

# ORIGINAL ARTICLE

## Challenges in Type 2 Diabetes Prevention among Senior High School Students: A Qualitative Study

Nila Kusumawati<sup>1,2</sup>, MPH; Syafrisar Meri Agritubella<sup>3</sup>, M. Kep; Alice Rosy<sup>3</sup>, M. Kep; Fitry Erlin<sup>4</sup>, M. Kep; Hanno Pijl<sup>5</sup>, PhD

<sup>1</sup>Department of Nursing, Faculty of Health Sciences, Universitas Pahlawan Tuanku Tambusai, Riau Province, Indonesia;

<sup>2</sup>Indonesian Diabetes Center, Universitas Pahlawan Tuanku Tambusai, Riau Province, Indonesia;

<sup>3</sup>Department of Nursing, Poltekkes Kemenkes Riau, Riau Province, Indonesia;

<sup>4</sup>Department of Nursing, Institut Kesehatan Payung Negeri, Riau Province, Indonesia;

<sup>5</sup>Leiden University Medical Center, Faculty of Internal Medicine, Leiden, the Netherlands

### Corresponding Author:

Nila Kusumawati, MPH; Jl. Tuanku Tambusai, Bangkinang, Kabupaten Kampar, Riau Province, Postal Code: 28463, Indonesia

Tel/Fax: +62 813 85525626; Email: nilakusumawati@universitaspahlawan.ac.id

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### ABSTRACT

**Background:** Schools, a place where students spend much more time than home, play an important role in preventing the nation's future generation from type 2 diabetes mellitus (T2DM). This study aimed to explore challenges in T2DM prevention among senior high school students.

**Methods:** The study was conducted in Riau Province, Indonesia, from June to August 2023 using a qualitative content analysis. 31 respondents, determined by data saturation, were recruited using purposeful sampling. They were public senior high schools' principals, vice principals, school health services staff, school canteen tenants, students, parents, and primary health care personnel in six districts. Data were collected through semi-structured face-to-face interviews and document review. Graneheim and Lundman's content analysis method was used to analyze the data in Nvivo version 11 software. The Lincoln and Guba Qualitative research criteria for trustworthiness were used to ensure the rigor of the study.

**Results:** The main concepts obtained from the data were classified into three themes entitled, "Nonoptimal existing diabetes prevention programs in schools", "Inadequate knowledge of school community on T2DM", and "Inadequate policies to prevent diabetes in schools".

**Conclusion:** An evidence-based, well-organized, and systematic school-based diabetes prevention program is fundamental to help overcome challenges and prevent future T2DM incidence. It requires relevant stakeholders' high level of awareness, strong collaborations with the school community, and effective school policies.

**Keywords:** Diabetes mellitus, Prevention, Primary health care, Qualitative study, Students

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## INTRODUCTION

Despite being a preventable disease, diabetes continues to be a serious health issue in many countries around the world, as evidenced by global commitments and initiatives.<sup>1,2</sup> According to the International Diabetes Federation (IDF), in 2021 no less than 537 million people aged 20-79 years old had diabetes, and 6.7 million people died due to the disease or its complications. Instead of declining, the IDF further projected that the number of people with diabetes will have increased to 643 million by the end of the 2030 Agenda of Sustainable Development, and 783 million in 2045. While adult-onset type 2 diabetes mellitus (T2DM) remains a major public health challenge, youth-onset T2DM, T2DM diagnosed under 20 years old, also increasingly requires exigent attention.<sup>3</sup>

Several studies have shown that most of the risk factors responsible for T2DM, such as sedentary lifestyle behavior, unhealthy dietary patterns, and obesity, are modifiable.<sup>4,5</sup> Indeed, exposure to these risk factors at an early age could influence the development of the disease later in life.<sup>6,7</sup> As such, preventive measures are essential and must be instilled from the early stages of life with the support of parents, local communities, local healthcare providers, policy makers, and schools.<sup>8</sup> The fact that students spend most of their time at schools and that it is relatively easy to modify lifestyle habits at an early age makes school a potentially effective locus to promote health and address the prevention of T2DM.<sup>9,10</sup>

Indonesia is ranked 3<sup>rd</sup> concerning the number of people with undiagnosed diabetes, and 5<sup>th</sup> for the number of adults aged 20-79 with diabetes in the world in 2021, after climbing up from 7<sup>th</sup> place in 2019.<sup>3</sup> The endeavors of the country to prevent and control a projected future increase of T2DM incidence include but are not limited to obesity and diabetes screenings in people as young as 15 years,<sup>11</sup> which also pertains to students in secondary education.<sup>12</sup> To achieve these targets and to provide other school health services (SHS), the government mandates primary health care

(PHC) to accommodate at least 20% of all levels of schools located within its catchment area. PHC must visit the schools at least four times a year to activate SHS which consists of health education, health service, school environment supervision, and the student's physical activity.<sup>13</sup> Additionally, a school should be equipped with a school health unit, globally known as School Health or SHS office, to perform school health efforts. As mandated by a regulation of four joint ministries, i.e. education, health, home affairs, and religion, an SHS office, with PHC, is responsible for SHS in a school, particularly senior high school.<sup>14</sup>

Indonesia, as well as other countries impacted by diabetes, is striving for non communicable disease (NCD) prevention and treatment, including diabetes, to achieve target 3.4 of the 2023 Sustainable Development Goals.<sup>1</sup> One of the efforts is the launch of the World Health Organization (WHO) Diabetes Global Compact, one of the three specific goals of which is to bolster health promotion activity, specifically among young people.<sup>2</sup> These endeavors emphasize the importance of diabetes prevention among students in a school setting. However, only a few studies have explored the existing T2DM prevention efforts at schools in great depth, particularly in Indonesian schools. This qualitative study aimed to explore the challenges that schools encounter in preventing T2DM among their students from the perspectives of PHC staff, schools administrators, school canteen tenants, students, and parents.

## METHODS

This study used a qualitative content analysis. It was conducted in Riau, one of four provinces in Indonesia, with the highest increase in diabetes prevalence over the last 10 years. As reported by the latest Indonesian Basic Health Survey, the prevalence rate of diabetes in the province rose by almost 100% from 1.0% in 2013 to 1.9% in 2018. The increase swiftly positioned Riau as the 14<sup>th</sup> of the 33 listed provinces with high diabetes

prevalence in the country.<sup>15</sup> Of 12 regencies/cities in Riau Province, Kampar Regency was selected for its continuous rise of diabetes prevalence and highest number of senior high schools and students.<sup>16,17</sup> Data collection took place from June 13 to August 16, 2023, in six districts of Kampar Regency: Bangkinang, Kampa, Kampar, Kuok, Pantai Cermin, and Tambang.

The study participants were school principals, vice principals, SHS staff, canteen tenants, students of public general senior high schools, and parents. In the Indonesian setting, senior high school (grades 10-12), also known as upper secondary education, is compulsory education attended after the junior high school (grades 7-9). Generally, senior high school students are aged 15-17 years,<sup>12</sup> which makes them a target of national early detection of NCD programs, including diabetes. Students who transferred from another school less than one year ago and parents who lived separately from the students were excluded. Only the school personnel who had worked for the same schools for at least one year and school canteen tenants who had rented the stalls for at least six months were included. In addition, we recruited PHC personnel, including the head and staff in charge of SHS, health promotion, and NCD programs in the districts for a minimum of one year.

The convenience of accessibility was used to select the districts and schools. PHC, all participants of the schools in the selected districts and parents were selected by purposeful sampling.<sup>18</sup> Data saturation, a point where no new information emerged, determined the number of participants to be recruited for the study. None of the researchers had a relationship with the participants before the study.

This study used semi-structured interview topic guides, developed by the authors. The topic guides were reviewed by an expert and then pilot tested by one senior high school principal, two senior high school students, one SHS staff, one canteen tenant, and one PHC staff in Bangkinang Kota district. Modifications were made to improve the topic guides. The PHC staff and school administrators were first asked the main

question “What challenges do you encounter in preventing diabetes among students?”, the students were asked the question “What do you do, especially at school, to stay healthy?”, the canteen tenants were asked the question “What do you consider when selecting foods and beverages to sell to students in school?”, and the parents were asked the question “How do you think school helps prevent your child from diabetes?”.

Data were collected during face-to-face semi-structured interviews and document reviews. The interviews were done by the principal investigator, NK, in a comfortable room of the participants’ offices, schools, or homes to avoid any distractions. All interviews used the Indonesian language and were audio recorded. Field notes were taken to highlight important statements delivered by the participants. The interviews lasted from 47 to 65 minutes. No repeat interview was performed. The document reviews were conducted by NK in SHS offices by checking SHS documents, such as students’ health records about students’ health status, particularly diabetes, using a checklist. The checklist, which had been reviewed by one diabetes expert, consisted of 10 items whose main questions included students’ anthropometric measurements and blood glucose.

Then, the co-authors, AR and FE, immediately prepared verbatim transcription prepared after each interview. For its accuracy, each transcript was checked back against the original audio recording by SMA. NK used the first three transcripts to make a codebook. All researchers agreed upon the final codebook. The transcripts, document review results, and field notes were analyzed using the Graneheim and Lundman’s content analysis in Nvivo, version 11 software.<sup>19</sup> To start the data analysis, we tried to get a general overview of the data by repeatedly reading and understanding the transcripts, document review results, and field notes. Subsequently, we divided up the texts into meaning units and then condensed the meaning units. We coded the condensed meaning units according

to the codebook. We grouped the codes based on the similarity of their contents and contexts into subcategories. We collated the similar subcategories repetitively and grouped the sub-categories into categories. We cross-checked the categories and developed the themes. The developed themes and quotes were then translated into English for reporting. The study is reported using the Consolidated Criteria for Reporting Qualitative Studies.<sup>20</sup>

The four criteria of the Lincoln and Guba's qualitative research trustworthiness were used to assure the study rigor. Credibility criterion was ensured by collecting data from multiple sources: document reviews and interviews with different school communities. We also performed member checking for transcripts and the study findings by having five participants from different study areas comprising one PHC staff, one SHS staff, one school administrator, one student, and one parent to help verify the data. The dependability criterion was established through discussions with diabetes experts and qualitative researchers. The transferability criterion was addressed by describing the participants' characteristics, data collection, and analysis process in all research stages. The confirmability criterion was ensured by developing a reflexive journal and reporting the audit trail.

One author (HP) in the Netherlands is a professor of diabetology who has extensive experience in research and diabetes, and the first four authors are assistant professors in nursing departments of higher education institutions in Riau Province, Indonesia, who had training in, and experience with qualitative studies, and completed their senior high school in the province. Having a health educational background and interest in diabetes, the Indonesian researchers expected that SHS staff was the health personnel. Being aware of the fact that our experience and expectation could influence the study, we ensured the reflexivity by writing a reflexive journal throughout the research process.

The study obtained ethical approvals from the ethics committee of Universitas Hang

Tuah, Riau Province (No. 651/KEPK/UHTO/XII/2022) and Research and Community Services Unit, Universitas Pahlawan Tuanku Tambusai (No. 055/LPPM/UPTT/V/2023). We also obtained permission from the Education Office of Kampar Regency, Riau Province (No. 421/cabdisdik/6.2/2023/083) to conduct the study in the affiliated schools. The study was conducted following the Declaration of Helsinki. The study only recruited the participants who voluntarily agreed to participate. Before data collection, we explained about the study objectives, including the rights to withdraw at any time and to reject any question without any consequences. Participants who agreed to participate signed an informed consent form. No participants refused to participate or withdrew from this study.

## RESULTS

As shown in Table 1, 31 participants were recruited. The participants consisted of one senior high school principal, two vice principals, nine SHS staff, four canteen tenants, four students, and three parents. The participants also included one PHC head, and seven PHC staff that comprised two SHS program, four NCD program, and one health promotion program coordinators who had been working in the program for two to six years. The participants belonged to a PHC and two schools in Kuok, a PHC and one school in Kampar, a PHC and two schools in Kampa, a PHC in Bangkinang, a school in Tambang, and a PHC in Pantai Cermin districts. The data analysis yielded 682 condensed meaning units, 247 codes, 53 subcategories, nine categories, and three themes. The categories and themes are shown in Table 2.

### *1. Nonoptimal Existing Diabetes Prevention Programs in Schools*

Our study findings revealed that no school designed its diabetes prevention program. Some diabetes-related interventions conducted in schools' premises were part of SHS whose minimum targets were set by the Ministry of Health through its regulation.

**Table 1:** Characteristics of the participants

Number of Participant	Age (Years)	Sex	District	National School Accreditation	Role	Educational Background
P1	49	Female	Kampa	A (Very good)	School Principal	Master of Arts
P2	51	Male	Kampar	B (Good)	Vice Principal	Bachelor of Education
P3	36	Female	Kampa	A (Very good)	Vice Principal	Bachelor of Education
P4	26	Female	Kampar	A (Very good)	SHS <sup>a</sup> Staff	Diploma III of Midwifery
P5	32	Female	Bangkinang	A (Very good)	SHS Staff	Bachelor of English Language Education
P6	29	Female	Kuok	A (Very good)	SHS Staff	Bachelor of English Language Education
P7	31	Female	Kuok	B (Good)	SHS Staff	Bachelor of Economics
P8	26	Female	Kampa	A (Very good)	SHS Staff	Diploma III of Nursing
P9	25	Female	Kampa	A (Very good)	SHS Staff	Diploma IV of Nursing
P10	32	Female	Tambang	A (Very good)	SHS Staff	Bachelor of Indonesian Language Education
P11	28	Female	Tambang	A (Very good)	SHS Staff	Bachelor of English Language Education
P12	28	Female	Kampa	B (Good)	SHS Staff	Diploma III of Nursing
P13	42	Female	Pantai Cermin	-	Head of PHC <sup>b</sup>	Master of Health Law
P14	39	Female	Kampa	-	PHC Staff – SHS Program	Dental Residency Program
P15	31	Female	Kampa	-	PHC Staff – NCD <sup>c</sup> Program	Bachelor of Midwifery
P16	33	Female	Kampa	-	PHC Staff – Health Promotion program	Nursing Residency Program
P17	32	Female	Kampar	-	PHC Staff – SHS Program	Dental Residency Program
P18	35	Female	Kampar	-	PHC Staff – NCD Program	Nursing Residency Program
P19	38	Female	Kuok	-	PHC Staff – NCD Program	Nursing Residency Program
P20	34	Female	Pantai Cermin	-	PHC Staff – NCD Program	Diploma III of Nursing
P21	17	Male	Kuok	-	Student	Grade XI Senior High School
P22	17	Female	Kampa	-	Student	Grade XI Senior High School
P23	18	Female	Pantai Cermin	-	Student	Grade XII Senior High School
P24	17	Male	Kampar	-	Student	Grade XII Senior High School
P25	48	Female	Tambang	-	Canteen Tenant	Did Not Attend School
P26	52	Male	Kuok	-	Canteen Tenant	Senior High School
P27	35	Female	Kampar	-	Canteen Tenant	Junior High School
P28	30	Female	Pantai Cermin	-	Canteen Tenant	Did Not Attend School
P29	28	Female	Pantai Cermin	-	Parent	Junior High School
P30	32	Male	Kuok	-	Parent	Senior High School
P31	54	Male	Kampa	-	Parent	Elementary School

<sup>a</sup> School health services; <sup>b</sup> Primary health care; <sup>c</sup> Non communicable disease

**Table 2:** Categories and themes generated from the data

Categories	Themes
Inadequately evidence-based diabetes prevention programs in schools	Nonoptimal existing diabetes prevention programs in schools
Inadequately resource-equipped diabetes prevention programs in schools	
School administrator’s low awareness of T2DM <sup>a</sup>	Inadequate awareness and knowledge of school community’s on T2DM
SHS staff’s inadequate knowledge of T2DM	
School canteen tenant’s poor awareness of T2DM	
School student’s inadequate knowledge of T2DM	
Insufficient accommodation of T2DM prevention measures at school curriculum	Inadequate policies to prevent diabetes in schools
Weak system of school health services office	
Lenient health-related school policies in school canteens	

<sup>a</sup>Type 2 diabetes mellitus

The local PHC, supervised by the local health office, was responsible for planning school visit schedules and their activities. However, the programs suffered from deficiencies in supporting the evidence and resources.

*I.a. Inadequately Evidence-based Diabetes Prevention Programs in Schools*

When PHC visited schools, it had independently planned a diverse array of targeted programs. Related to diabetes, the programs heavily targeted students and primarily focused on collecting the students’ physiological and biological data, and health promotions. However, school communities, specifically students, parents, and canteen tenants, were not involved in collecting essential information, following up the students’ screening results, improving the existing prevention program, or making commitment to a lifestyle modification plan. To some extent, SHS staff was involved in technical assistance. A PHC staff stated, *“We normally performed what the local health office had asked us to do. During our visits to schools, data that we collected included students’ annual random blood glucose, weight, height, waist, and upper arm circumferences...When we found students with obesity and diabetes, we sometimes did individual nutritional counseling on the spot. We did not perform any intervention beyond what was asked.”* (P14) An SHS staff revealed, *“There was no contact with the students or their parents following the PHC visit to the school. School possessed neither*

*a complete record of the students’ body measurements nor a record of their blood glucose results.”* (P9) A parent confirmed, *“Our communication with the school was all about our children’s academic matters.”* (P31)

*I.b. Inadequately Resource-equipped Diabetes Prevention Programs in Schools*

All targeted health programs in schools were performed by several PHC personnel disproportionate to the number of school students. When visiting schools, PHC staff had various targeted SHS to complete within a limited time, and schools could allocate. A PHC staff member stated, *“Due to PHC’s limited human resources, I am in charge of both health promotion and mental health departments, and responsible for several programs to be carried out in PHC, school, and community settings. When holding health promotion programs in a school, we have to cover various topics at once: anemia, menstruation, HIV/AIDS, cervical cancer, and NCD, to name a few. We do not have much time to explain each issue in depth within the time available. Sometimes, we need to focus on just one burgeoning health issue.”* (P18)

The findings of our study also revealed that diabetes health education or promotion in schools was not directed by a curriculum and did not use adequate educational materials, let alone interest-catching ones. A PHC staff member asserted, *“We carried out health promotion programs either in the school’ hall or classroom, where only limited students could attend.... We do not have a written*

*curriculum for health education programs we carry out in schools.” (P20) A student confirmed, “I attended health promotions program performed by PHC Personnel in my school. The health promotion program authorities used a traditional method without any visual materials, which made it rather boring.” (P23)*

## *2. Inadequate Awareness and Knowledge of School Community’s on T2DM*

Our study findings showed that the primary challenges of T2DM prevention in schools were inadequate awareness and knowledge of school community, including school administrators, SHS staff, school canteen tenants, students, and parents, on diabetes generally and T2DM specifically.

### *2.a. School Administrator’s Low Awareness of T2DM*

All school administrators assumed that diabetes was a disease of elderly people, which made them unaware of the importance of early diabetes prevention measures among their students. A school principal stated, *“I never considered raising awareness of my students about NCD or diabetes, a disease which they might not have now but could develop at some point later in their lives. I often assumed that infectious disease, reproductive health, and drug addiction were more important than diabetes as they bring about short-term adverse outcomes.” (P1)*

### *2.b. SHS staff’s Inadequate Knowledge of T2DM*

While a few SHS personnel were health workers, a great number of staff were not, which made them not sufficiently knowledgeable about health in general and diabetes in particular. Most of them assumed that diabetes was less important than infectious diseases. Almost all of the SHS personnel disclosed that they never had any diabetes training. They also did not know about the national SHS guideline, which highlights the schools SHS responsibilities, including NCD prevention. All SHS staff thought that the service SHS

provided to students in schools was merely first-aid training for emergency cases. An SHS staff with midwifery educational background even stated, *“As far as I know, my task is to take care of the students in need of emergency care in school. When the students came here with fever or gastritis, for example, I would give them over-the-counter medicines, which I used to take at home when I suffered these diseases myself. Diabetes is more about nursing. I am a midwife. Honestly, I do not have good knowledge about it.” (P4)*

### *2.c. School Canteen Tenant’s Poor Awareness of T2DM*

School canteen tenants did not think about any disease the students might contract, including diabetes, when planning to rent the school canteen stalls. Their choice of foods and beverages to sell was only based on financial constraints, cooking skills, and students’ general food and beverage preferences. Just hygiene was considered a critical issue. No school canteen tenant received training about healthy nutrition or diabetes. A tenant said, *“Students love sweetened drinks. I make various flavorings, extracts, and brands available for them to choose. This kind of drink is always students’ favorite in any school in the country. It never came to my mind that the beverages or food I sell potentially cause disease in the future.” (P27)*

### *2.d. School Student’s Inadequate Knowledge of T2DM*

While a few students knew about diabetes from their diabetic relatives, most of them were not aware of the disease. Over half of the students neither heard about diabetes in health promotion in school nor cared enough to self-access diabetes-related information. They mainly bought foods and beverages in the school canteens which they considered delicious and affordable. None of the students voluntarily worked out to stay healthy or avoid NCD or diabetes. A student said, *“I rarely heard about diabetes. Is it what people call*

*sweet pee disease?... I love cold sweet drinks available in the canteen. They taste really good, and are affordable... I think we will get obese only when we take too much rice ... Well, I play volleyball on Saturday or Sunday at home with friends as it is entertaining. Nothing else.” (P21)*

### *3. Inadequate Policies to Prevent Diabetes in Schools*

Our study findings revealed inadequate diabetes prevention policies in school curricula, canteens, and SHS offices.

#### *3.a. Insufficient Accommodation of T2DM Prevention Measures at School at School Curriculum*

In the school we studied, the school curriculum contained limited credit hours for physical exercise and sports. Most of the learning methods in the courses did not encourage students, who spent around 8-9 hours a day for five days a week in schools, to be physically active. Sports-related extracurricular activity was not mandatory, was scheduled on the weekend, and was selected only by male students. Lastly, the school curriculum always prioritized scholarly matters over the diabetes-related prevention program. A participant asserted, *“In the curriculum, students had a three-hour sport course per week... Outdoor group exercise is carried out merely once per month, on Thursday, for 30 minutes. Even though outdoor group exercise is obligatory, it is not attended by all students. Schools prioritize a lot of other activities to complete. Students have limited time as they should complete all their courses, too.” (P2)*

#### *3.b. Weak System of SHS Office*

No school had already written policies and standard operating procedures (SOP) for its SHS. Related to the workforce, each school employed full-time SHS staff. However, most of the schools had only one SHS personnel, who mostly did not have an educational background in healthcare.

Several SHS personnel were schoolteachers, who were responsible for both the SHS office and classes. Regarding the data management system, our study found that the students' health record was not digitalized and/or centralized. A simple paper-based health record was only used to register emergencies students experienced at schools, and the first aid given by SHS staff. No SHS office had a tracking system to detect and follow-up students with T2DM risk factors or T2DM. In one school, the SHS and administration office was located in the same small room. No SHS office had diabetes-related educational material or specifically-designed curricula for diabetes-related education and counseling. A SHS staff member asserted, *“In this school, I assume both administration officer and SHS staff positions. While I do not have a health educational background or training, my job description as the SHS staff is not clear. The SHS does not have SOPs to help guide me, leaving alone for diabetes prevention-related activities.” (P10)*

#### *3.c. Lenient Health-related Policies in School Canteens*

Schools did not have written rules for or contracts with tenants of school canteens about healthy foods and beverages they were allowed to sell. When school canteens made unhealthy foods and drinks available, schools neither had an SOP to follow nor a reward or penalty system to apply. Some tenants of canteens were school personnel's relatives. Sometimes, the prohibition of unhealthy foods led to family friction. A tenant stated, *“As far as I am concerned, the school did not provide any guideline of what I could sell in the canteen. I sold foods and beverages that students liked and could afford.” (P25)* A participant also said, *“We could not ask the canteen tenants to stop selling unhealthy foods and drinks. The problem was that precisely those foods and drinks were often purchased by the students. We felt bad to interfere with their business, and we did not want to get into trouble with them.” (P3)*



## DISCUSSION

The objective of this study was to explore the challenges of T2DM prevention among senior high school students. Our study findings emerged three themes that described the challenges. The themes were nonoptimal existing diabetes prevention programs in schools, inadequate awareness and knowledge of school community on T2DM, and inadequate policies to prevent diabetes in schools.

The first theme highlighted nonoptimal existing diabetes prevention programs in schools, with inadequate evidence and resources as the underlying reasons. Our study revealed that instead of being a locally-tailored intervention, that was based on evidence from the school community, and suited the specific needs of the school, the school diabetes prevention program usually entailed implementation of the national minimum standard of interventions. Consequently, the program never ran optimally. Our findings support a study that investigated SHS in 102 countries, excluding Indonesia, which reported that health programs in schools were not evidence-based and were not implemented well.<sup>21</sup> Another study emphasized the importance of a tailor-made program and local evidence generation when addressing factual needs or gaps.<sup>22</sup> The involvement of the school community, such as teachers and parents, as reported by studies, is essential, and can help improve diabetes prevention in adolescents.<sup>23, 24</sup>

Concerning resources, our study showed that diabetes prevention interventions in schools suffered from an inadequate workforce. A previous paper reports that too few human resources are indeed a primary organizational challenge experienced by SHS in both lower-middle- and high-income countries.<sup>21</sup> Indeed, overloaded healthcare providers are not able to properly implement a diabetes prevention program.<sup>21, 25</sup> Similar to the school healthcare system in several other countries, such as Peru,<sup>26</sup> each school that we studied was linked to PHC through an SHS

office, which usually employed full-time staff. However, the staff, oftentimes comprising schoolteachers or administrators without proper healthcare educational background, were not adequately trained in diabetes prevention and care. In stark contrast, another paper reported that SHS providers in most countries were well-trained psychologists, physicians, and nurses.<sup>21</sup> In its guideline on SHS, the WHO emphasized that it should be provided by properly trained healthcare workers, such as nurses or doctors, but not teachers.<sup>27</sup> A study reported that there was an association between the availability of school nurses with diabetes prevention.<sup>28</sup> A school nurse who is physically present in school can appropriately provide students with preventive and screening services, health education, and other critical support. Moreover, school nurses could function as liaisons to connect students, school, and healthcare personnel with family and community and serve a health program and policy in a leadership role.<sup>29</sup>

Further, our study also found that health education in schools lacked adequate resources. It was often delivered in an unstructured, monotonous didactic lecture-style, without a properly designed curriculum and/or interesting supporting materials. A study reported that diabetes education in schools played an important role in T2DM prevention.<sup>30</sup> Successful school health education could stimulate the adoption of a healthy lifestyle by students, which can have a positive impact on NCD incidence. As such, health education should be started as early as possible.<sup>30</sup> Further, health promotion must be structured and well planned, the content of its educational messages should be credible and evidence-based, its methodology should be innovative, its format and context should use visually supportive material, and its delivery method should use a platform preferred by adolescents.<sup>30-33</sup> Indeed, a great number of people in the country, including students, have smartphones and Internet access.<sup>17</sup> Worth noting, adolescents prefer an interactive diabetes prevention program.<sup>33</sup>

The second theme was poor awareness and knowledge of T2DM in school communities, particularly school administrators, SHS staff, school canteen tenants, and students. Our study findings corroborate the other studies with a diverse array of school communities as participants. A report from India shows that a great number of its school teachers believe that diabetes only affects older people.<sup>34</sup> Similar to a study finding in Iran, our study revealed that SHS staff did not have adequate knowledge of diabetes, did not receive the required training, and were not familiar with health programs and guidelines.<sup>25</sup> A study in Indonesia revealed that canteen tenants had inadequate knowledge of nutrition and healthy foods.<sup>35</sup> Also, studies in Bangladesh, Nepal, and Trinidad found that students did not have adequate knowledge of diabetes.<sup>10, 36, 37</sup>

Inadequate policies to prevent diabetes in schools were the last theme that emerged from our analysis. This theme revealed inadequate curriculum in supporting T2DM prevention measures in schools. Physical activity, healthy eating habits, and a healthy lifestyle are effective in the prevention of T2DM among students. As such, integrating them into the school curriculum might make their adoption more effective. Studies have suggested several ways to promote T2DM prevention in schools via the inclusion of T2DM diabetes prevention and management in school curricula,<sup>37</sup> or the delivery of health-related education as an extracurricular program.<sup>30</sup> Another study suggested that health education should be incorporated into school teaching activities.<sup>28</sup> Also, nutrition education in the school science curriculum significantly improved the students' knowledge of nutrition-related diseases. Teaching it with a theory-based, behavior-focused, and interdisciplinary approach even made the curriculum more effective.<sup>38</sup> Given its importance, the WHO suggested that health literacy should be incorporated into school curricula.<sup>30</sup> Also, a study suggested that students and families could be involved in co-designing the development of a T2DM prevention

curriculum for schools.<sup>24</sup>

The theme also described that the weak system of the SHS office was another challenge of the school in preventing T2DM among students, manifested in the unavailability of SHS policies and SOPs. Our study findings were in line with those of another study, which reported that a great number of SHS in a total of 102 countries from low-income economies to high-income economies did not have adequate policies on SHS, such as its position within an educational institution, staff responsibilities, and evaluation standard.<sup>21, 39</sup> Our study revealed that the schools did not have policies that regulated foods and beverages allowed to be offered by the canteen tenants in the school canteens. Our study was in line with a study carried out in other parts of Indonesia, reporting specific policies on foods and beverages that could be made available in school canteens were not yet in place.<sup>35</sup> It is essential that a school canteen offers clarity regarding permitted and not permitted food items by law to support a healthy school food environment, as highlighted by a study in Iran.<sup>40</sup>

Our study had some strengths. As far as we know, this is the first study in Indonesia that explored challenges in the context of T2DM prevention among senior high school students. However, our study has limitations as well. First, the study was conducted in public senior high schools in rural areas of the country. The findings, consequently, cannot be generalized to public senior high schools in urban areas. Second, our study findings cannot be generalized to private senior high schools either in rural or urban areas, as this type of school has more flexibility and authority to create institutional policies for SHS and T2DM prevention.

## CONCLUSION

Nonoptimal existing diabetes prevention programs in schools, inadequate awareness and knowledge of school community on T2DM, and inadequate policies to prevent diabetes in

schools are challenges in the prevention of T2DM among senior high school students. Creating evidence-based, well-organized, and systematic school-based diabetes prevention programs, providing relevant school community with systematic and well-structured trainings on diabetes prevention, and making locally tailored school policies with the support of relevant stakeholders and policymakers will help overcome the challenges to prevent T2DM among senior high school students.

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### REFERENCES

- 1 United Nations. The sustainable development goals report: special edition. US: United Nations; 2023.
- 2 World Health Organization. The WHO global diabetes compact. Geneva: World Health Organization; 2021.
- 3 International Diabetes Federation. IDF Diabetes Atlas 10<sup>th</sup> Edition. Belgium: International Diabetes Federation; 2021.
- 4 Kyrou I, Tsigos C, Mavrogianni C, et al. Sociodemographic and lifestyle-related risk factors for identifying vulnerable groups for type 2 diabetes: a narrative review with emphasis on data from Europe. *BMC Endocrine Disorders*. 2022;20:134.
- 5 Ismail L, Materwala H, Al Kaabi J. Association of risk factors with type 2 diabetes: a systematic review. *Computational and Structural Biotechnology Journal*. 2021;19:1759-85.
- 6 Noh JW, Jung JH, Park JE, et al. The relationship between age of onset and risk factors including family history and life style in Korean population with type 2 diabetes mellitus. *Journal of Physical Therapy Science*. 2018;30:201-6.
- 7 Lascar N, Brown J, Pattison H, et al. Type 2 diabetes in adolescents and young adults. *The Lancet Diabetes & Endocrinology*. 2018;6:69-80.
- 8 Serbis A, Giapros V, Kotanidou EP, et al. Diagnosis, treatment and prevention of type 2 diabetes mellitus in children and adolescents. *World Journal of Diabetes*. 2021;12:344-65.
- 9 American Association of Diabetes Educators. Management of children with diabetes in the school setting. *The Diabetes Educator*. 2018;44:51-6.
- 10 Sitaula D, Shrestha N, Timalcina S, et al. Knowledge, attitude and practice regarding diabetes and hypertension among school students of Nepal. A rural vs. urban study. *PLoS One*. 2022;17:e0270186.
- 11 Minister of Health Regulation. Concerning technical standards for fulfilling basic service quality in minimum service standards in the health sector. Indonesia: Minister of Health Regulation; 2019. [Cited 3 August 2023]. Available from [http://hukor.kemkes.go.id/uploads/produk\\_hukum/PMK\\_No\\_\\_4\\_Th\\_2019\\_ttg\\_Standar\\_Teknis\\_Pelayanan\\_Dasar\\_Pada\\_Standar\\_Pelayanan\\_Minimal\\_Bidang\\_Kesehatan1.pdf](http://hukor.kemkes.go.id/uploads/produk_hukum/PMK_No__4_Th_2019_ttg_Standar_Teknis_Pelayanan_Dasar_Pada_Standar_Pelayanan_Minimal_Bidang_Kesehatan1.pdf) [In Indonesian]
- 12 Sukmayadi V, Yahya AH. Indonesian education landscape and the 21<sup>st</sup> century challenges. *Journal of Social Studies Education Research*. 2020;11:219-34.
- 13 Minister of law and human rights of the republic of indonesia. Immigration crossing system electronic card facilities at the immigration check place. Indonesia:

- Minister of law and human rights of the republic of Indonesia; 2022. [Cited 3 August 2023]. Available from <https://www.regulasip.id/themes/default/resources/js/pdfjs/web/viewer.html?file=/eBooks/2023/January/63bfc0e9b4789/Peraturan%20Menteri%20Hukum%20Nomor%2013%20Tahun%202022.pdf> [In Indonesian].
- 14 Indonesian Ministry of Education and Culture. UKS management in high school. Indonesia: Indonesian Ministry of Education and Culture; 2021. [Cited 9 August 2023]. Available from [https://is3.cloudhost.id/storagedirectus1/manajemen\\_uks/files/publikasi/1T0z6KNYegU3R3NDRVGmLRQBqJQpAOJV S7KwXlM9.pdf](https://is3.cloudhost.id/storagedirectus1/manajemen_uks/files/publikasi/1T0z6KNYegU3R3NDRVGmLRQBqJQpAOJV S7KwXlM9.pdf) [In Indonesian].
  - 15 Ministry of Health of Republic Indonesia. Riskesdas National Report 2018. Indonesia: Ministry of Health of Republic Indonesia; 2018. [Cited 10 August 2023]. Available from <https://repository.badankebijakan.kemkes.go.id/id/eprint/3514/1/Laporan%20Riskesdas%202018%20Nasional.pdf> [In Indonesian].
  - 16 Riau Provincial Health Service. Riau Province Health Profile. Indonesia: Riau Provincial Health Service; 2021. [Cited 9 August 2023]. Available from <https://dinkes.riau.go.id/sites/default/files/2023-02/Profil%20Kesehatan%20Provinsi%20Riau%20Tahun%202021.pdf> [In Indonesian].
  - 17 BPS Riau Province. Riau Province In 2021 Figures. Indonesia: BPS Riau Province; 2021. [Cited 10 July 2023]. Available from <https://repository.universitaspahlawan.ac.id/1879/1/Provinsi%20Riau%20Dalam%20Angka%202021.pdf> [In Indonesian].
  - 18 Andrade C. The inconvenient truth about convenience and purposive samples. *Indian Journal of Psychological Medicine*. 2021;43:86-8.
  - 19 Graneheim UH, Lundman B. Qualitative content analysis in nursing research: concepts, procedures, and measures to achieve trustworthiness. *Nurse Education Today*. 2004;24:105-12
  - 20 Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007;19:349-57.
  - 21 Baltag V, Pachyna A, Hall J. Global overview of school health services: data from 102 countries. *Health Behavior & Policy Review*. 2015;2:268-83.
  - 22 Parascandola M, Neta G, Salloum RG, et al. Role of local evidence in transferring evidence-based interventions to low- and middle-income country settings: application to global cancer prevention and control. *JCO Global Oncology*. 2022;8:e2200054.
  - 23 Lambrinou CP, Androutsos O, Karaglani E, et al. Effective strategies for childhood obesity prevention via school based, family involved interventions: a critical review for the development of the Feel4Diabetes-study school-based component. *BMC Endocrine Disorders*. 2020;20:52.
  - 24 Spurr S, Bally J, Nalwooga N. Honoring the voices of families: an interpretive description of parents' understandings of, and insights into preventing type 2 diabetes in adolescents. *BMC Pediatrics*. 2022;22:458.
  - 25 Sadeghi S, Mahani F, Amiri P, et al. Barriers toward the national program for prevention and control of diabetes in Iran: a qualitative exploration. *International Journal of Health Policy and Management*. 2023;12:6908.
  - 26 Choi Y, Kang S, Kim JS, et al. School health needs assessment in Chanchamayo, Peru: a health promoting school project. *Frontiers in Public Health*. 2020;8:333.
  - 27 World Health Organization. WHO Guideline on School Health Services. Geneva: World Health Organization; 2021.
  - 28 Pawils S, Heumann S, Schneider SA,

- et al. The current state of international research on the effectiveness of school nurses in promoting the health of children and adolescents: an overview of reviews. *PLoS One*. 2023;18:e0275724.
- 29 Council on School Health. Role of the school nurse in providing school health services. *Pediatrics*. 2016;137:e20160852.
  - 30 Pulimeno M, Piscitelli P, Colazzo S, et al. School as ideal setting to promote health and wellbeing among young people. *Health Promotion Perspectives*. 2020;10:316-24.
  - 31 Shan R, Sarkar S, Martin SS. Digital health technology and mobile devices for the management of diabetes mellitus: state of art. *Diabetologia*. 2019;62:877-87.
  - 32 Berry E, Aucott L, Poobalan A. Are young adults appreciating the health promotion messages on diet and exercise? *Journal of Public Health*. 2018;26:687–96.
  - 33 Pike JM, Moore CM, Yazel LG, et al. Diabetes prevention in adolescents: co-design study using human-centered design methodologies. *Journal of Participatory Medicine*. 2021;13:e18245.
  - 34 Rawal T, Schayck OC, Willeboordsw M, et al. How to promote a healthy lifestyle among children: development of an intervention module (i-PROMISE). *Public Health in Practice*. 2022;3:100262.
  - 35 Rachmadewi A, Soekarjo D, Maehara M, et al. School canteens in selected areas in Indonesia: a situation analysis. *Food and Nutrition Bulletin*. 2021;42:225-46.
  - 36 Akter F, Rashid SM, Alam N, et al. Knowledge, attitude and practice of diabetes among secondary school-going children in Bangladesh. *Frontiers in Public Health*. 2022;10:1047617.
  - 37 McDonald AE, Granderson IF, Stewart CS. Channel to death: high school students' perception about diabetes in Trinidad. *International Journal of Health Sciences*. 2015;3:1-6.
  - 38 Babashashi M, Omidvar N, Joulaei H, et al. Scrutinize of healthy school canteen policy in Iran's primary schools: a mixed method study. *BMC Public Health*. 2021;21:1566.
  - 39 Jansen D, Vervoort H, Visser A, et al. School health services. In: Blair M, Rigby M, Alexander D, editor. *Issues and opportunities in primary health care for children in Europe*. England; Emerald Insight; 2018. p. 192-206.
  - 40 Amahmid O, Guamri YE, Rakibi Y, et al. Nutrition education in school curriculum: impact on adolescents' attitudes and dietary behaviours. *International Journal of Health Promotion and Education*. 2020;58:242-58.