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Original Article

Public Awareness of Type 1 Diabetes and the New Italian Childhood Screening Program: Results From a Cross-Sectional Survey in Italy

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ABSTRACT

Objectives: To assess public knowledge of type 1 diabetes (T1D), awareness of the newly introduced Italian national T1D pediatric screening program, and willingness to participate in screening among survey respondents.
Methods: By a nationwide cross-sectional online survey demographic data and T1D knowledge, awareness and attitudes toward the screening program were collected. A composite T1D knowledge score (range −1 to +1) was calculated using a right-minus-wrongs method.
Results: A total of 695 respondents participated. Although 93.4% had heard of diabetes, specific knowledge of T1D was limited, with a median T1D knowledge score of 0.45. Significantly higher scores (P value<.05) were observed among females, residents of pilot regions, health care workers, and individuals who knew someone with diabetes. Awareness of the screening program is modest, with only 35.8% of participants adequately informed, with higher percentage in pilot regions (54.3%). Despite limited awareness, willingness to screen was high, with 93.4% of respondents and 95.4% of parents of eligible children open to screening. Higher knowledge scores were associated with greater willingness (P value = .037).
Conclusions: Results highlight strong public readiness for T1D screening, but significant gaps in knowledge and awareness. Targeted education and communication are needed to ensure informed participation and support successful nationwide implementation of the program.

Introduction

Type 1 diabetes (T1D) is a chronic autoimmune disease caused by immune-mediated destruction of pancreatic β-cells, requiring lifelong insulin therapy, and commonly diagnosed in childhood and adolescence, although it can occur at any age. In recent years, population-based screening for presymptomatic T1D has progressed from research to potential implementation in public health, aiming to reduce diabetic ketoacidosis (DKA) at onset and identify individuals in early stages who may benefit from immunomodulatory treatments, such as teplizumab, capable of delaying clinical onset.[1] Large initiatives—including the Fr1da study in Bavaria[2,3] and the Autoimmunity Screening for Kids program in Colorado[4,5]—have demonstrated that autoantibody-based screening is feasible, acceptable, and associated with reductions in DKA and improved recruitment into disease-modifying trials.

High participation is essential for the success of any population-level program. Lower participation would reduce the number of children identified in presymptomatic stages and limit public health impact.[6,7] Participation depends on public understanding of the disease[8]: people who understand the condition and its consequences are more willing to undergo preventive testing,[9] whereas limited knowledge or misconceptions—common for T1D and often confused with type 2 diabetes (T2D)—can hinder uptake.[10]

Abbreviations: DKA, diabetic ketoacidosis; IQR, interquartile range; T1D, type 1 diabetes; T2D, type 2 diabetes.

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Italy is the first country to legislate a national T1D screening program.[11,12] Preliminary data from the "D1Ce Screen" pilot study in Campania, Lombardy, Marche, and Sardinia[13] have already confirmed reductions in DKA at diagnosis.[14] The success of this initiative, however, depends on effective dissemination of information and sustained motivation among both health care professionals and the public. Early work has explored pediatricians' perceptions,[15] but little is known about population-level knowledge and willingness to participate.

This study assesses public knowledge of T1D, awareness of the national screening program, and willingness to participate, identifying barriers and facilitators to implementation in Italy.

Highlights

- Using a large nationwide online survey, this study provides the first national assessment of public knowledge of type 1 diabetes (T1D) and awareness of Italy's newly legislated population-wide T1D screening program, identifying multilevel determinants such as gender, residence in pilot regions, personal diabetes experience, and health care professional status
- Despite only moderate T1D knowledge and low awareness of the screening program (~35%), willingness to participate was exceptionally high (>90%). Knowledge level, prior exposure to diabetes, and clarity of information strongly influenced acceptability, and nearly half of hesitant respondents would reconsider with better education
- Participants in pilot regions demonstrated significantly higher T1D knowledge and screening awareness, indicating early "awareness effects" of regional implementation efforts, and confirming the importance of structured communication strategies
- Health care professionals were the most trusted information source, underscoring the need for targeted training to support effective family-facing communication and maximize population uptake

Clinical Relevance

This first national assessment shows limited public knowledge of type 1 diabetes (T1D) and low awareness of Italy's new screening program, yet strong willingness to participate. Understanding factors shaping T1D knowledge and screening acceptability can guide education, enhance early diagnosis, reduce diabetic ketoacidosis, and support effective implementation and policy planning.

Materials and Methods

Survey Instrument Development

The survey instrument was developed through a systematic step-by-step approach. An initial pool of 17 items was reviewed independently by 3 experts for face and content validity. After consensus, a pilot test with 3 laypersons confirmed clarity and usability. The final anonymous questionnaire included 17 items across 4 sections: (1) demographics; (2) T1D knowledge; (3) awareness of the screening program; and (4) attitudes toward screening (questionnaire available in the Supplementary file). Google Forms (Google LLC) was used for online administration, with mandatory fields to ensure completeness. No identifiable data were collected.

Participant Selection

The study population was defined in a heterogeneous manner to include individuals of different ages and gender, with the aim of gathering the broadest and most diverse range of views possible on perceptions of T1D and the pediatric screening program. No specific exclusion criteria were applied, in order to encourage maximum participation. Participants were recruited through snowball sampling to obtain heterogeneous opinions across age and gender groups. No exclusion criteria were applied. Recruitment occurred between February and August 2025 through social media (Facebook, Instagram), messaging platforms (WhatsApp), and email networks. Participation was voluntary and without incentives. Responses could be reviewed before submission. Data were exported to Excel and stored on an encrypted device accessible only to the research team.

T1D Knowledge Score

A composite "T1D knowledge score" was created based on 11 items (5 true and 6 false) covering the etiology, clinical features, and commonly taught epidemiological characteristics of T1D. Only items explicitly referring to T1D were included in the score calculation; questions assessing general awareness of "diabetes" (eg, having heard of diabetes or knowing someone affected) were analyzed descriptively and not incorporated into the score.

A right-minus-wrongs method was applied, rewarding correct endorsements and correct rejections while penalizing incorrect answers. The score was calculated as:

$$\frac{(\text{N correct selected} + \text{N incorrect not selected}) - (\text{N incorrect selected} + \text{N correct not selected})}{\text{N total answers}}$$

yielding a score from -1 to $+1$.

Statistical Analysis

Sample size was estimated using Cochran's formula for large populations,[16,17] yielding a minimum of 384 respondents for adequate representativeness. Descriptive statistics were used to summarize demographic characteristics and survey responses.

The normality of continuous variables was assessed using the Shapiro-Wilk test and were reported as mean ± standard deviation or as median and interquartile range (IQR), whereas

categorical variables were reported as absolute and percentages frequencies.

Since the T1D knowledge score was not normally distributed, differences between groups were evaluated using the Mann–Whitney *U* test (for 2 groups) and the Kruskal–Wallis test (for more than 2 groups), followed by pairwise post-hoc comparisons adjusted for multiple testing using the Bonferroni correction.

A multivariate linear regression model was performed to identify independent predictors of T1D knowledge score, including sex, age, education, employment status, living in a pilot region, having heard of diabetes, and knowing someone with diabetes as covariates. Standardized regression coefficients (β) and *P* values of significance were reported. Relative importance analysis was conducted to assess the contribution of each predictor to the explained variance.

Associations between participants' level of awareness of the screening program (3 categories: no knowledge, limited knowledge, good knowledge) and other study variables were assessed using appropriate statistical tests according to variable type.

Specifically, chi-square or Fisher's exact tests were applied for categorical variables. Continuous variables that did not meet normality assumptions were compared across awareness groups using the Kruskal–Wallis test, followed by pairwise Mann–Whitney *U* tests with Bonferroni correction for multiple comparisons when applicable.

Responses regarding participants' attitudes toward T1D screening (children eligible, willingness to screen, reconsideration after receiving information, interest in further information) were summarized using descriptive statistics (absolute frequencies and percentages). Associations between willingness to undergo screening and explanatory variables were evaluated using appropriate inferential tests: *t*-test or Wilcoxon–Mann–Whitney test for continuous variables, and chi-square test or Fisher's exact test for categorical variables.

Given the self-selected recruitment strategy, additional stratified analyses were performed to explore differences in outcomes according to participants' exposure to T1D. Respondents were categorized into 3 groups: (1) individuals with T1D or a family member with T1D, (2) health care professionals, and (3) participants without personal or professional exposure to T1D. Group comparisons were conducted using chi-square test were applied for categorical variables, and the Kruskal–Wallis test for continuous variables.

All tests were two-tailed and a *P* value <.05 was considered statistically significant. Statistical analyses were conducted using R software (v4.3.2 www.r-project.org).

Results

Participant Characteristics

A total of 695 individuals completed the survey; their demographic characteristics are summarized in Table 1. The majority of responders were female ($n = 578$, 83.2%). The overall mean age was 43.4 ± 12.6 years (range 18-78), with most participants aged between 30 and 50 years ($n = 396$, 57%). Geographically, participants were distributed across nearly all Italian regions. Half of the sample resided in Friuli Venezia Giulia ($n = 350$, 50.4%), where the study originated, followed by Lombardy ($n = 87$, 12.5%) and Veneto ($n = 54$, 7.8%). Overall, 63.5% of participants lived in North-East Italy, 14.7% in North-West, 12.2% in Central Italy (including Sardinia), 9.3% in Southern Italy (including Sicily), and 0.3% abroad. Approximately one-quarter of participants ($n = 160$, 23.0%) lived in pilot regions where the T1D screening program had already implemented.

Regarding educational attainment, 63 subject (9.1%) had completed only elementary or middle school, 276 (39.7%) had a high school diploma, 252 (36.3%) held a university degree, and 104 (14.9%) had completed postgraduate education. Most participants were employed ($n = 513$, 73.8%), while 54 (7.8%) were students, 53 (7.6%) were retired, and 75 (10.8%) were unemployed or fell into other categories. Among employed respondents, 187 (36.3%) worked in health sector, 60 (11.6%) in education, 41 (8.0%) in other scientific fields, and 227 (44.1%) in other sectors. Retired participants, students, and respondents who did not answer the employment question were not included in these calculations.

Table 1
Demographic Characteristics of Respondents

Respondents ($n = 695$)	
Gender, *n* (%)	
Female	578 (83.2)
Male	115 (16.5)
Other	2 (0.3)
Age, mean ± SD	43.4 ± 12.6
Region, *n* (%)	
Friuli-Venezia Giulia	350 (50.4)
Lombardy[a]	87 (12.5)
Veneto	54 (7.8)
Sardinia[a]	49 (7.1)
Sicily	28 (4.0)
Campania[a]	20 (2.9)
Emilia-Romagna	19 (2.7)
Lazio	18 (2.6)
Trentino-South Tyrol	18 (2.6)
Piedmont	11 (1.6)
Tuscany	11 (1.6)
Apulia	10 (1.4)
Calabria	5 (0.7)
Liguria	4 (0.6)
Marche[a]	4 (0.6)
Umbria	3 (0.4)
Abroad	2 (0.3)
Abruzzo	1 (0.1)
Basilicata	1 (0.1)
Macro-area, *n* (%)	
North-East	441 (63.5)
North-West	102 (14.7)
Center (incl. Sardinia)	85 (12.2)
South (incl. Sicily)	65 (9.3)
Abroad	2 (0.3)
Pilot region, *n* (%)	
Yes	160 (23.0)
No	535 (77.0)
Education, *n* (%)	
Elementary/middle school	63 (9.1)
High school diploma	276 (39.7)
University degree	252 (36.3)
Postgraduate degree	104 (14.9)
Employment status, *n* (%)	
Student	54 (7.8)
Employed	513 (73.8)
Retired	53 (7.6)
Other (unemployed, homemaker, etc.)	75 (10.8)
Field of employment ($n = 515$), *n* (%)	
Health care	187 (36.3)
Education	60 (11.6)
Other scientific field	41 (8.0)
Other	227 (44.1)

Data are presented as number (*n*) and percentage (%) or mean ± standard deviation (SD).
[a] Regions included in the pilot study.

Knowledge of T1D

General knowledge of diabetes, personal exposure, and specific knowledge items related to T1D – the latter forming the basis of

the T1D knowledge score - are summarized in Table 2. Most respondents (n = 649, 93.4%) reported having heard of diabetes mellitus, and 571 (82.2%) indicated that they personally knew at least 1 individual with the condition. Among these, 268 (46.9%) referred to a family member, 242 (42.4%) to a friend or acquaintance, 60 (10.5%) to themselves, and 1 respondent (0.2%) did not specify. Regarding the type of diabetes, 268 (46.9%) reported knowing someone with T1D, 77 (13.5%) with T2D, 138 (24.2%) with both types, and 88 (15.4%) were unable to identify the diabetes type.

Table 2
General Awareness of Diabetes and Type 1 Diabetes-Specific Knowledge

Respondents (n = 695)	
Have you ever heard of diabetes mellitus? n (%)	
Yes	649 (93.4)
No	46 (6.6)
Do you know at least one person with diabetes mellitus? n (%)	
Yes	571 (82.2)
No	124 (17.8)
Who is this person? n (%)	
A family member	268 (46.9)
A friend/acquaintance	242 (42.4)
Myself	60 (10.5)
No indication	1 (0.2)
What type of diabetes does this person have? n (%)	
Type 1	268 (46.9)
Type 2	77 (13.5)
I know people with both type 1 and type 2	138 (24.2)
I don't know	88 (15.4)
Type 1 diabetes knowledge score items, n (%)	
Presents with increased thirst and urination[a]	
Yes	403 (58.0)
No	292 (42.0)
Most common form of diabetes in children/adolescents[a]	
Yes	402 (57.8)
No	293 (42.2)
Autoimmune disease[a]	
Yes	348 (50.1)
No	347 (49.9)
Due to genetic predisposition[a]	
Yes	297 (42.7)
No	398 (57.3)
Presents with weight loss[a]	
Yes	259 (37.2)
No	436 (62.8)
Genetic disease[b]	
Yes	102 (14.7)
No	593 (85.3)
Caused by poor diet[b]	
Yes	78 (11.2)
No	617 (88.8)
Most common form of diabetes in adults/elderly[b]	
Yes	66 (9.5)
No	629 (90.5)
Consequence of obesity[b]	
Yes	56 (8.1)
No	639 (91.9)
Presents with weight gain[b]	
Yes	40 (5.8)
No	655 (94.2)
Infectious disease[b]	
Yes	0 (0%)
No	695 (100%)

Data are presented as absolute frequencies (n) and percentage (%).
[a] Indicates statements considered correct according to the questionnaire scoring system for type 1 diabetes.
[b] Indicates statements considered incorrect according to the questionnaire scoring system for type 1 diabetes.

Table 2 also presents the items used to assess knowledge about T1D, which formed the basis for the T1D knowledge score. The most frequently recognized features, correctly associated with T1D, included "increased thirst and urination" (58.0%), "most common of diabetes in children/adolescents" (57.8%), "autoimmune disease" (50.1%), "genetic predisposition" (42.7%), and "presents with weight loss" (37.2%). Misconceptions were also common: 14.7% considered T1D a "genetic disease," 11.2% "caused by poor diet," 9.5% believed it was the "most common form of diabetes in adults/elderly," 8.1% described it as "consequence of obesity," 5.8% as "presents with weight gain," while no respondents identified T1D as an "infectious disease".

Errors highlighted a heterogeneous pattern of knowledge about T1D. While 70 respondents (10.1%) correctly identified all the 5 relevant characteristics, 135 (19.4%) missed only 1 item, 94 (13.5%) missed two, 93 (13.4%) missed 3, and 154 (22.2%) missed four. A smaller proportion demonstrated more limited knowledge: 46 (6.6%) missed 5 items, 72 (10.4%) missed six, 20 (2.9%) missed seven, and 11 (1.6%) missed 8 items.

Using the scoring system, the median "T1D knowledge score" was 0.45 (IQR 0.55; range −0.45 to 1) (Supplementary Table 1 reports the median and IQR of the T1D knowledge scores for all the variables considered). The score did not differ by age (P value >.05), but gender differences were observed with females scoring higher than males (0.45 vs 0.27, P value <.001). Significant differences were also found by region (P value = .006) and macroarea (P value <.001), with Central Italy scoring higher than the South and North-East (0.64 vs 0.45 and P value = .017 and P value <.001, respectively).

The distribution of the score differed significantly between pilot and nonpilot regions, with higher values observed in the pilot regions compared with the nonpilot regions (0.55 vs 0.45, respectively; P value <.001) (Fig. 1 *A*).

T1D knowledge score was different depending on the level of education (P value = .035), with university graduates scoring higher than high school graduates (0.64 vs 0.45, P value = .031) (Fig. 1 *B*). The score did not differ by employment status but did differ by professional sector (P value = .002), with health care professionals scoring higher than those working in the education sector and in the "other" sector (0.64 vs 0.45, P value = .033 P value = .002, respectively) (Fig. 1 *C*).

Participants who knew about diabetes or had personal experiences with diabetic individuals scored significantly higher than those who did not (0.45 vs −0.09, and 0.45 vs 0.27, respectively; P value <.001) (Fig. 1 *D* and *E*). Scores were highest among participants with diabetes themselves (0.82), followed by those whose family member with diabetes (0.64), both higher than participants who knew a friend or acquaintance with diabetes (0.45, P value <.001 for both comparison). Those who knew people with T1D had higher scores than participants who knew people with T2D (0.64 *vs* 0.27, P value <.001) or who could not identify the diabetes type (0.64 *vs* 0.27, P value <.001). Similarly, those who knew individuals with both T1D and T2D also scored higher (0.64) than both comparison groups (P value <.001) (Fig. 1 *F*).

In the multivariate linear regression model, higher T1D knowledge scores were independently associated with living in a pilot region (β = 0.08, P value = .023), having heard of diabetes (β = 0.19, P value = .009), and knowing someone with diabetes (β = 0.23, P value <.001). Male gender was associated with lower scores (β = −0.15, P value <.001). Education, employment status, and age were not significantly associated with knowledge (Table 3).

Relative importance analysis showed that knowing someone with diabetes (38.6%), having heard of diabetes (23.3%), and sex

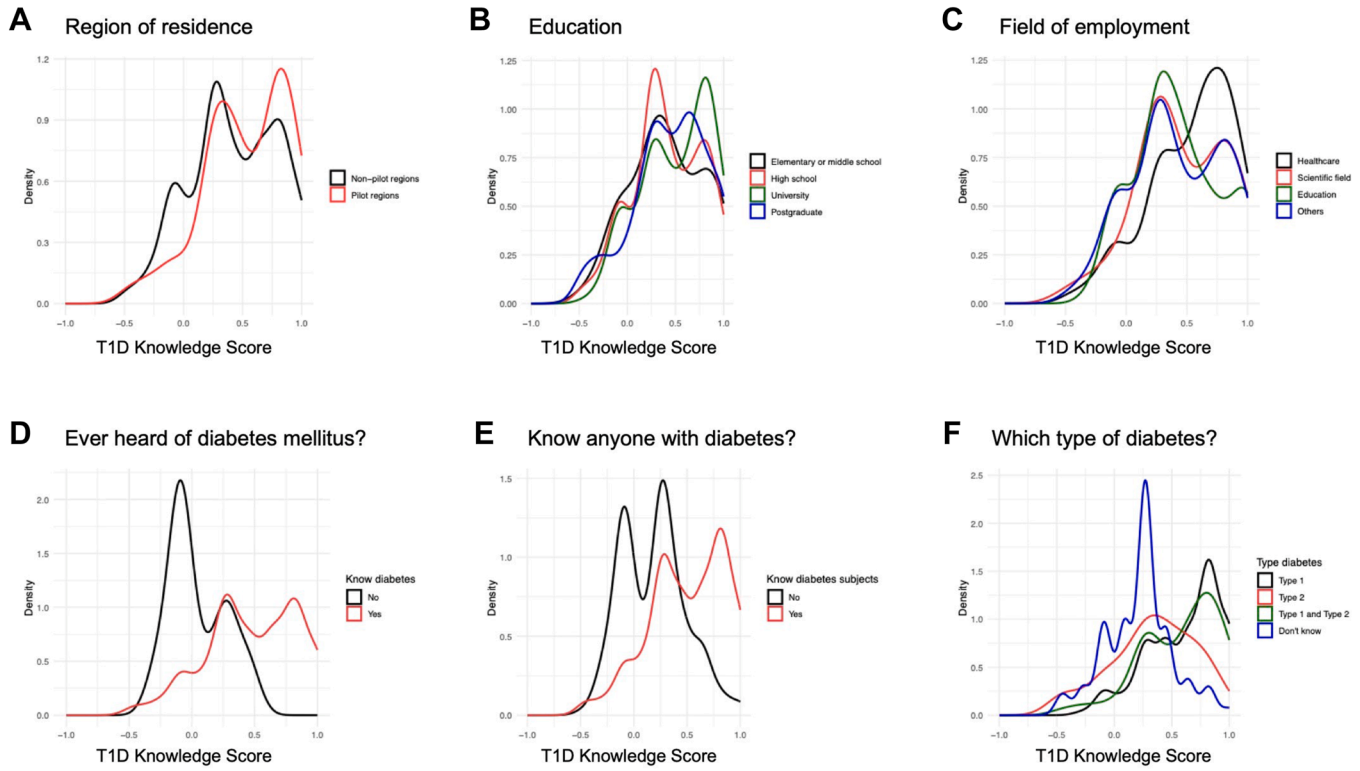

Fig. 1. Distribution of type 1 diabetes (T1D) knowledge scores across participant characteristics. Kernel density distribution of T1D knowledge scores across participant characteristics. Panel show distribution stratified by: (*A*) region of residence: (pilot *vs* nonpilot regions); (*B*) education level (elementary/*middle* school, high school, university degree, postgraduate degree); (*C*) field of employment: (health care, scientific fields, education, other sectors); (*D*) Ever heard of diabetes mellitus?: prior awareness of diabetes; (*E*) Know anyone with diabetes?: personal acquaintance with someone with diabetes; (*F*) Which type of diabetes?: (type 1 diabetes; type 2 diabetes; both; unknow type). The x-axis reports the T1D knowledge score, ranging from −1 to +1.

(16.8%) were the strongest contributors to the variance in T1D knowledge scores. Education, employment field, and living in a pilot region contributed modestly (5% to 8%), whereas age had minimal impact (Fig. 2 and Table 3).

Table 3
Multivariate Linear Regression Analysis of Factors Associated With Diabetes Knowledge Score

Predictor	Estimate[a]	*P* value	Relative importance (%)
Intercept	0.17	.09	
Sex (male *vs* female)	−0.15	**<.001**	16.8
Age (years)	−0.001	.50	0.62
Pilot regions (yes *vs* no)	0.08	**.023**	5.60
Education			8.41
High school *vs* primary/middle	−0.04	.46	
University *vs* primary/middle	0.05	.40	
Postgraduate *vs* primary/middle	0.001	.99	
Field of employment			6.75
Scientific field *vs* health sector	0.01	.88	
Education *vs* health sector	−0.09	.09	
Others *vs* health sector	−0.05	.15	
Heard about diabetes (yes *vs* no)	0.19	**.009**	23.3
Knowing a person with diabetes (yes *vs* no)	0.23	**<.001**	38.6

Model R^2 = 19.1%. Significant results were indicated in bold (*P*-values ≤.05). Reference categories: Sex = female; Pilot region = No; Education = Primary/middle school; Field employment = Health sector; Heard about diabetes = No; Knowing a person with diabetes = No.
[a] Regression coefficient.

Awareness About the Screening Program

When asked about their knowledge of the Italian national T1D screening program, 446 respondents (64.2%) reported being unaware, 183 (26.3%) had heard of it but knew little, and 66 (9.5%) considered themselves sufficiently well-informed (Table 4). Among those aware, the main sources of information were health care professionals (n = 116, 46.6%), people with T1D (n = 56, 22.5%), newspapers (n = 40, 16.1%), and television (n = 30, 12.0%), with smaller contributions from friends (n = 24, 9.6%), relatives (n = 17, 6.8%), social networks (n = 12, 4.8%), radio (n = 10, 4.0%), podcasts (n = 9, 3.6%), and other sources (n = 17, 6.8%) (Fig. 3).

Awareness of the national screening program was related to higher T1D knowledge score (*P* value < .001), as acquaintance of a person with diabetes (*P* value < .001), especially if the person had T1D (*P* value < .001).

Region of residence (*P* value <.001) and living in a pilot region (*P* value <.001) were also significant factors. Specifically, 54.3% of respondents in pilot regions were aware of the screening compared with 30.3% in nonpilot regions.

No significant differences were observed by sex, age, education level, occupation, or professional sector.

Attitudes Toward Screening

Only a minority of respondents (n = 109, 15.7%) had a child in the eligible age range (2 and 6 years) for screening; of these, 95.4% were open to screening their children. Overall, the vast majority (n = 649, 93.4%) stated they would be willing to have their children or grandchildren screened for T1D, while 46 (6.6%) expressed

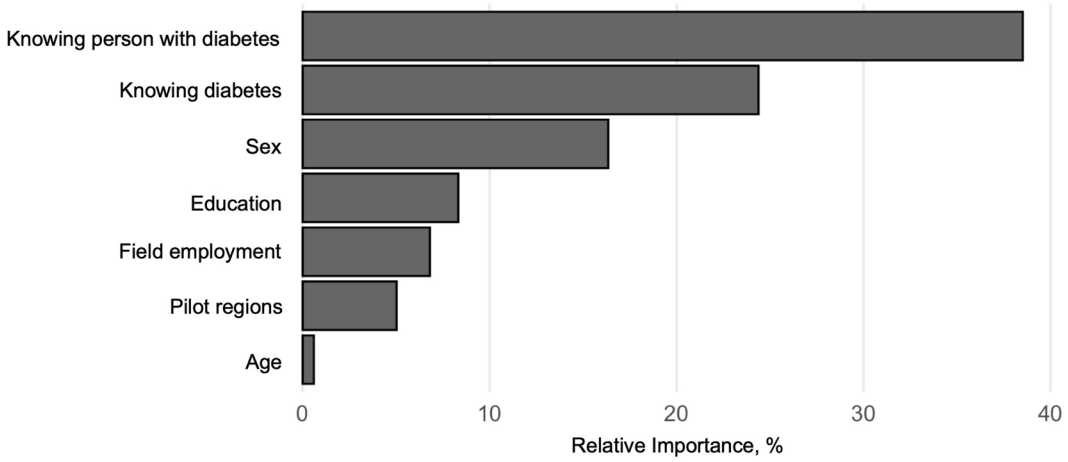

Fig. 2. Relative importance of predictors for the type 1 diabetes (T1D) knowledge score. Relative importance of predictor for the T1D knowledge score, based on the multivariate regression model. Higher percentages represent a stronger contribution of each predictor to the model's explained variance.

Table 4
Attitudes Toward Screening

Respondents (n = 695)	
Awareness about the screening, n (%)	
Unaware	446 (64.2)
Heard but little	183 (26.3)
Well informed	66 (9.5)
Children eligible for screening, n (%)	
Yes	109 (15.7)
No	597 (84.3)
Willingness to screen own (or future) children/grandchildren, n (%)	
Yes	649 (93.4)
No	46 (6.6)
If "No": Likely to reconsider with more information, n (%)	
Yes	23 (50.0)
No	21 (45.7)
Not reported	2 (4.3)
Interested in receiving more information about screening, n (%)	
Yes	497 (71.5)
No	198 (28.5)

Data are presented as frequencies (n) and percentage (%).

reluctance. Of these, 23 (50.0%) indicated they might reconsider if provided with additional information. Moreover, a large majority (497, 71.5%) expressed interest in receiving more information about the screening program (Table 4).

The association between willingness to undergo screening and several explanatory variables was assessed. Analyses showed that 94% of individuals who had heard of diabetes were willing to participate in the screening program, compared with 80% of those who were unaware of the condition (P value < .001), whereas knowing someone with diabetes had no impact. Individuals who were not willing to undergo screening had a median T1D knowledge score of 0.27 (IQR 0.69), while those who were willing to participate had a significantly higher score of 0.45 (IQR 0.55) (P value = .037) (Fig. 4). Sex, age, education level, occupation, geographical macro-area, and living in pilot regions were not associated with willingness to undergo diabetes screening.

Stratified Analyses by Personal or Professional Exposure to T1D

Stratified analyses revealed marked differences in T1D knowledge according to participants' personal or professional exposure to the disease. The T1D knowledge score differed significantly across groups (P value < .001), with the highest median score observed among individuals with T1D or a family member with T1D (0.82), followed by health care professionals (0.64), and substantially lower scores among participants without personal or professional exposure to T1D (0.27).

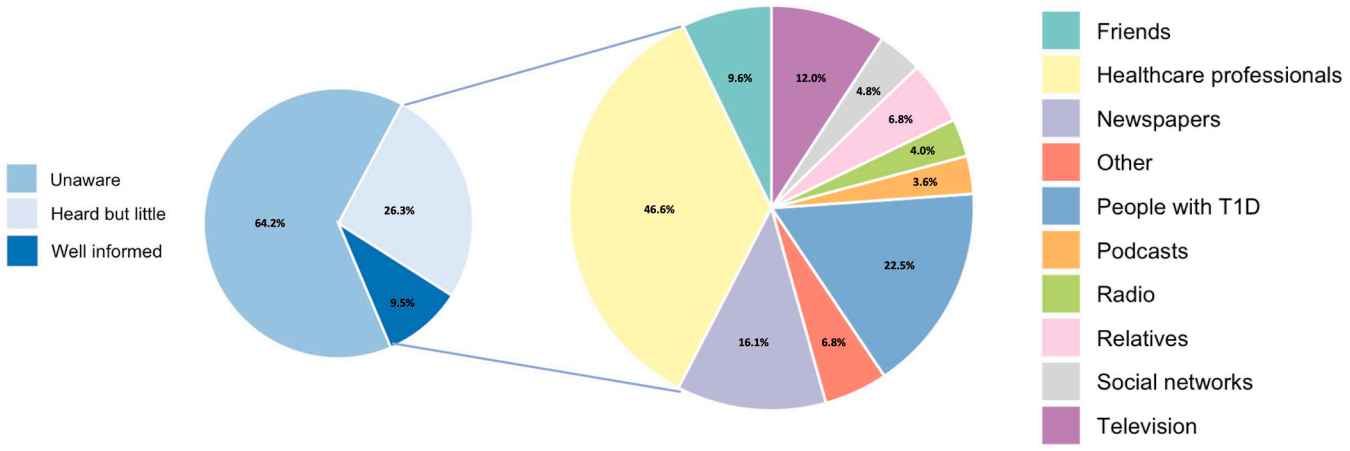

Fig. 3. Awareness of the national type 1 diabetes screening program and information sources. The *left panel* shows the proportion of respondents who were unaware, had heard little, or felt well informed about the program. The *right panel* shows the main information sources among those aware of the program.

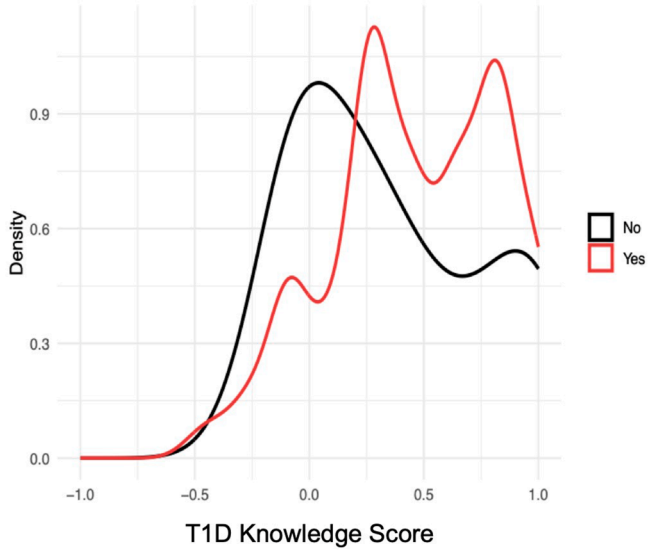

Fig. 4. Distribution of type 1 diabetes knowledge scores by willingness to participate in type 1 diabetes screening. Kernel density distribution of T1D knowledge scores among respondents willing to participate in the type 1 diabetes screening program ("Yes") and those unwilling to participate ("No"). The x-axis reports the diabetes T1D knowledge score, ranging from −1 to +1.

Awareness of the national T1D screening program also differed significantly between groups (P value < .001), being highest among individuals with T1D or affected family members (61.2%), intermediate among health care professionals (39.3%), and lowest among other participants (19.3%).

In contrast, willingness to participate in screening did not differ across groups, with uniformly high acceptance rates exceeding 92% in all 3 groups (92.9%, 93.9%, and 93.5%, respectively) (Supplementary Table 2).

Discussion

This nationwide survey involving 695 respondents provide the first insight into public knowledge of T1D in Italy, as well as awareness of and willingness to participate in the newly introduced national screening program. Despite broad familiarity with diabetes, specific understanding of T1D and knowledge of the screening initiative were limited. Nevertheless, the vast majority expressed a strong willingness to participate in screening, indicating high receptiveness despite low awareness. This paradox highlights the need for targeted educational and communication strategies to support informed participation as the program progresses toward national implementation.

Knowledge of T1D

The T1D knowledge score indicated that, despite moderate overall knowledge of T1D, only 10% of respondents answered all items correctly, highlighting widespread gaps in knowledge about T1D, consistent with findings from other surveys assessing public knowledge of T1D.[17-19]

In the present work, a substantial proportion of respondents correctly identified the statement that T1D is the most common form of diabetes in children and adolescents. While this reflects accurate knowledge about pediatric diabetes, it may also contribute the misconception that T1D does not occur in adulthood, with a considerable number of incident cases diagnosed in adulthood and a higher prevalence in adults.[20-22]

Furthermore, consistent with international reports, it emerged that the etiology of T1D is often confused with that of T2D and this could result in an underestimation of the risk and severity of T1D in children.[9,18]

As found in other studies, this study also found no association between knowledge of T1D and the age of the questionnaire participant,[19] while female gender, higher education, and employment in the health care sector were associated with greater knowledge, reflecting the findings of other population-based surveys.[17,19,23,24]

A particularly relevant finding was that respondents living in pilot regions showed higher T1D knowledge levels, suggesting that early communication efforts may already be exerting a measurable educational impact. This aligns with recent Italian evidence demonstrating an "awareness effect," whereby preparatory activities for the screening program have already contributed to improved recognition of diabetes symptoms and reductions in DKA at onset.[14,25] A similar phenomenon had already been documented in Italy in the 1990s during the "Parma campaign," an intensive public awareness initiative targeting early symptoms of T1D in children. The campaign—based on coordinated messaging to families, schools, and primary care providers—was associated with a 78% reduction in DKA at diagnosis, demonstrating how structured, community-wide education can markedly improve early disease recognition.[26] Comparable improvements in DKA rates following awareness initiatives have been observed internationally as well, reinforcing the concept that public communication and early symptom education can substantially alter pathways to diagnosis.[27]

Personal experience with diabetes—either direct or through a family member—especially with T1D, was the strongest predictor of higher knowledge, suggesting that familiarity with T1D specifically enhances recognition of its clinical features. This "proximity effect" underlines the importance of lived experience in shaping disease awareness and highlights the value of involving patients and families as community knowledge multipliers.[19]

Overall, these findings emphasize the need for targeted educational interventions that reach individuals without personal experience of diabetes. Strengthening public understanding of the autoimmune nature, symptoms, and rationale for early detection will be essential to support informed participation in the upcoming national screening program.

Awareness of the Screening Program

Despite the imminent launch of the national screening program, the questionnaire revealed that awareness of this initiative remains limited, with only about 35% of respondents reporting that they had heard of it. Awareness was higher among individuals who personally knew someone with T1D. The "awareness effect" generated by regional communication efforts and early implementation activities was confirmed[22]; in fact, more than half of respondents living in the 4 pilot regions were aware of the screening program, compared with roughly one-third of those residing in other regions.

The questionnaire highlighted the central role of pediatricians in communicating information about the screening program. However, recent data indicate that many pediatricians feel inadequately prepared to provide counseling, follow-up, and communication of results.[15] Strengthening provider training from the earliest stages of implementation will therefore be crucial.

Digital media and social networks have the potential to complement traditional communication channels and enhance public engagement.[28] At the same time, the risk of misinformation underscores the need for authoritative, evidence-based

content—preferably hosted on institutional platforms and endorsed by professional societies—to ensure consistency and reliability.

Attitudes Toward Screening

The study reveals a high level of willingness to participate in the national screening program with more than 90% of respondents expressing readiness to screen their children or grandchildren. These findings echo international experiences from programs such as Fr1da and Autoimmunity Screening for Kids, where parental participation was consistently high when program objectives and procedures were clearly communicated.[1,2] Similarly, early data from the Italian pilot project reported high participation rates, ranging from 69% in Campania to 95% in Lombardy.[29]

A key finding of this study is that those with the greatest knowledge of T1D were most willing to participate in screening. This is consistent with the notion that disease familiarity is a major determinant of engagement in preventive testing.[8-10] Public health history offers parallels: after Jade Goody's cervical cancer diagnosis, UK screening uptake increased markedly,[30] illustrating how visibility and awareness shape preventive behaviors.

These findings underscore that increased visibility and clear communication about a disease can promote screening participation, which may explain why individuals with greater T1D knowledge in our study showed higher willingness to participate, even amid limited awareness of the national program.

The lack of association between willingness to participate and acquaintance of people with diabetes reinforces the idea that screening decisions may depend more on accurate knowledge, perceived clarity, and trust in the process than on personal exposure to the disease. Consistent with evidence from newborn and genetic screening programs,[8] nearly half of initially hesitant respondents indicated they might reconsider participation if provided with more information, and more than 70% expressed interest in learning more about the program. These findings underscore the importance of communication strategies that reach the broader population, not only those already familiar with diabetes care, and point to a substantial opportunity for targeted communication to significantly increase adherence.

Role of Personal and Professional Exposure to T1D

Stratified analyses highlighted the importance of both personal and professional exposure to T1D on study outcomes. Participants with T1D or affected family members and health care professionals demonstrated substantially higher levels of disease knowledge and greater awareness of the national screening program compared with participants without such exposure. These findings are consistent with the concept that familiarity with a condition, whether through lived experience or professional training, is a major driver of disease-specific knowledge and engagement.[31]

Notably, despite marked differences in baseline knowledge and screening awareness, willingness to participate in screening was uniformly high across all groups. This suggests that acceptance of population-based T1D screening may be driven less by prior exposure to the disease and more by perceived trust in the screening initiative and its anticipated benefits. From a public health perspective, this finding is encouraging, as it indicates that high uptake may be achievable even among individuals with limited prior familiarity with T1D.

Limitations and Strengths

This study has limitations. Snowball sampling and online distribution introduce selection bias, with over-representation of women and individuals with higher educational attainment (per ISTAT data[32]). In addition, given the specific focus of the survey on T1D and the national pediatric screening program, participation was likely higher among individuals with personal or direct experience of T1D and health care professionals, which limits the generalizability of the findings to the broader Italian population. Similarly, the relatively low proportion of respondents reporting familiarity with T2D may reflect the study's thematic focus and recruitment dynamics rather than true differences in disease exposure.

Finally, only a minority of respondents reported having children or grandchildren in the narrow age range eligible for screening (2 and 6 years), which limits the direct generalizability of attitudes toward screening to parents of age-eligible children. Digital literacy requirements may have excluded older or less connected individuals. Knowledge and awareness were assessed through brief self-reported items, which may not fully capture understanding. Willingness to participate may not directly reflect real-world behavior, although consistency with pilot participation rates[29] suggests reasonable validity.

Despite these limitations, the present study is the first to evaluate public awareness and acceptance of the Italian national T1D screening program shortly after pilot study was implemented capturing responses from participants across Italy.

Conclusions

Although the Italian public shows strong interest in T1D screening, substantial gaps remain in disease knowledge and program awareness. To ensure successful implementation, 3 priorities emerge:

1. Strengthen public knowledge about the autoimmune nature of T1D, early symptoms, differences from T2D, and rationale for screening.
2. Reinforce the role of health care professionals, ensuring pediatricians and frontline providers are trained for counseling and communication.
3. Develop targeted communication strategies to reach individuals less engaged digitally or outside health care networks.

Future research should evaluate tailored educational interventions, identify optimal communication channels, and monitor real-world uptake, in line with recent consensus guidance highlighting the need for adequate training of health care professionals, clear and consistent communication, and standardized monitoring pathways for individuals at risk of T1D.[33] Addressing these gaps may allow the Italian initiative to serve as an international model for population-based T1D prevention.

Disclosure

The authors have no conflicts of interest to disclose.

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Author Contributions

I. L. G. A. and A. F. are joint first authors.

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