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## **SARS-CoV-2 outbreak and lockdown in a Northern Italy hospital. Comparison with Scandinavian no-lockdown country**

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Running title: In-hospital SARS-CoV-2 outbreak

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The ongoing SARS-CoV-2 pandemic has evolved with cases of local transmission soon after the detection of imported cases in affected countries <sup>1</sup>. However, the pandemic did not reach all countries at the same time and our country (Italy) had to act as forerunners. As first containment line, the heightened vigilance has become critical to prevent sustained transmission in new locations but many challenges have emerged - and others are still emerging – worldwide <sup>2</sup>. When applicable, lockdown was demonstrated to be effective in reducing transmission rates and need for hospitalization. However, those preventive measures cannot be applied everywhere, and many variables should be considered. In this regard, it can be useful to compare two opposite European countries, in which lockdown was imposed by authorities (i.e. Italy) or not (i.e. Sweden). Three weeks after the first containment measures in outbreak Italian regions, contagions dropped throughout national territory. Nationwide lockdown further contributed to contagion decline, but probably less than expected. Conversely, the contagion curve in Sweden seems to have not yet reached a decreasing trend. Being the number of tests carried out progressively risen over the weeks, such difference in contagion trend becomes even more evident. However, those are crude data that deserve further comments. Given the intimate nature of the infection, we should consider that Italy is 10-fold more densely populated than Sweden, and Lombardy even 20-fold more (Table 1). When compared with other – and more comparable – Scandinavian countries the impact of lockdown measures on contagion trend dramatically emerges <sup>3</sup>. Although this unorthodox policy based on the high levels of trust in Swedish society even got the interest of New York Times, it led to an amplification of the epidemic, which has now a number of death per million higher than other Scandinavian countries and even of U.S. (358 vs. 93 for Denmark, 53 for Finland, 44 for Norway and 267 for U.S.). Even considering the economic effect, a benefit from no-lockdown approach seems unlikely, as noticed by Financial Times.

Concerning the different approaches in testing suspect cases any consideration about mortality would be too speculative. Sweden has tried to analyze burden and prevalence of prognostic factors for severe SARS-CoV-2 infection showing a relative low prevalence of chronic obstructive pulmonary disease (0.8%) and cardiovascular disease (7.4%) <sup>4</sup>. However, also considering the different median age, lethality, distribution across sex and comorbidities would be similar in Italy and Sweden.

With regard to in-hospital control of outbreak, lesson from long-term care facilities clearly teaches us how aged populations living together in semi-confined spaces are most vulnerable to severe infections and rapid spread <sup>5</sup>. Employees, workers and new residents unavoidably bring SARS-CoV-2 infection into the facilities, thus perpetuating transmission in the community and ultimately contributing to overall disease spread. The still debated duration of the incubation period of SARS-CoV-2 infection, alongside with extended period of viral shedding and high rate of asymptomatic illness, further fosters virus transmission <sup>6</sup>. As result, care home residents account a large amount of SARS-CoV-2-related in both Italy and Sweden and other Scandinavian countries as well.

In-hospital setting shows the same critically issues with exponentially worse consequences <sup>7</sup>. Appropriate triaging and cohorting/isolation upon arrival at emergency department (ED) was immediately recognized as critical to minimize nosocomial spread. Segregated “fever areas” – equipped for critical care – have been then created. However, as the weeks go by from the SARS-CoV-2 outbreak, case definition posed its own set of challenge, different from those characterizing previous SARS and MERS pandemics. Although common during disease, fever and respiratory symptoms may be not present at initial presentation <sup>8,9</sup>. Similarly, isolating or cohorting patients with significant travel history have lost significance in the later phases, when the transmission of infection was already “local”. It has therefore become increasingly evident how a great number of late-confirmed cases did not fulfill definition criteria for SARS-CoV-2 infection. Such underestimation in early detecting infection at ED triage has represented a turning point as a single case managed without appropriate strategy may upset hospital organization determining rapid nosocomial spread among patients and healthcare professionals <sup>10</sup>. As the awareness of how case definition in clinical practice is widely dependent on the context grew, physicians have become more flexible and lowered the threshold of suspicion for determining who to test/isolate and how many times to do it. Further infrastructural modifications partitioning the ED into high- and low-risk “no fever areas” – with different traffic flows – have also taken place. However, the widespread use of tests and isolation/cohorting measures strains resources of ED, especially in institutions with

limited isolation beds. In addition, the flow of patients with non-SARS-CoV-2 diseases has risen again a few weeks after lockdown starting.

Whether they were asymptomatic or contracted infection during stay at ED, a growing number of patients admitted to general ward was recognized as positive to SARS-CoV-2 infection. Therefore, several Hospitals in Italy had hospital-wide translated the concept of “different traffic flow” for SARS-CoV-2-positive and negative subjects. Also in the general ward, shared community facilities are closed, admitted patients are nursed in cohort rooms with two patients to a room – spaced at least 1 meter apart – and partitions are placed between beds. Patients are advised to wear surgical mask and no visitors are allowed, with very few exceptions. Healthcare workers use full personal protective equipment (PPE) (PPF2 mask, disposable gowns and gloves, and face shields) till two further nasal-pharyngeal swabs – and possibly chest CT – did not rule out the SARS-CoV-2 infection.

Our research group will retrospectively analyze the effectiveness of such measures in the next months, but some consideration may be already drawn. Pending randomized clinical trials validating therapeutic strategies and the development of a vaccine, this experience highlights the critical role of healthcare system organization <sup>11,12</sup>. A common indication is to limit hospital access to life-threatening clinical conditions. Such call was widely received by population and has contributed to limit SARS-CoV-2 spread in the early phases of outbreak. This aspect is of paramount importance especially in countries where the healthcare system is universally guaranteed, a concept often misinterpreted and reduced to that of “free service”. Noteworthy, this indication is coming at a time when the reorganization of hospital services toward the outpatient care was already felt as an urgent need in many Italian regional healthcare systems. Such reorganization is certainly appealing from an economic point of view but potential clinical advantages are less clear <sup>13</sup>. Highly efficient “out-patient hospital” may potentially contain multi-drug resistant bacterial infections but they are incompatible with epidemic occurrence. Indeed, outpatient care is largely closed in our institution and it is likely that some patient has needed to care at ED.

Implementing general practitioner activity may represent a step forward in developing a real out-hospital care system, although not applicable to all patient settings (e.g. patients on dialysis and chemotherapy). Noteworthy, once provided with PPE and therapeutic indications, general practitioners have significantly reduced hospitalization rate for SARS-CoV-2 infection and symptom severity <sup>14</sup>. In the meanwhile, lockdown measures have proven to be as effective as they have been tightened worldwide (e.g. South Korea and China). In Italy, lockdown measures significantly limited the spread of contagion in Lombardy – the most populous and affected region – and prevented a further outbreak in the southern less populated regions, where most immigrants of Lombardy come from. Even in the case of a second epidemic wave – which is considered probable – these lockdown measures will again represent the first strategy to be applied in order safeguard the health of the population.

**Conflict of interest:** none

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**Table 1. Comparisons of lockdown vs. no lockdown strategy for containing SARS-CoV-2 infections in two European countries (data updated at may 13<sup>th</sup> 2020).**

	Italy	Sweden
Lockdown imposed by authorities	Yes	No
Performed Tests (at mid-May), n	2,735,628	148,000
Confirmed cases (at mid-May), n	222,104	27,909
Letality rate, %	13	12
Country area (Km <sup>2</sup> )	301,340	450,295
Population, n	60,317,116	10,333,456
Population density, n/ Km <sup>2</sup>	201	23
Average population age, years	45.4	40.9