COVID-19

Impact of the COVID-19 pandemic on the infectious disease epidemiology

ALESSIO FACCIOLÀ[1], ANTONIO LAGANÀ[1,2], GIOVANNI GENOVESE[1], BRUNO ROMEO[1], SALVATORE SIDOTI[3], GIUSEPPA D'ANDREA[3], CATERINA RACO[3], GIUSEPPA VISALLI[1], ANGELA DI PIETRO[1]
[1] Department of Biomedical and Dental Sciences and Morphofunctional Imaging, University of Messina, Messina, Italy;
[2] Istituto Clinico Polispecialistico C.O.T. Cure Ortopediche Traumatologiche S.p.A., Messina, Italy;
[3] Department of Prevention, Provincial Health Agency, Messina, Italy

Keywords

COVID-19 pandemic • Infectious diseases epidemiology • Mandatory notifications

Summary

Introduction. *COVID-19 pandemic has exerted a huge impact on different aspects of public health. Mandatory notifications are a fundamental tool to have a general picture of infection disease spread in a population. The aim of this study was to evaluate the impact the COVID-19 pandemic had on infectious disease epidemiology.*
Methods. *We collected and analyzed all the infectious disease notifications made in the pre-pandemic (2017-2019) and the pandemic (2020-2022) three-years periods in the provincial territory of Messina, Italy.*
Results. *The total number of notifications significantly decreased by 41% in the pandemic period compared to the pre-pandemic one, with very high reduction of certain disease notifications such as measles and varicella. Similarly, other airborne infections, such as meningococcal meningitis and tuberculosis, underwent an important decrease. Conversely, an increase was found for some infections such as syphilis and, especially, scabies that reported a percentage value of +159.9%.*
Conclusions. *The COVID-19 pandemic, reducing the possibility of microbial spread following to the lockdown and, in addition, to the constant use of face masks and other personal protective equipment, the frequent hand-washing, more ventilation of the living locals, and less gathering, surely reduced the occasions and the possibility to get many infections. On the other hands, the pandemic had a negative impact on scabies diffusion probably due to different causes among which the worsening of some poor realities, the restrictions that forced people to live in strict contact and, especially, the worsening of the conditions of the elderly living in care homes.*

Introduction

Infectious diseases represent still a huge challenge for global public health and economic stability due to their high rate of mortality, disability and morbidity on a global level [1]. The recent COVID-19 pandemic that has been literally upset the world, as well as some health problems among which the resurgence of some old diseases such as syphilis or tuberculosis [2-4], and the dramatic spread of antibiotic-resistant bacteria in healthcare settings [5, 6], have aroused many concerns worldwide. For this reasons, the control of infectious diseases appears crucial for public health in order to reduce their incidence, prevalence or eliminating long-term impairments [7].
Currently, we have different effective weapons that allow to minimize the transmission of pathogens, among which a continuous monitoring of the notified cases thanks to mandatory notifications and specifically dedicated surveillance systems. In Italy, notification of infectious diseases is mandatory according to the Ministerial Decree 15 December 1990 [8]. Since 2019, the notification system has been changed and the new infectious disease reporting system (called PREMAL) has been activated Reporting of probable or confirmed cases of an infectious disease is made by local General Practitioners (GPs), Primary Care Pediatricians (PCPs) or hospital physicians. This completely online system uses the ICD9-CM coding for the classification of infectious diseases, and allows to face any emerging or emergency syndromes. In addition to this general system, there are other specific surveillance systems at national level, such as those for legionellosis, influenza and viral hepatitis [9]. This mandatory notification system allows for a continuous analysis at a central and local level.
To date, the COVID-19 pandemic has been caused in the world about 770,000,000 cases and 7,000,000 deaths (WHO, 2023) [10, 11]. This pandemic, also due to the transmission containment measures, such as general lockdowns, has caused a huge impact not only to the global economy, world industry, and the world food system but also to public health [12, 13].
Considering this premises, the aim of this study was to evaluate the impact that the COVID-19 pandemic has had on the epidemiology of infectious diseases through the analysis of the mandatory notifications made during the pre-pandemic and the pandemic period, evaluating the role that the pandemic had not only on general notifications but also understanding what diseases were most involved in this critical and unexpected situation.

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Methods

We carried out a cross-sectional study examining all the infectious disease notifications made in the three-year periods 2017-2019 and 2020-2022 in the Italian province of Messina, Italy. The provincial territory had, in the studied periods, an average population of 618,713 inhabitants, healthy administered by the Provincial Health Agency 5 (ASP 5), divided into eight districts, of which the largest one is represented by the Metropolitan city of Messina (comprising the 37% of the whole population). All the notifications made by the local physicians are managed by the Public Health, Epidemiology and Preventive Medicine Unit of the Messina ASP 5 Prevention Department, which has the task of insert the information into the IT platforms of the general (PREMAL) and specifically dedicated national websites. Specifically, in Italy some informative systems are completely dedicated to some diseases, among which the most important ones are the SEIEVA (Sistema Epidemiologico Integrato delle Epatiti Virali Acute, Integrated epidemiological system of acute viral hepatitis), the INFLUNET (Sistema Nazionale di Sorveglianza Epidemiologica e Virologica dell'Influenza, National System of Epidemiological and Virological Surveillance of Influenza), the Integrated Measles-Rubella Surveillance System, the Surveillance System of Legionellosis, and the Surveillance System of Invasive Bacterial Diseases caused by meningococcus, pneumococcus and *Haemophilus influenzae* b. The notification data collected by these systems were used to obtain disease incidence values, considering the resident population per each year in order to make a difference between the pre-pandemic (2017-2019) and the pandemic (2020-2022) period. Resident population data were collected using the specific website of the National Institute of Statistics (in Italian ISTAT).

Statistical processing was performed using the Prism 4.0 software. Descriptive statistics were used to find the percentages and the 95% confidence interval (CI). Exact "F-tests" was performed in order to compare the mean values between the studied periods while a Spearman's correlation test was performed to evaluate the general trend of notifications made for all the notifiable diseases starting from 2011 to 2022. Significance was assessed at the $p < 0.05$ level.

Results

In the pandemic period (2020-2022), 393 infectious disease cases were notified, compared to 672 cases of the pre-pandemic one (2017-2019), with a percentage decrease of -41.5% ($p < 0.0001$). Specifically, in the pandemic period, absolute numbers of 135, 130 and 128 cases were notified in 2020, 2021 and 2022 respectively. To verify that this decrease was real and occurred properly in the pandemic period, we also have evaluated the number of notifications made in the previous three-year periods starting from 2011. In addition, to evaluate that this decrease was not linked to changes in population, we have calculated the incidence rates based on resident population. Specifically, in the pre-pandemic period (2017-2019), the average incidence rate was 35.6/100,000 ± 7.4 (95% CI: 27.2-44.0) while, in the pandemic period, the average incidence rate was 21.7/100,000 ± 0.5 (95% CI: 21.1-22.3). Therefore, a significant percentage decrease of -39% between the average values of the two periods incidences was detected ($p = 0.0089$). Figure 1 shows the incidence rates of notified infectious diseases in the previous three-year periods starting from 2011.

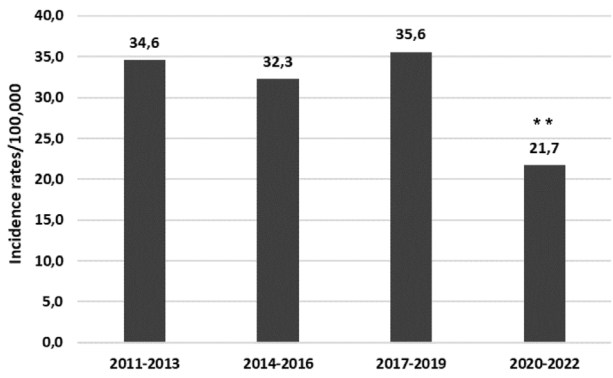


Fig. 1. Incidence rates/100,000 resident population of the infectious disease notifications made from 2011 in the Messina provincial geographical area (** = $p < 0.01$).

Then, we evaluated the absolute numbers of the infectious disease notifications made in the pre-pandemic and the pandemic periods in order to calculate the corresponding percentage changes for the single notifiable infectious diseases. The results are shown in Table I.

Table I shows that a remarkable percentage decrease of notifications for certain infectious diseases occurred in the pandemic period compared to the pre-pandemic one. It is important to highlight that only three diseases had a percentage increase, *i.e*. syphilis, *non-tuberculous mycobacteriosis* and especially scabies that reported a very remarkable increase of +159.5% ($p < 0.0001$). Actually, also all the remaining diseases not individually considered and classified with the name "other" reported a remarkable increase. Under this denomination we considered some diseases such as leishmaniasis, listeriosis, leptospirosis, malaria, skin mycosis, tularemia, gonorrhea *etc*., inconstantly present in our territory and rarely notified.

In the pandemic period, in Italy there was a complete lockdown starting from March 11th and until May 1st, 2020. It has been very interesting to evaluate the trend of the notifications made in that period of time compared to the rest of the year (Fig. 2).

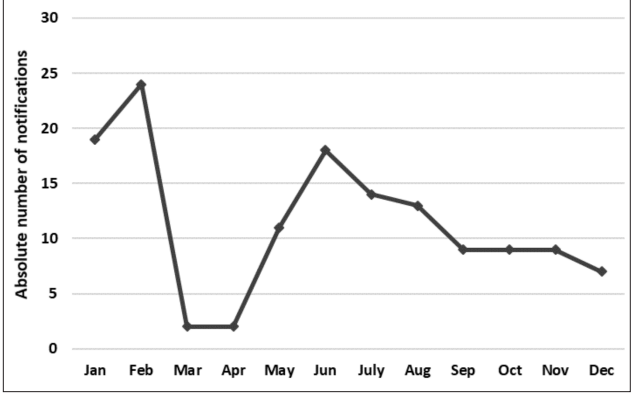
We can observe a remarkable and sudden decrease of notifications during the complete lockdown, with the notification of only 3 cases of scabies and 1 of varicella, with a rise in the next two months, followed by a decrease with a constant but lower presence in the rest of the year.

Tab. I. Comparison between the absolute numbers of the infectious disease notifications made in the pre-pandemic (2017-2019) and pandemic (2020-2022) periods, with corresponding percentage changes (Δ%) and statistical significance.

	2017-2019 absolute number of notifications	2020-2022 absolute number of notifications	Δ%	Fisher test
Acute hepatitis B	6	2	-66.7%	ns
Brucellosis	24	11	-54.2%	$p = 0.0352$; OR = 0.4727
Hepatitis A	27	1	-96.3%	$p < 0.0001$; OR = 0.0382
Legionellosis	13	10	-23.1%	ns
Measles	97	0	-100%	$p < 0.0001$; OR = 0.0053
Meningoencephalitis	25	7	-72.0%	$p = 0.002$; OR = 0.2888
Mumps	9	3	-66.7%	ns
Non-tuberculous mycobacteriosis	9	13	+44.4%	ns
Non-typhoid salmonellosis	26	25	-3.8%	ns
Pediculosis	5	3	-40%	ns
Pertussis	9	0	-100%	$p = 0.0031$; OR = 0.0543
Rickettsiosis	10	4	-60.0%	ns
Rubella	1	0	0%	ns
Scabies	79	205	+159.5%	$p < 0.0001$; OR = 2.677
Scarlet fever	24	2	-91.7%	$p < 0.0001$; OR = 0.0859
Syphilis	17	22	+29.4%	ns
Tetanus	3	0	-100%	ns
Tuberculosis	75	42	-44.0%	$p = 0.0039$; OR = 0.5775
Varicella	201	16	-92.0%	$p < 0.0001$; OR = 0.0821
Others	12	26	+116.7%	ns
Total	672	393	-41.5%	$p < 0.0001$; OR = 0.6093

ns: not significant.

Fig. 2. Absolute numbers of notifications made in 2020 in the Messina provincial territory.



However, in order to evaluate the real role played by the pandemic in the observed decreases and to exclude that the latter were due to a decrease already existing in the previous years, we consider the notifications for each notifiable disease made in the previous pre-pandemic nine-year period starting from 2011. The results are shown in Table II.

Airborne infectious diseases

Measles, Mumps, Rubella, Varicella, Pertussis and Scarlet fever

For these diseases, very high values of percentage decreases occurred between the three-year pandemic period and the three-year pre-pandemic one (Tab. I). Specifically, measles ($p < 0.0001$) and pertussis ($p = 0.0031$) had a complete decrease (no cases) while mumps notifications fell by two third (-66.7%). Rubella was present with only 1 case in the pre-pandemic period and no case was notified in the pandemic one. However, considering all the pre-pandemic nine-years only pertussis ($p = 0.0032$), varicella ($p = 0.0047$) and scarlet fever ($p = 0.0320$) had a significant correlation (Tab. II). A particular mention has to be made for varicella that was by far the most notified disease in the last twenty years in our geographical area [14]. Specifically, for this disease we observed a highly significant difference between the two different considered periods of time ($p < 0.0001$), confirmed by a highly significant correlation considering the pre-pandemic nine-year period and the pandemic one ($p = 0.0047$). Figure 3 shows the three-year trend of varicella notification in our area starting from 2011.

Tuberculosis

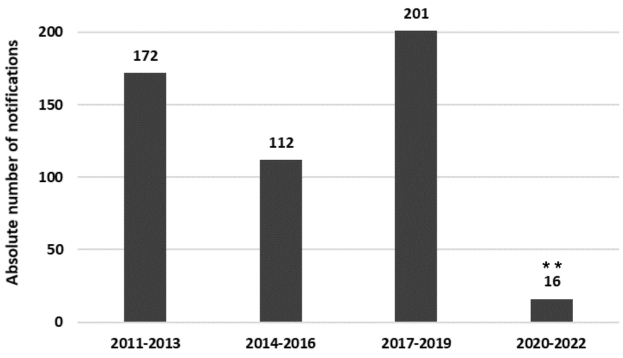
Tuberculosis reported a highly significant difference of -44.0% between the pre-pandemic period and the pandemic one ($p = 0.0039$) (Tab. I). A highly significant correlation was found also considering the entire period under study ($p = 0.0446$) (Tab. II). In the pandemic period, the disease affected men for 70%, of which 45.0% Italians and 55.0% foreigners. The mean age of affected people was 41 ± 23.9 (min. 16; max. 86). These features are very similar to those found in the pre-pandemic period when the mean age was 38.4 ± 25.1 (min. 1; max.

Tab. II. General trend of notifications made in the period 2011-2022 and statistical evaluation between the pandemic period (2020-2022) and the pre-pandemic one (2011-2019).

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Spearman's test
Acute hepatitis B	3	1	2	2	0	2	2	4	0	0	1	1	ns
Brucellosis	16	11	32	17	13	137	11	6	7	5	4	2	$p = 0.0046$
Hepatitis A	6	3	2	0	1	0	22	3	2	1	0	0	ns
Legionellosis	0	1	0	2	0	0	1	5	7	3	2	4	ns
Measles	31	1	0	0	1	0	63	33	1	0	0	0	ns
Meningoencephalitis	7	8	14	12	20	15	12	9	4	3	2	2	$p = 0.0045$
Mumps	3	6	0	0	1	3	2	5	2	0	2	1	ns
Non-tuberculous mycobacteriosis	3	2	2	1	1	0	0	5	4	5	6	1	ns
Non-typhoid salmonellosis	7	12	8	3	3	8	4	15	7	13	8	4	ns
Pediculosis	0	25	30	63	0	0	0	5	0	0	2	1	ns
Pertussis	7	2	3	2	6	2	3	2	4	0	0	0	$p = 0.0032$
Rickettsiosis	8	14	8	3	8	5	6	2	2	1	0	2	$p = 0.0102$
Rubella	1	11	0	0	0	0	1	0	0	0	0	0	ns
Scabies	0	15	21	8	17	0	0	46	33	52	68	85	$p = 0.0043$
Scarlet fever	30	7	11	0	2	36	15	5	4	2	0	0	$p = 0.0320$
Syphilis	9	4	6	2	7	10	4	9	4	10	3	9	ns
Tetanus	0	0	1	0	1	0	1	1	1	0	0	0	ns
Tuberculosis	38	27	23	16	24	29	29	27	19	17	20	6	$p = 0.0446$
Varicella	29	33	110	51	23	38	129	32	40	11	4	1	$p = 0.0047$
Other	27	26	13	38	2	32	26	11	20	12	8	9	ns
TOTAL	225	209	286	220	130	317	331	225	161	135	130	128	$p = 0.0282$

ns: not significant.

Fig. 3. Absolute number of varicella notifications made from 2011 in the Messina provincial territory (** = $p < 0.01$).



83) and the most affected people were men (72.3%) of which 47.4% Italians and 52.6% foreigners. However, despite the reduction observed during the pandemic, this disease was constantly present in our territory in the last decade, with 88 and 70 cases notified in 2011-2013 and 2014-2016 respectively.

Meningoencephalitis

Meningoencephalitis reported a significant percentage decrease of -72.0% compared to the pre-pandemic period ($p = 0.002$) (Tab. I). A highly significant correlation was found also considering the entire period under study ($p = 0.0045$) (Tab. II). However, this general value includes infections of both bacterial and viral etiology. Specifically, bacterial forms decreased of -80.0% ($p = 0.0028$; OR = 0.2063) in the pandemic period compared to the pre-pandemic one, with meningococcal and pneumococcal forms that decreased of -80.0% (ns) and -87.5% ($p = 0.0304$; OR = 0.1146) respectively. In fact, only 4 cases of bacterial meningitis, of which one of meningococcal and one of pneumococcal origin, occurred in 2020-2022, compared to 20 cases, of which 5 of meningococcal and 8 of pneumococcal origin, occurred in the pre-pandemic period. The significance was also confirmed for bacterial meningitis considering the nine-year period ($p = 0.0350$) but not for meningococcal and pneumococcal forms (Fig. 4).

Foodborne infectious diseases

Hepatitis A was the foodborne disease reporting the highest decrease compared to the pre-pandemic period (-96.3%) ($p < 0.0001$) (Tab. I). However, we did not find a significant correlation considering the whole period under study (Tab. II). This situation was probably due to the quite constant low reporting of this disease with only an isolate occurrence, in the pre-pandemic period, of an outbreak of 22 cases occurred in 2017 in a population composed especially of men (89.3%) for the most part (76.7%) aged 25-64 and reporting, in most cases, homosexual habits. An important decrease (-54.2%) occurred also for brucellosis ($p = 0.0352$) (Tab. I), a disease constantly present in our territory characterized by occasional occurrence of outbreaks, of which the last one occurred in 2016 [15]. For this disease, a significant correlation was also found considering the whole

Fig. 4. Differences between pre-pandemic and pandemic period concerning bacterial meningitis, meningococcal and pneumococcal forms (* = $p < 0.05$; ** = $p < 0.01$).

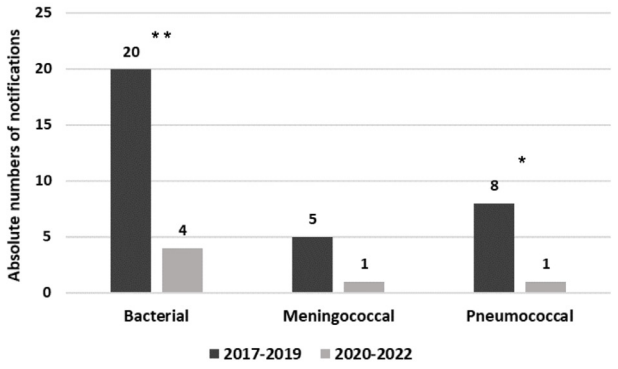
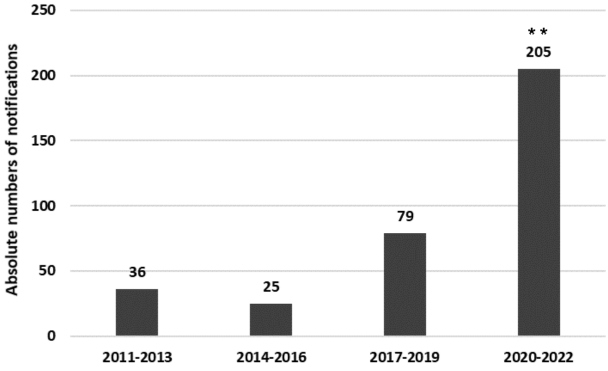


Fig. 5. Absolute number of scabies notifications made from 2011 in the Messina provincial territory (data of 2022 referred to the period 1st January-31st October) (** = $p < 0.01$).



period under study ($p = 0.0046$) (Tab. II). In this group of diseases, the only one that did not report a decrease was non-typhoid salmonellosis whose notification rate was quite constant (only -3.8%) between the two considered periods of time. No correlation was also found considering the whole period under study.

Sexually-transmitted infections

Among STIs, some cases of acute hepatitis B and syphilis were notified in the pandemic period. For the first one, only few cases were reported in both the two period under study, with a not significant percentage decrease of -66.7% (Tab. I). No significant correlation was found considering also the whole period. The same was for syphilis for which, however, was reported a quite high increase (+29.4%) in the pandemic period compared to the pre-pandemic one (Tab. I). Anyway, considering the whole period, no significant correlation was found. In fact, the disease was always present with a quite constant low number of cases. In the pandemic period, syphilis affected especially men (95.4%) with a mean age of 34.8 ± 17.1 (min. 1; max. 79) for the most part of Italian nationality (90.5%). The same personal details were found in the cases notified in the pre-pandemic period.

Vector-borne and parasitic diseases

Rickettsiosis is an endemic disease in our geographical area and, in the pandemic period, it reported a not significant percentage decrease of -70% compared to the pre-pandemic one (Tab. I). However, considering the whole period under study, a significant correlation was found ($p = 0.0102$) between the pandemic period and the nine previous pre-pandemic years ($p = 0.0102$) (Tab. II). A separate mention has to be made for scabies because while almost all the notifiable diseases decreased or remained quite stable during the considered periods of time, scabies reported a high significant percentage increase of +159.9% in the pandemic period compared to the pre-pandemic one ($p < 0.0001$) (Tab. I). This increase was reported also considering the whole period under study with a significant correlation ($p = 0.0043$) (Tab. II). Specifically, the increase was present in all the pandemic period with 52, 68 and 85 notifications in 2020, 2021 and 2022, respectively. In the pandemic period, the disease affected men with a little higher percentage (57.9%) than women. The mean age of affected people was 42.8 ± 25.9 (min. 1; max. 93) but the disease was evenly distributed in all the different age groups. The majority of the sample (92.6%) was of Italian nationality. However, there was a big difference between the two groups because Italians cases had a median age of 48 (IQR: 20-63; min. 1, max 93) while foreign ones had a median age of 17 (IQR: 17-23; min. 4; max. 58). Indeed, affected foreigners were minors (< 18) in 66.7% of cases while Italians were over-60s in almost one-third of cases. Figure 5 shows the trend of scabies notification in our territory starting from 2011.

Discussion

The COVID-19 pandemic has upset each field of human life with a huge impact on different aspects of society. Healthcare has been one of the most affected field both in terms of provided care and also as preventive tools [16-18]. Italy is a high-income country with a typical epidemiological situation characterized by a constant and remarkable reduction of infectious diseases overtime thanks to high hygienic-sanitary standards and also to significant vaccination policies [19]. Anyway, and without any doubts, COVID-19 pandemic has exerted an impact on infectious disease epidemiology and for many different reasons.

Our study aimed to compare the epidemiological situation of infectious diseases before and during the pandemic in a provincial geographical area of a typical high-income country, which is Italy, through the analysis of mandatory notifications. Furthermore, in order to better understand the real role played by the pandemic, we also evaluated the significance between the reduction observed during the pandemic and the trend of notifiable infectious diseases in the previous nine-year pre-pandemic period. In a previous study [14], we showed a marked and constant decrease of infectious

diseases during the last two decades except for some foodborne diseases (*i.e.* hepatitis A, brucellosis and non-typhoid salmonellosis) and syphilis. The remarkable and significant decrease of notifications that we observed in our geographical area in the pandemic period was in line with what reported by previous evidences [20-22]. This decrease involved almost all airborne diseases but only for some of them, such as varicella, pertussis and tuberculosis, which were always present in our territory despite the availability of effective vaccines against some of them, we observed a real role played by the pandemic. COVID-19 pandemic was probably able to cause this reduction in different ways: 1) decreasing the possibility of viral circulation following both to a lower people movement and gathering possibility that occurred in general and specifically during the lockdown and the constant wearing of face masks and other PPEs; 2) the frequent hand-washing, that is, without any doubt, one of the most important preventive action against the spread of infectious diseases; 3) the habit to increase ventilation of living environments. However, despite strong and valid evidences highlight the key role played by the pandemic in the reduction of infectious disease notifications, we cannot exclude a possible role of the widespread phenomenon of underreporting that is a well-known malpractice present in ordinary situations [23], and that it could be stressed in the extraordinary situation given by the pandemic, due to the huge load exerted on healthcare professionals, especially involved for the most part in managing the pandemic.

Actually, regarding varicella, we have to highlight that vaccination against MMRV is currently mandatory in Italy and starting from 2017, after a recent measles outbreak occurred in Italy in the same year with a high number of cases reported, also, in our geographical area [24, 25]. However, we can exclude that such a reduction can be due to an improvement of vaccination coverage, because only children of 3-4 years have been involved by this change considering that the first dose of MMRV vaccine is administered in Italy at 13th-15th month of life. Moreover, an average increase of only 5% and 10% was reported from 2017 to 2019 for MMR and varicella vaccines respectively.

A similar conclusion can be made also for bacterial meningitis that reported, in the pandemic period, a remarkable decrease in line with other literature data [26]. This is especially valid for meningococcal forms for which the closure of schools and other aggregation places for young people and the constant use of face masks played without any doubts a positive role in the case reduction. For pneumococcal forms, besides the same conditions, we can also assume an important role played by the drastic decrease of influenza cases occurred in Italy especially during the 2020-2021 season [27], given that pneumococcal disease, including meningitis, can occur as complication of influenza, especially in the elderly [28].

About foodborne infectious diseases, hepatitis A showed the highest reduction but linked especially to the lack of outbreaks during the pandemic period. Actually, the most cases notified during the pre-pandemic period were due to an outbreak occurred in 2017 in men having sex with men (MSM), similarly to other important outbreaks occurred in the same period in other parts of Italy and in different countries worldwide [29-32]. Moreover, in contrast to a reduction of non-typhoid salmonellosis reported by the ECDC in 2020 [33], we have found the constant presence of this disease during the pre- and the pandemic period. In addition, we have found a complete opposed situation because the most part of notifications made during the pandemic period occurred exactly in 2020, therefore in the full pandemic phase. However, no cases were notified in the first semester, when Italy was in the complete lockdown, but after June, with the reopening of food commercial activities. This epidemiological situation was probably due to the more and more common habit to eat raw and low cooked food, condition recognized as one of the main sources of salmonellosis [34], bought from the large distribution and/or delivered directly to your own home. For instance, food delivery has been recently associated with some non-typhoid salmonellosis outbreak [35].

Syphilis registered a percentage increase of almost 30% compared to the pre-pandemic period. Actually, this disease has been constantly present in our territory during the last twenty years with a remarkable increase compared to other infections. This is in line with data from different countries where syphilis has been a resurgent disease especially in some particularly at-risk group of population [3, 14, 36, 37]. Probably, the detected increase was potentially a natural consequence of the already reported increase during the pre-pandemic period and, considering that most of the diagnosis occur in an advanced clinical phase, we can hypothesize this detected trend. Like non-typhoid salmonellosis, also for syphilis no cases were notified in the lockdown period.

A separate mention has to be made for scabies, which reported a remarkable increase in the pandemic period compared to the previous one. Actually, this disease showed already a certain increase in the pre-pandemic period compared to the previous years. We can hypothesize that the pandemic could have exacerbated an already existing situation characterized by a general increasing trend linked to various variable. This situation is in line with what reported by other countries where an analogous increase was detected in last years [38-40]. Many reasons can be hypothesized to explain this increase. An important role might have been played by the remarkable economic crisis induced by the pandemic in Italy [41], especially in those families that already lived into very poor conditions, which are well-known factors favoring scabies onset. Moreover, we can assume that, in 2020, during the lockdown, people were forced to spend more time at home and therefore with relatives, increasing the risk of transmitting the parasite through direct contact or by fomites in those family groups with poorest living conditions. In addition, the pandemic with its huge impact on health services that determined an engulf of the waiting lists, especially for those health specialties not linked to acute diseases such as dermatology,

along with population's fear of leaving home unless it was strictly necessary, not seeking medical attention, caused a late in diagnosis with consequences in the next years and a remarkable increase of diagnosis and notifications. A further explanation can be deduced by the very remarkable age difference between Italians and foreigners. Probably, affected foreigners were young irregular migrants living in reception centers distributed in our territory that was, in last years, interested by a massive irregular migration flow [42], while, regarding Italians, given the presence of the disease in many elderly people, we can assume a role of some care homes, where important outbreaks can occur, as showed by previous studies [43, 44]. Probably, the pandemic induced a higher isolation of the elderly living in care homes due to the very severe restrictions adopted by the structures that did not allow relatives to visit their loved ones. Moreover, many health personnel of these structures were affected by COVD-19 with the worsening of the assistance time quality and quantity.

Conclusions

Our analysis highlighted how the COVID-19 pandemic have impacted the epidemiology of infections in a geographical area belonging to a high-income country that have assisted to a progressive decline of infectious diseases overtime. This decrease was particularly marked during the pandemic period with a general percentage decrease of many infectious diseases. Many factors emphasized by the pandemic, such as social restrictions, the constant use of face masks and other personal protective equipment, the frequent hand-washing, living in more ventilated locations, and less gathering possibilities, reduced the occasions to get especially airborne infections that, among all communicable diseases, have the highest incidence in developed countries. However, to this epidemiological picture we can also assume a potential role played by the always present phenomenon of underreporting, which might have been strengthen by such extraordinary situation given by the pandemic, due to the huge load of healthcare professionals involved, for the most part, in managing the pandemic.

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Informed consent statement

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Conflict of interest statement

The authors declare no conflicts of interest.

Authors' contributions

AF, ADP: Conceptualization. AF, AL, GV, GG and BR: Methodology. AF, GV: Formal analysis, data curation and writing - original draft. GDA, CR, SS: Resources. All Authors revised the manuscript and gave their contribution to improve the paper. All authors read and approved the final manuscript.

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Correspondence: Alessio Facciolà, Department of Biomedical and Dental Sciences and Morphofunctional Imaging, University of Messina, via Consolare Valeria 5, 98125 Messina (Italy). Tel. +39-090-2213897. E-mail: alessio.facciola@unime.it

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