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A33 Comparative Cost-effectiveness Analysis of SARS-CoV-2 Testing Strategy

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Introduction

Schools are an important part of the communities as they provide safe learning environments and social, physical, behavioral, and mental health services [1]. Secondary transmission of SARS-CoV-2 infection can occur in school settings, leading to outbreaks [2-3]. Although COVID-19 appear to be less prevalent in children, their role in SARS-CoV-2 transmission, particularly in schools, remains unclear [4].

Testing for SARS-CoV-2 is a key strategy for controlling the COVID-19 pandemic [5-6]. Nucleic acid amplification tests (NAAT) are the gold standard for detecting COVID-19 [6], the preferred one being polymerase chain reaction (RT-PCR) assay [7]. Antigen detection tests (AgDT) are often less sensitive than NAAT [6]. Reported sensitivity varies significantly [8-10]. The World Health Organization recommends the use of AgDT within the first 5 to 7 days following the onset of symptoms, in settings where NAAT is unavailable or where prolonged turnaround times preclude clinical utility [11].

In Portugal, the use of AgDT screening is recommended at the reopening of schools, in counties with 14-day truncated cumulative incidence higher than 120 cases per 100 000 residents and in outbreak situations [12]. In spite of that, other screening strategies have been used, but its cost-effectiveness is still unknown.

This paper addresses the investigation of a Portuguese school outbreak. The screening took place 16 days after the first confirmed case and 38 cases were already detected. This paper aims to compare the cost-effectiveness of COVID-19 screening strategies in the context of a school outbreak investigation.

Methods

This is a comparative cost-effectiveness analysis of COVID-19 screening strategies: AgDT, mixed strategy screening (whenever symptoms were present and AgDT was negative, RT-PCR test was also used) and RT-PCR. Estimated duration of each screening strategy were 5, 8 and 4 hours respectively, as the organization of each strategy requires different logistics.

The analysis was split into direct, indirect and intangible costs. The description of these costs is available on Table 1. The salary reference of the Portuguese government for each career was used to calculate the costs with healthcare staff. The reference table of the Central Administration of the Health System was used to calculate the costs related with the diagnostic tests and materials. The cost per detected COVID-19 case and the incremental cost-effectiveness ratio (ICER) were calculated to analyse the cost-effectiveness of each screening. All costs are presented in Euros (€).

Table 1 – Type of costs of each screening strategy

Type of Cost	Cost
Direct Costs	Logistic costs
	Individual equipment protection
	Covid-19 diagnostic tests
	Safety staff
	Healthcare staff
	Office supplies
	Healthcare waste
	Cleaning procedures
	Covid-19 diagnostic tests transportation
Indirect Costs	Individuals' transportation
	Labor absence
Intangible Costs	Anxiety
	Discomfort

Keywords:
Costs and Cost Analysis, COVID-19, COVID-19 Testing, Disease Outbreaks, Mass Screening, SARS-CoV-2, Schools

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Results

From a universe of 178 individuals, 101 were tested with 3 different COVID-19 screening strategies (Table 2).

Table 2 – Population characteristics

	Total School Population		Screened Population	
Type of population	**N**	**%**	**N**	**%**
Students	142	79,8	68	67,3
Professors	13	12,9	21	20,8
Other School Staff	23	7,3	12	11,9
Gender	**N**	**%**	**N**	**%**
Feminine	91	51,1	58	57,4
Masculine	87	48,9	43	42,6
Age (mean in years)	23,0	(-)	26,1	(-)

AgDT strategy detected 0 positive results; the mixed strategy detected 8 positive results (the cost per detected case was 675,82€); RT-PCR strategy detected 12 positive results (the cost per detected case was 573,46€) (Table 3). The detailed cost of each screening strategy is available on Table 4. In all screening strategies the higher costs were the direct costs; within these, the higher were the COVID-19 diagnostic tests, followed by healthcare staff costs. ICER was calculated using the AgDT screening as reference. The extra cost per extra confirmed case using the mixed strategy was 410,37€ and using the RT-PCR was 392,34€.

Table 3 – Effectiveness of each screening strategy

Screening Strategy	Tests (n)	Positive results (n)	Cost per case
Antigen detection screening	101	0	-
Mixed strategy screening	101 AgDT + 41 RT-PCR	8	675,82
RT-PCR screening	101	12	573,46

Table 4 – Detailed costs of each screening strategy

Type of Cost		Costs (€)		
		Antigen detection screening	Mixed strategy screening	RT-PCR screening
Direct Costs	Logistic	69,04	69,07	69,04
	Individual equipment protection	90,37	170,51	90,37
	Covid-19 diagnostic tests	1767,50	4432,50	6565,00
	Safety staff	42,35	67,76	33,88
	Healthcare staff	160,45	667,36	128,36
	Office supplies	3,30	6,20	3,30
	Healthcare waste	1,52	2,10	0,59
	Cleaning procedures	11,13	11,13	11,13
	Covid-19 diagnostic tests transportation	0,00	2,01	2,01
Indirect Costs	Individuals' transportation	268,18	268,18	268,18
	Labor absence	10,31	14,43	6,19
Intangible Costs	Anxiety	-	-	-
	Discomfort	-	-	-
	Total costs	**2123,59**	**5406,54**	**6881,60**

Discussion

Two of the screening strategies showed to be effective to detect COVID-19 cases: RT-PCR screening and the mixed strategy. Even though RT-PCR strategy is the costliest, it proved to be the most cost-effective, as it detects more cases, has a lower cost per detected case and a lower ICER. This strategy can be even more cost-effective if Academy undertakes the laboratory testing, as the direct cost with each COVID-19 diagnostic test decreases. Nevertheless, the direct and indirect costs associated with each non-detected positive case may be enormous, which justifies the extra cost associated with RT-PCR. This strategy is also less time-consuming, which is important in the pandemic context, as the healthcare staff may be overworked and at risk of burnout.

Although the AgDT strategy is the least costly, it showed no effectiveness or utility in this context. This may be because some individuals tested on this outbreak were either asymptomatic or already out of the 5-7 days following the onset of symptoms.

This study provides important information on health decision making regarding the type of screening that should be used on the context of a school outbreak investigation. However, it has some limitations: p.e., the sample used was small or the specific AgDT used was not taken into consideration (which is an important bias as reported sensitivity varies significantly).

This paper shows that understanding the cost-effectiveness of COVID-19 screening strategies is fundamental to sustain health decision making.

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