of Knowledge (Pre-Test) of Citra Bangsa Mandiri Christian High School Students in the Intervention Group (Primary and Secondary Communication) and Control Group Before Counseling on Early Prevention Efforts for Diabetes Mellitus Disease

The pre-test given to each group showed that the level of knowledge of Citra Bangsa Mandiri Christian High School students in efforts to prevent early diabetes mellitus was mostly in the category of poor knowledge (139 people or 60.9%). The primary communication group was 40 people (52.6%), the secondary communication group was 46 people (60.5%), and the control group was 53 people (69.7%).

The results of this pre-test analysis showed that before the intervention, the students' knowledge level regarding early prevention of Diabetes Mellitus was relatively homogeneous or not significantly different among the three research groups (primary communication group, secondary communication group, and control group). This balanced initial condition is important to see whether there is a possible change in the value of the knowledge score observed after the intervention (post-intervention measurement (post-test)).

The results of the pre-test of students' knowledge are in line with information from teachers and some students of SMA Kristen Citra Bangsa Mandiri that health education related to diabetes mellitus has never been conducted in any form. So far, there has only been counseling or health education about reproductive hygiene and prevention of anemia conducted by the local Puskesmas.

In line with research conducted by Gokdemir [10] which states that individuals with a better understanding of a disease are more likely to adopt preventive measures. This finding underlines that minimal knowledge creates cognitive and motivational barriers to prioritizing preventive measures. Meanwhile, research conducted by Lee and Lee [11] showed that a comprehensive health education program significantly improved knowledge and attitudes towards disease prevention. This indicates that lack of knowledge is a barrier that can be overcome through effective educational efforts, ultimately increasing awareness and adoption of disease prevention measures.

4.2. Knowledge (Post-Test) of Citra Bangsa Mandiri Christian High School Students After Being Counseled Using Primary Communication Media in an Effort to Prevent Early Diabetes Mellitus Disease

The results of the primary communication post-test related to knowledge of early prevention of diabetes mellitus in 76 students of Citra Bangsa Mandiri Christian High School showed an increase in knowledge. The Mann-Whitney U test results show that the mean value of the level of knowledge is significantly higher than the mean value of the level of knowledge in the control group, with a p-value of 0.000 ($p < 0.001$), which indicates a significant difference in the level of knowledge of students after the intervention regarding diabetes mellitus disease in an effort to prevent early diabetes mellitus disease. This shows that the intervention in the form of primary communication is effective in increasing students' knowledge.

The above is in line with research conducted by Hapitria [12] which states that there is an increase in knowledge after being given face-to-face counseling (primary communication). Health education is an effort to assist individuals, groups, and communities in improving knowledge, attitudes, and skills for healthy living. There are various forms of health education, therefore the selection of appropriate educational

methods is highly recommended so that the expected goals can be achieved optimally. Health education that is often carried out is using primary communication media, namely direct face-to-face education [13].

The results of this study indicate that providing health education in an effort to prevent early diabetes mellitus with primary communication can increase the knowledge of Citra Bangsa Mandiri Christian High School students. This is because primary communication (direct face-to-face) builds a direct connection between the communicator and the communicant so that it provides a sense of security and comfort to receive information. In addition, in primary communication, nonverbal communication such as body cues, facial expressions, eye contact, and tone of voice play a more significant role in conveying meanings and emotions that go beyond the spoken word, increasing understanding and engagement. The physical presence of the communicator allows for the use of these nonverbal cues to reinforce the message, leading to increased knowledge. Likewise, the use of visual aids such as PowerPoint presentations in health education has great potential to improve learning outcomes because the information presented is interesting and simple, making it easier for respondents to understand and accept.

In face-to-face counseling sessions, to increase the attractiveness and retention of information, face-to-face counseling utilizes visual media in the form of PowerPoint. The messages delivered were designed to be easy to understand, logically structured, and actively engage students. Information on the basics of diabetes mellitus, the causes of diabetes, how to prevent diabetes in general and its prevention in schools is presented in simple and interesting language along with the use of concrete examples close to everyday life to help students visualize and internalize the information. The dangers of diabetes are conveyed in a way that does not scare but is enough to provide awareness of the importance of preventive measures as early as possible. By connecting the topic of diabetes prevention to their current and future health and well-being, students are expected to be more motivated to pay attention to the information presented and remember it. In addition, the face-to-face session allows for two-way interaction, where students can ask questions directly and get instant clarification, ensuring a deeper understanding and reducing potential misconceptions that ultimately contribute to improved knowledge scores at post-test.

4.3. Knowledge of students of Citra Bangsa Mandiri Christian High School after being given counseling (Post-Test) using secondary communication media in an effort to prevent early diabetes mellitus disease

The results of this study indicate that there is an increase in knowledge of Citra Bangsa Mandiri Christian High School students when given counseling using secondary communication media. The statistical test results show a p-value of 0.000 ($p < 0.001$), which means that there is a significant difference in knowledge levels and the provision of interventions in the form of secondary communication is effective in changing knowledge levels.

The results of this study are in line with research conducted by Sembada [14] which states that the use of online media, one of which is Google Meet as a means of health education, has proven effective in efforts to increase knowledge. In addition, research by Tedjasulaksana [15] reported that health education through platforms such as Google Meet offers a flexible and accessible alternative to traditional face-to-face education and is effective in increasing knowledge before and after intervention. This method allows real-time interaction between communicators and communicants from different locations with an internet connection [16].

The results of this study show that health education using secondary communication media is highly effective in improving knowledge and allows synchronous interaction between students and educators to participate at the same time, similar to traditional face-to-face classes. Secondary communication allows for direct questions and answers, discussion and a sense of social presence, albeit in a virtual format. The use of screen sharing facilitates the presentation of visual aids such as PowerPoint presentations, ensuring that students receive the same information as in a face-to-face session. A study by The International Conference on Public Health Proceeding [17] showed a significant increase in students' knowledge after being educated through an online platform, indicating that virtual delivery of health information can be an effective method to improve understanding of disease prevention behaviors.

4.4. Differences in the Effectiveness of Primary and Secondary Communication in Early Prevention of Diabetes Mellitus at Citra Bangsa Mandiri Christian High School

The results of the Mann-Whitney U analysis showed that there was a significant difference in the level of knowledge between Primary Communication compared to

Secondary Communication characterized by a value of $p=0.000$ ($p<0.05$). The difference is also seen from the mean rank on the post-test and gain score where the mean value of the post-test, the primary communication group (94.51) has a higher mean value than the secondary communication group (58.49). Similarly, in the gain score results, the primary communication group (87.52) had a higher mean score than the secondary communication group (65.48). This suggests that primary communication is likely to be more effective in producing knowledge improvement compared to secondary communication in Citra Bangsa Mandiri Christian High School students.

To evaluate the effectiveness of primary and secondary communication, this study is in line with research conducted by Sari [18], where the results showed that direct face-to-face education (primary communication) was more effective in increasing knowledge than education that took place online through the Google Meet platform. Likewise, according to Hong [19], which states that online interventions have a positive and strong role in increasing knowledge, but the effect is lower than direct face-to-face.

Primary communication in the form of face-to-face counseling is more effective than secondary communication because the physical presence in face-to-face counseling can increase the focus and overall engagement of participants. The lack of distractions from the home or digital environment that may occur when using Google Meet is expected to maximize attention to the extension materials. In addition, in-person interaction allows for a richer reading of body language and facial expressions, facilitates more spontaneous communication and natural flow of discussion, and builds stronger rapport and trust between communicators and communicants.

Direct face-to-face extension allows for minimal technical constraints, and communicators can observe participants' responses directly to adjust the delivery of the material which ultimately results in a more significant increase in knowledge compared to face-to-face extension through virtual platforms such as Google Meet. A study by Altschuller and Benbunan-Fich [20], found that face-to-face interaction resulted in deeper concept understanding and better application skills compared to online learning. This is likely due to the greater opportunity for immediate clarification, in-depth discussion, and the building of shared understanding in a face-to-face environment. Although online technology continues to evolve, the challenge of fully replicating the richness of face-to-face interaction remains.

The results of this study differ from the results of research by Subramanian et al [21] which shows the use of online media is more effective than direct face-to-face methods. This difference is because in the research of Subramanian et al, the online media used is in the form of web-based learning that can be accessed alone to learn without face-to-face communication and is more flexible. As pointed out by Jiao [22], secondary communication is better in terms of flexibility while primary communication excels in terms of effectiveness, efficiency, and atmosphere. This difference also depends on several factors including the complexity of learning objectives, duration of intervention, form of learning, and student characteristics (gender, learning style, attitude, satisfaction, and engagement) [23].

5. Conclusions

Primary and secondary communication are effective in increasing health knowledge as an effort to prevent diabetes mellitus early on in students of Citra Bangsa Mandiri Christian High School. The majority of students in the primary communication group initially had a level of knowledge of Poor and Fair, showing an increase to a level of knowledge of Excellent after the intervention. In the secondary communication group, there was an increase in the proportion of students with Good and Excellent knowledge levels after the intervention. Based on the comparison of the distribution of knowledge levels after the intervention, primary communication proved to be more effective than secondary communication.

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7. Conflicts of Interest

The authors declare no conflict of interest.

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