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COVID-19 control school-based interventions: characteristics and impact of a national-level educational programme in Italy

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Abstract. *Objective:* to report on the characteristics and impact of "Igiene Insieme", a school-based national-level educational programme designed and implemented in Italy to promote hygiene and sanitation in schools, stimulate healthy behaviors in teachers, students and their families, and ultimately fight COVID-19. *Methods:* the project targeted kindergartens and primary schools and included three components: the design and delivery of innovative health education interventions to i) students and ii) teachers, and iii) the provision of sanitation products in schools. Here we describe the intervention, report on the project penetration and evaluate its impact. First, a survey was conducted on a convenience sample of 1,005 teachers to evaluate the project at the national level, then a retrospective analysis was conducted in the Lombardy region comparing SARS-CoV-2 infection incidence rate in schools participating to the project with regional burden data. *Results:* Over 8,000 Italian schools joined the project, for a total of 32,000 teachers and 1.1 million students. Survey respondents rated the educational interventions and the provision of sanitation products as excellent (66.6% and 82.5%, respectively) and reported the project to have greatly impacted on students' health behaviors. In the Lombardy region, 271 primary schools (11%) joined the project and 140 (52%) provided COVID-19 burden data. Over the study period, SARS-CoV-2 infection incidence rate in schools participating in the project was 14% lower as compared to regional-level data (643 per 100,000 vs. 747 per 100,000). *Conclusions:* We raise awareness on the importance of promoting health education and infectious diseases primary prevention in schools, and to plan, implement and monitor student-centred interventions during and beyond COVID-19 times. (www.actabiomedica.it)

Keywords: School, COVID-19, prevention, hygiene, health education, infection, hand hygiene.

Introduction

Schools are an important part of the infrastructure of communities; they provide safe, supportive learning environments for children and adolescents and employ teachers and other staff (1). Since the start of the COVID-19 outbreak, schools, as other indoor spaces, were identified as potential infection hotspots (2).

In fact, long stays, close contacts, the practice of educational and leisure activities, including eating can influence pathogens' transmission, even more so, if personal hygiene and ventilation rules are not respected (3). According to *Flasche et al.* (4) schools and school-aged children played a considerable role in SARS-CoV-2 transmission, with particular reference to high frequency and close contacts in often poor-

ly ventilated environments. During the first wave of the COVID-19 pandemic schools of all levels were closed in most countries. (5,6) The evidence on the effects of schools closure is not conclusive, with a rapid systematic review published in April 2020 reporting a limited benefit on slowing the spread of COVID-19(6). A study by *Ferguson et al.*(7) estimated that in UK, schools closure alone might reduce COVID-19 deaths by only 2-4%. At the same time, schools' closures negatively impacted on children and young generations' lifestyle habits, social life, physical and mental health(8). In this context, schools reopening was identify as priority and has been implemented with great heterogenicity over time and in different settings and subject of large debate both at the practice and policy level (9–11). Physical distancing, face masks, correct individual behavior and the adoption of hygiene measures, including hand hygiene and frequent sanitizing of objects and surfaces are important to limit infection spread school settings and ensure safe schools reopeneing. (12–20) . Schools might be the ideal environment where to deliver effective health education messages and promote environmental and personal hygiene. targeting teachers, students and their households. We describe and evaluate the impacts of the "*Igiene Insieme*", a national level health education project conducted in a sample of Italian schools (kindergarten and primary schools) to promote COVID-19 prevention and control in educational settings.

Methods

The "Igiene Insieme" project

"*Igiene Insieme*" (Hygiene Together) is a national-level project designed and implemented between September 2020 and January 2021 to promote health education and infectious diseases primary prevention in schools, with particular reference to COVID-19 prevention and control. The project intervention targeted kindergartens and primary schools across the country and included three components: i) the design and delivery of health education interventions to students and parents, ii) the design and delivery of health education interventions to teachers, and iii) the provision of sanitation products in schools.

Health education interventions' content focused on: infectious diseases' prevention, transmission control in community settings, hand and surfaces' hygiene and COVID-19 outbreak characteristics and burden. It was conceived and developed with the supervision of public health experts from Vita-Salute San Raffaele University in Milan, Italy, and was delivered taking into account the characteristics of the two target populations of interest, respectively students and teachers. Children health education materials included *ad hoc* designed leaflets (Figure 1), posters and children games, six *ad hoc* designed video experiments to teach kids about good hygiene practices, and a "nudgebook" with 27 activities to realize together in class to promote virtuous behaviours and practices. Teachers health education interventions included a 30-hour training course accredited by the Italian Ministry of University and Research and 14 short educational videos (video pills). The third component of the intervention was the provision free-of-charge of "*Igiene Insieme*" customized sanitation products (hygiene kits) for hand and surfaces hygiene to be used in schools, this including, among others, hydroalcoholic liquid rubs and alcohol-based gel rubs. The project included the creation of a dedicated website, "Igieneinsieme.it", with email and green number contacts(21).The "Igiene Insieme" project was promoted by Napisan®, part of Reckitt Italia, in collaboration with "La Fabbrica", a communication agency with expertise in educational projects. Schools were enrolled on a voluntary basis in multiple ways. La Fabbrica organized a large recruitment campaign targeting the 8000 Italian schools part of its network which were contacted and invited to join the project via email, social media, and dedicated communication. Schools could also self-candidate registering to the "Igieneinsieme.it" portal.

Analysis and impact evaluation

In the current paper we report on the project penetration across Italy and we try to evaluate its impact. In particular, two sub-studies were conducted to assess the project impact at the national and regional

level. First, a survey was conducted on a convenience sample of more than 1,000 teachers to explore their experiences and opinion on the project, students' participation and satisfaction, and reported impacts on students and their families' health behaviors and interests. An on-line 17 item semi-structured questionnaire was distributed via email and social media and administered between December 2020 and January 2021.

The second sub-study is a retrospective analysis on the impacts of the project in the Lombardy Region, the area first and most heavily hit by the COVID-19 pandemic in Italy (22). We collected data from primary schools in the Lombardy Region which participated in the "*Igiene Insieme*" project and made school COVID-19 burden data available. In particular, we used schools' reported confirmed SARS-CoV-2 cases during the study period 30/09/2020 - 31/10/2020 (corresponding to the second COVID-19 epidemic wave in Italy) to compile SARS-CoV-2 incidence rate (per 100.000 population). The incidence rate in the intervention arm was then compared to regional level SARS-CoV-2 incidence rate in the same age group (6-10 years) retrieved from the Lombardy Region surveillance system for the period of interest (23).

Results

Overall, 8,000 Italian schools applied to the educational project "*Igiene Insieme*", of which 1,500 kindergartens (18.7%) and 6,500 primary schools (81.3%), for a total of 32,000 teachers and 1.1 million students involved. The geographical distribution of participating schools, by region is reported in Figure 2.

Project assessment and estimated impacts on teachers' and students' knowledge and awareness

A convenience sample of 1,005 teachers replied to survey (32% from kindergartens and 68% from primary schools), the majority of which (95.1%) reported he/she would recommend to other colleagues the project. Survey results are reported in Table 1, in particular, the large majority of responders rated the educational

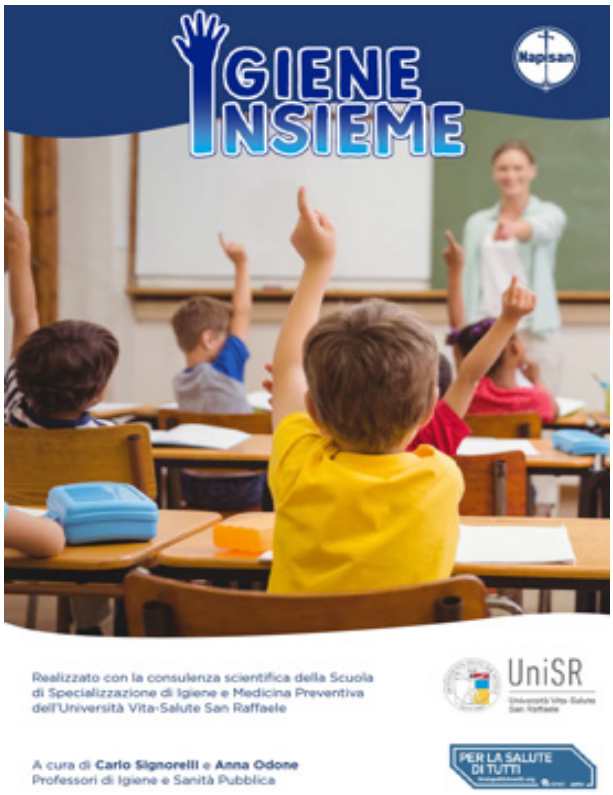

Figure 1. Example of project leaflet

Figure 2. Geographical distribution of 8000 schools participating in the project "Igiene Insieme", by region

Table 1. Survey results on teachers' and students' satisfaction

	Not used	*1*	*2*	*3*	*4*	*5*
TEACHERS						
Supply of sanitizing products	1.8%	0.7%	/	2.7%	12.3%	82.5%
Educational material	1.9%	0.6%	0.4%	5.5%	25.1%	66.6%
Videolabs	41.8%	0.5%	1%	5.8%	18.4%	32.5%
Nudge approach	/	1.2%	0.8%	14.8%	41.1%	38.1%
STUDENTS						
Supply sanitizing products	2.2%	0.9%	0.5%	3%	13.8%	79.6%
Educational materials	3.9%	0.3%	1%	6.4%	27.4%	61.1%
Videolabs	42%	0.6%	1.2%	5.5%	20.1%	30.6%

Notes: On a scale of 1 to 5, where 1 indicates very poor and 5 excellent

interventions and the provision of sanitation products as excellent (66.6% and 82.5%, respectively) or good (25.1% and 12.3%, respectively). Educational videos were only adopted in 58.2% of cases with excellent (32.5%) or good (18.4%) experiences. Similarly, students' participation was rated as excellent or good for educational interventions (61.1% and 27.4%, respectively) and for use of sanitation products (79.6% and 13.8%, respectively). Students were reported to enjoy the hygiene kit the most (75.5%), followed by educational interventions (62.5%) and videos (30.6%), the latter not adopted in 41.6% of cases. The "nudge" approach was rated by teachers as good in 45.1% of cases, excellent in 38.1% and average in 14.8%.

Teachers reported "*Igiene Insieme*" to have greatly impacted on students' health behaviors. In 70.3% of cases the whole class were more prone to adhere to healthy behaviors after participating to the project, while in 28.5% of cases all but few students in the class did. In particular, the greatest improvements were observed in hand sanitation (25%), hand washing (19%), school desks sanitation (13%) and physical distancing (11%, Figure 3)

Project estimated impacts on infection transmission

As of 30 September 2020, 271 (11%) primary schools out of a total of 2,472 in the Lombardy Region

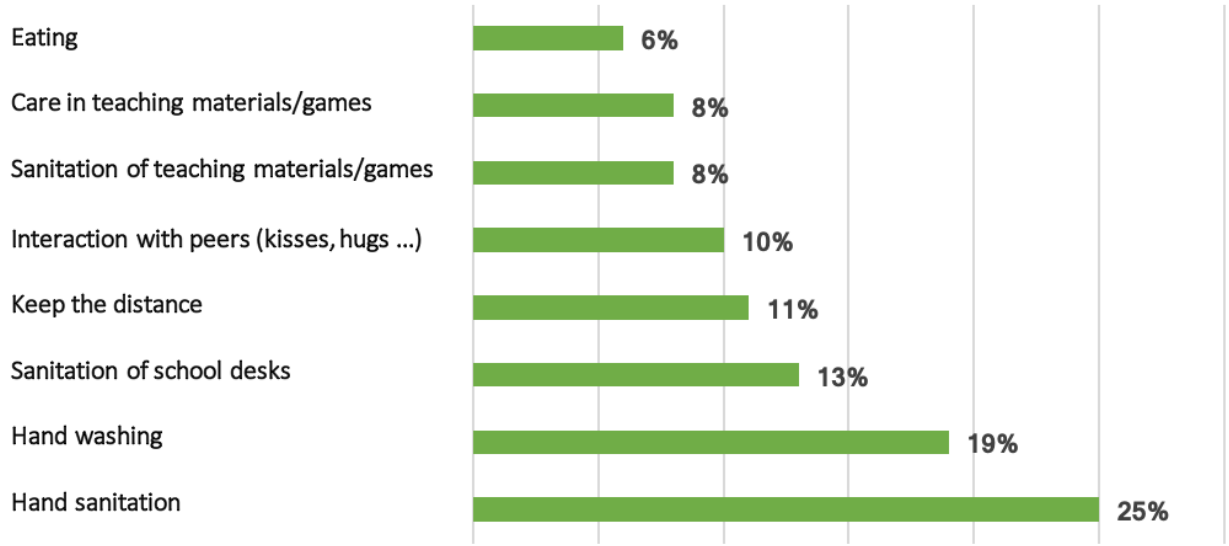

Figure 3. Reported health behavioral improvements

joined "*Igiene Insieme*". Out of the total study sample, 140 (52%) schoold provided COVID-19 burden data and were included in the analysis. The study population included 2.033 classes, and 43,096 students. Between 30/09/2020-31/10/2020, 277 SARS-CoV-2 infections were reported. Number of infections, study population and number of schools participating in the project, by province are reported in Table 2.

The participation of the Schools to this project was: 70 schools (26,975 students) participated in the project in the province of Milan; 10 schools (2,392 students) in the province of Bergamo, 7 schools (1,242 students) in the province of Brescia, 5 schools (1,336 students) in the province of Como, 3 schools (583 students) in the province of Cremona, 6 schools (663 students) in the province of Lecco, 4 schools (575 students) in the province of Lodi, 2 schools (1,787 students) in the province of Mantova; 12 schools (2,739 students) in the province of Monza-Brianza; 8 schools (1,900 students) in the province of Pavia; 2 schools (366 students) in the project in the province of Sondrio; 11 schools (2,538 students) in the province of Varese.

Overall, 277 confirmed SARS-CoV-2 infections were reported in the schools participating to the project over the study period, corresponding to a SARS-CoV-2 infection incidence rate of 643/100,000. The distribution by province is reported in Table 2. Lombardy Region SARS-CoV-2 incidence rate over the same study period in the same age group was 747 / 100.000. COVID-19 incidence rate in the schools participating to the "*Igiene Insieme*" project was 14% lower than the regional burden.

Discussion

We report on the characteristics and impact of a large national-level project designed and implemented to promote health education and infectious diseases primary prevention in schools, showing how it was well received by teachers and students, improved students' adherence to healthy behaviors and potentially contributed to limit infection spread in educational settings. Over 8,000 Italian schools joined the project, for a total of 32,000 teachers and 1.1 million students. The majority of participating teachers rated the "*Igiene Insieme*" educational intervention and the provision of sanitation products as excellent and reported the project to have greatly impacted on students' health behaviors. In the Lombardy region, 271 primary schools (11%) joined the project and 140 (52%) provided COVID-19 burden data. Over the study period, SARS-CoV-2 in-

Table 2. Regional distribution of schools, classes, students and reported SARS-CoV-2 infections among provinces of the Lombardy region

Partecipating schools (kit sent)	Study period: until 30/09/2020			
	Schools	**Classes**	**Students**	**SARS-CoV-2 reported infections**
Bergamo	10 (7%)	116 (6%)	2,392 (6%)	7 (3%)
Brescia	7 (5%)	62 (3%)	1,242 (3%)	3 (1%)
Como	5 (4%)	65 (3%)	1,336 (3%)	7 (3%)
Cremona	3 (2%)	27 (1%)	583 (1%)	0 (0%)
Lecco	6 (4%)	36 (2%)	663 (2%)	7 (3%)
Lodi	4 (3%)	32 (2%)	575 (1%)	4 (1%)
Mantova	2 (1%)	66 (3%)	1,787 (4%)	0 (0%)
Milano	**70 (50%)**	**1,265 (62%)**	**26,975 (63%)**	**188 (68%)**
Monza-Brianza	12 (9%)	134 (7%)	2,739 (6%)	27 (10%)
Pavia	8 (6%)	90 (4%)	1,900 (4%)	18 (6%)
Sondrio	2 (1%)	19 (1%)	366 (1%)	0 (0%)
Varese	11 (8%)	121 (6%)	2,538 (6%)	16 (6%)
Total	**140 (100%)**	**2,033 (100%)**	**43,096 (100%)**	**277 (100%)**

fection incidence rate in schools participating in the project was 14% lower as compared to regional-level data. Although such data have to be considered with great caution, they clearly demonstrate the great potential offered by school-based health education campaigns.

Our study has both strengths and limitations. "*Igiene Insieme*" is one of the largest national-level campaigns timely implemented in all Italian regions during the COVID-19 epidemic. Evidence-based educational content was designed with support and endorsement of high-level academic public health experts and accredited by the Italian Ministry of University and Research. In addition, we applied innovative "Nudges" approach to foster the adoption of good hygiene practices. In fact, the BVA DOXA Nudge Unit was consulted to incorporate in the project an experimental and cutting-edge approach to improve adherence to healthy behaviors integrating behavioral sciences into scientific content. The project could benefit from a dedicated online portal and from support from a leading communication agency with expertise in educational projects and an extensive network of schools and teachers' communities.

We acknowledge limitations in the impact assessment analysis. In fact, the survey was conducted on a convenience sample of participating teachers with low response rate which might have introduced information bias. Only half of participating schools (140 out of 271) provided Sars-CoV-2 infection data and were included in the comparative analysis conducted in the Lombardy region, the region most heavily hit by the COVID-19 pandemic in Italy (24,25). Taking into consideration the adopted study design we cannot infer causality between the "*Igiene Insieme*" project and lower infection rate, as compared to regional burden. However, 14% lower infection rate compared to the Lombardy average in the same age group represents an encouraging figure and lays the foundations for implementation of the project and promotion on a larger scale.

Schools provides a structured setting in which students can learn and develop social competencies (self-confidence, friendship, empathy, respect, responsibilities) to become conscious member of a solidarity-based community and that's the reason why it is fundamental to rethink the role of the school after COVID-19. *Paakkari and Okan* (26) highlighted the need to improve health literacy in educational settings. Faculty and teachers should act as health promoters for their students from a young age, by actively fostering healthy habits (physical activity, good personal hygiene and balanced diet) and raising awareness on the consequences of risky behaviors. For a more inclusive and student-centered education, learning processess should be used to convey public health messages among students, to encourage personal reconstruction of knowledge and to engage schools' community to adopt healthy lifestyles. According to *Colao et al.*, health literacy should be integrated into school curricula (27).

While returning to school as soon as possible is imperative for maintaining educational standards, social development, and young generations' mental and physical welfare of children, it is essential to implement the appropriate measures so as to ensues going back to school is safe. The US Centers for Disease Control and Prevention (CDC) issued guidelines(28) to reduce the risk of infection transmission in schools and mitigate the impact of COVID-19 on children and families, recommending, among others, to keep bubbles' size small and reduce movement among bubbles, to reduce class size and use large spaces to teach, to provide hand washing stations and hand sanitizers, to keep adequate ventilation, to guarantee indoor hygiene and sanitation and promote adherence to healthy behaviors.

We raise awareness on the fundamental importance to consider schools as settings where to plan, implement and monitor health education interventions that are student-centred, and aimed at promoting wellbeing through informed adherence to healthy behaviors (29). We provide a successful example which can be further implement within and beyond COVID-19 times, as well as scaled up or adapted to other countries and communities.

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