CSP CADERNOS DE SAÚDE PÚBLICA
REPORTS IN PUBLIC HEALTH

ENSAIO
ESSAY

Burden of disease from COVID-19 and its acute and chronic complications: reflections on measurement (DALYs) and prospects for the Brazilian Unified National Health System

Carga de doença da COVID-19 e de suas complicações agudas e crônicas: reflexões sobre a mensuração (DALY) e perspectivas no Sistema Único de Saúde

Carga de enfermedad de la COVID-19 y de sus complicaciones agudas y crónicas: reflexiones sobre la medición (DALY) y perspectivas en el Sistema Único de Salud de Brasil

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doi: 10.1590/0102-311X00148920

Abstract

COVID-19 is an acute infectious respiratory distress syndrome (ARDS) caused by the novel coronavirus SARS-CoV-2. The disease is highly communicable and produces mild to severe symptoms, generating a high demand for intensive care and thousands of deaths. In March 2020, COVID-19 was declared a pandemic and has already surpassed five million cases and 300,000 deaths in the world. The natural history of the disease has still not been fully established, hindering the elaboration of effective clinical protocols and preventive measures. Nevertheless, the disease requires a systemic approach, since there is evidence of acute and chronic complications, in addition to the catastrophic effects on the population's mental health. This highlights the need for a methodology that more effectively captures the effect of COVID-19, considering such aspects as severity, duration, and the potential to generate chronic complications that will increase the demands on Brazilian Unified National Health System (SUS). DALYs, or disability-adjusted life years, are thus an extremely useful indictor that adds mortality, an estimate of years of life lost (YLLs), and morbidity, an estimate of years of life lived with disability (YLDs). This article discusses the relevance and difficulties of studying the burden of COVID-19 and its complications in the Brazilian context, highlighting the natural history of the disease and estimating indicators such as YLDs, considering the high burden of disease in planning strategies to deal with the consequences of COVID-19 after the pandemic. The article also discusses the future challenges to deal with the disease in the SUS and the effects on the calculation of DALYs.

Coronavirus Infections; Potential Years of Life Lost; Indicator of Morbidity and Mortality; Primary Health Care

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Definition and relevance of COVID-19

In December 2019, the World Health Organization (WHO) office in China [1] reported the first official case of a pneumonia, still of unknown cause, in Wuhan, Hubei province, triggering particular interest among health authorities. By late January 2020, a state of public health emergency of international concern had been declared. By February 2020, the acute respiratory distress syndrome (ARDS) that was spreading with exponential progression was named COVID-19 by World Health Organization (WHO) [1], and on March 11, 2020, WHO declared the disease a pandemic. By that time, COVID-19 was present in some 100 countries, with more than 100,000 confirmed cases of the disease, and specific measures were needed for its identification, prevention, and control [1,2,3].

COVID-19 is an infectious ARDS caused by the novel coronavirus, the etiological agent SARS-CoV-2. Other epidemics had been reported with similar etiological agents, such as SARS-CoV-1 and MERS, but none of them with such magnitude [2]. SARS-CoV-2 presented particularly rapid spread and increase of new cases.

In Wuhan, the indicator of transmissibility (R_0), which indicates the speed of viral spread in humans, was 2.2 (95%CI: 1.4; 3.9), indicating that each infected person can infect two more persons on average through actual contact [4]. In the recent literature, the R_0 of SARS-CoV-2 varied from 1.95 (95%CI: 1.4; 2.5) [1] to 6.5 (95%CI: 5.7; 7.2) [4], with an estimated mean R_0 of 3.3 and median of 2.8 [4]. The observed variation is due to estimates at different moments in the outbreak of COVID-19 [1,4].

Concerning pathogenesis, 70% to 80% of infected individuals are either asymptomatic or present mild symptoms of the disease. Still without consensus in the literature, an estimated 20% will develop the more severe form of the disease in hospital care and may reach 5%-10% in intensive care [1,5]. Mean convalescence time is 19 days (2 to 5 days until the appearance of symptoms and 14 days after symptoms until recovery), but cases in intensive care take 3 to 6 weeks [1]. Since the entire population is susceptible, a very rapid increase in the number of infected individuals will lead to an overload on hospital beds, procedures, and equipment [5,6]. The risk factors associated with severity feature advanced age (over 60 years, especially for increased risk of mortality) and presence of comorbidities (cardiovascular diseases, obesity, diabetes, hypertension, pulmonary diseases, etc.), accelerating the progression of symptoms, with worse prognosis [4].

According to WHO data (https://www.covidvisualizer.com, accessed on 30/May/2020), the world had reported approximately 6 million confirmed cases of COVID-19, with more than 365,000 deaths associated with the disease. By the same date, the Brazilian Ministry of Health had reported 470,000 confirmed cases (incidence of 221.5 per 100,000 inhabitants) and nearly 30,000 deaths from the disease, with a case-fatality rate of 6% (mortality rate of 13.3 per 100,000 inhabitants), noting that the first case had been reported on February 26, 2020, and the first official death on March 17, 2020 (Ministério da Saúde. https://covid.saude.gov.br/, accessed on 30/May/2020). The current scenario is due to Brazil's adherence to the social distancing protocol recommended by the WHO and adopted since March 12, 2020 [7].

Measurement of DALYs from COVID-19: reflections, limits, and possibilities

Despite the importance of measurement and analysis of morbidity and mortality for understanding the impact of COVID-19, we highlight the relevance of a methodology that more effectively computes how much this disease influences the population's health status, considering such aspects as severity, duration, and the potential to generate chronic complications according to age bracket, sex, and location, besides the impact on the Brazilian Unified National Health System (SUS).

Thus, an extremely useful indicator is disability-adjusted life years (DALYs), developed by Murray & Lopez [8,9] in the mid-1990s in the context of the *Global Burden of Disease* (GBD) study. The indicator is divided into two components: (1) mortality, estimated years of life lost (YLLs), and (2) morbidity, estimated as years lived with disability (YLDs).

Nearly three decades since studies on global burden of disease emerged [9], they have incorporated updates and methodological refinements [10,11]. This period has witnessed intense debates on the methodological proposal for measuring DALYs, and various methodological refinements have

been incorporated. The field has also incorporated researchers, research groups, and institutions from throughout the world as collaborators in the various editions of the national/global estimates of GBD, under the coordination of Christopher Murray, who heads the core group of the Institute of Health Metrics and Evaluation (IHME), Washington University (Seattle, USA). There was a significant increase in the number of target diseases and sequelae, as well as the potential risk factors [8,10,12,13].

The challenges and the emergence/resurgence of new and old diseases require updates, new methodologies to estimate the years lived with disability (YLDs), often with an important degree of incompleteness, given the limited knowledge on the natural history of the disease, like arbovirus infections, more specifically Zika and chikungunya, and currently the SARS-CoV-2 pandemic. In addition, questions related to the specificities, given the economic and demographic characteristics and social inequalities, are still debated to reflect on the national/global estimates.

Brazil has conducted two national editions of the burden of disease study. The first was in the year 1998 [14,15,16] and the second in 2008 [17,18,19], besides studies on specific diseases such as diabetes [20,21], hepatitis/cirrhosis [22,23,24], external causes [25,26,27], and neglected diseases [28]. The last version of the Brazilian study features methodological refinements that underscore the originality of national studies, representing an important difference in relation to the GBD, more specifically in relation to the morbidity component (YLDs). In this sense, the two versions of the *Brazilian Burden of Disease Study* (1998 [14] and 2008 [17]) cannot be compared directly, which would require the replication of methodological contributions for each disease [26].

In the case of COVID-19, the clinical and epidemiological panorama of the acute and chronic complications requires some time for execution. The available and necessary scientific literature for performing estimates of YLDs, given the short time since the onset of COVID-19 for investigation of recovered cases, points to challenges for calculating DALYs: mapping acute and chronic complications of COVID-19 and the respective clinical and epidemiological parameters.

DALY is sensitive to the quality and precision of the information used as the data source to obtain inputs for estimates, as well as the weights assigned to the severity of measured chronic complications (measurements to be constructed), which currently introduces a relevant degree of uncertainty for DALYs in COVID-19. This emphasizes the relevance of studies with sensitivity analysis that assess the observed uncertainty in the estimates, considering the different scenarios of inputs and the decision-making process, for example, in relation to assigning weights and/or sources of information [29]; as well as weighting according to the presence and amounts of associated comorbidities, which introduce so much variability in YLLs [30]. Two scenarios of possible sources could thus be considered: (a) official data from the State Health Departments/Brazilian Ministry of Health (Ministério da Saúde. https://covid.saude.gov.br/, accessed on 30/May/2020) and (b) alternative sources such as the SIVEP-Gripe database (http://info.gripe.fiocruz.br, accessed on 30/May/2020) and the Civil Registry of Deaths (Portal da Transparência. Painel registral. https://transparencia.registrocivil.org.br/especial-covid, accessed on 23/Apr/2020). Based on these compositions of scenarios, sets of sensitivity analyses could be performed: official data versus data corrected for underreporting, which would certainly involve differences in the final set of DALYs.

The DALY indicator has the further advantage of specific analysis by age structure, a significant risk factor for COVID-19, added to the presence/number of comorbidities, as seen in the study by Hanlon et al. [30] showing an important variation in YLLs by age, based on the presence of other preexisting chronic conditions. For example, there are 35 YLLs (on average) for men 50-59 years of age (without comorbidities) and 19 YLLs for those with five comorbidities, due to the lower life expectancy and lower incidence in this group with more comorbidities. Meanwhile, for those 80 years and older, the loss is 11 YLLs (without comorbidities) and 1.5 YLLs for 11 comorbidities, despite the higher risk and higher incidence in this age group.

Another relevant in the decision-making process for calculating YLDs is the challenge of defining the set of weights assigned to the severity of acute and chronic complications associated with COVID-19, given the current lack of complete knowledge on the natural history of the disease, its clinical and epidemiological horizon (which affects the duration), changes in the treatment protocol due to technological innovations from emerging studies at the global level, both to measure the efficacy of known medicines and the search for new drugs and vaccines (which will mean the indicator of percentage of treated individuals, also incorporated into the YLDs).

All these questions will have a direct impact on measurement of YLDs, translated as the time lived with disability associated with the underlying disease, given access to the treatment protocol, weighted by the severity of each acute or chronic complication [8,9].

Current and future problems: acute and chronic complications of COVID-19 and construction of the metric for burden of COVID-19

The essential elements for calculation of YLDs involve incorporation of the "lost" time resulting from the complications and their respective severities, compiled via the weights of the disabilities and duration of acute and chronic complications, even though the possible complications of COVID-19 have not been exhausted, given the need for more studies on cell tropism and pathogenic mechanism [31,32]. The disease requires a systemic approach, given the evidence of possible complications in vital organs. Thus, the dissemination and thus the effects of SARS-CoV-2 in the body are extensive [33,34,35].

When the etiological agent SARS-CoV-2 enters the host organism, it binds to the angiotensin-converting enzyme-2 (ACE-2) receptor, allowing entry into the target cell and replication, triggering an immune response in the host and the first symptoms and clinical manifestations [35]. Despite the known tropism of the virus for the upper respiratory tract and lung tissue, due to the portal of entry, other organs that also express this receptor can be affected [36], and the individual can develop other corresponding clinical manifestations [37].

To understand the distribution of the disease in the humans, Wu et al. [38] conducted studies on metabolomic and lipidomic alterations in which they demonstrated an apparent correlation between them and the development of COVID-19, indicating that the disease altered metabolism throughout the body, with effects ranging from the cellular level to various organ systems.

These metabolic alterations, due to the relative underlying susceptibility to the infectious process by endothelial deregulation from the inflammatory mechanism, reduce the vessels' capacity to perform important regulatory functions [31,37]. These alterations can thus lead to acute or chronic complications that are related to the more serious forms of the disease [30,31,37,39,40].

In the current scientific literature, the above-mentioned target organs include the lungs, but the lack of oxygen and the systemic inflammation can also acutely damage the kidneys [41] (27%), liver [42] (50%), and gastrointestinal tract [43,44,45] (20%) and cause alterations in the coagulation cascade and hematopoietic system, heart, and cardiovascular system [46], brain and central nervous system (CNS) [47], and other organs [41].

As for acute complications [36], the propensity to develop blood clots from inflammation in these vessels, especially in the lungs, can account for the development of more severe forms of the disease, since the thrombi can play a direct and significant role in the gas exchange abnormalities and multisystem organ dysfunction [31,32,37].

The central nervous system sequelae can be devastating, especially due to respiratory viral infections, since there are at least two known entry routes for the virus into the CNS, the bloodborne route mediated by ACE-2 receptors and the retrograde neuronal pathways and infection induced by neuropathic virus, which can explain the increase in the occurrence of stroke, behavior changes, and anosmia [31].

As for the heart and vascular system, the most frequently reported complications are acute cardiac lesion, cardiac insufficiency, myocarditis, vascular inflammation, and cardiac arrythmias [39,40,48]. The heart problems, associated with an increase in cardiac enzyme levels, can be related to a combination of a significant systemic inflammatory response and vascular inflammation located at the arterial plaque [46].

Renal insufficiency in COVID-19 patients has occurred due to increased serum creatinine and decreased glomerular filtration rate. SARS-CoV-2 infection can induce severe acute tubular necrosis and lymphocyte infiltration, causing more tubular damage via recruitment of macrophages to infiltrate the interstitial tubule [34,48,50], potentially explained by ACE-2 receptor expression in the renal tubules [34,50].

Thrombotic alterations have been identified in COVID-19 patients [32,37,51,52], and thrombocytopenia has been associated with fivefold higher odds of developing the more severe form of the

disease [49,50]. Studies show that COVID-19 can increase the risk of developing disseminated intravascular coagulation [51]. One can infer that deregulation of the coagulation cascade and the resulting formation of intra-alveolar or systemic fibrin clots are prominent findings in both COVID-19 and in other severe respiratory diseases [51].

The virus thus acts on a receptor that is involved in control of the circulatory system, acting on the small arteries, which leads to numerous acute complications [36]. Therefore, when calculating YLDs, it is necessary to consider that the complications require practically a "complete burden of disease study", with workup of clinical and epidemiological parameters for each of these conditions. A "more simplified" estimate would be to aggregate cases by differentiated severities and thus estimate the YLDs for COVID-19 in mild, moderate, and severe/ICU cases with complications. This lends considerable complexity to the estimate. The same is obviously true for chronic complications in relation to the estimate of duration and weights of disabilities.

In this scenario in which the natural history of the disease is in constant evolution, it is also impossible to determine all the chronic complications that COVID-19 survivors will experience. Thus, one cannot rule out that chronic complications will be related to the acute complications cited above, such as renal insufficiency, stroke, and liver failure, among others [37,38,39,47,48,51].

Mapping the chronic complications of COVID-19 and understanding their onset can draw on studies of severe pneumonias that evolve to acute respiratory distress syndrome (ARDS) [53], leading to scars that generally cause long-term respiratory problems and that increase the risk of heart attack and stroke [47]. Patients following hospitalization for severe pneumonia with ARDS have presented fourfold higher risks of heart attack and stroke in the first year and 1.5 times higher in the nine subsequent years.

Extremely severe COVID-19 patients who spend long periods in the ICU are prone to developing "intensive care syndrome" [53,54,55,56], characterized by a set of physical (muscle atrophy and weakness, 50%), cognitive (79%), and mental alterations (28%) that jeopardize the quality of life for both patients and their caregivers [53,55].

As for cognitive impairment, the risk factors associated with this process feature the duration of delirium in the ICU, acute cerebral dysfunction (stroke, alcoholism), hypoxia (ARDS, cardiac arrest), hypotension (severe sepsis, trauma), respiratory insufficiency that requires prolonged mechanical ventilation, and the use of renal replacement therapy [54,55].

Neuromuscular weakness acquired in the ICU is the most frequent physical alteration, occurring in more than 25% of ICU survivors, with reduced mobility, recurrent falls, or quadriparesis [53,54].

Mental alterations include the risk of developing psychological changes that can exceed 60% [54] with such symptoms as anxiety, depression, and posttraumatic stress [53,54,55].

Given the above, improving the patient's quality of life after post-ICU hospital discharge encompasses a series of measures such as post-hospitalization physical therapy, nutritional care, and psychological support [58]. This supports the hypothesis of the impact on caregivers and increased costs associated with care in convalescent COVID-19 patients.

As reported above, SARS-CoV-2 has the potential for systemic coagulation [31,37] and thus reduced blood flow to the brain, causing CNS complications such as seizures, loss of consciousness, anosmia or loss of smell (5% to 10%), and "intense and prolonged delirium", which can lead to long-term cognitive impairment including memory deficit [47,53,54,56]. In COVID-19, the delirium can be aggravated by the use of sedatives (benzodiazepines) [57] to treat the violent coughing attacks and the anxiety and discomfort from the breathing tube [47,53,54,56]. The emerging literature also reports the following complications: symptoms similar to Kawasaki syndrome in children [58,59], Guillain-Barré syndrome [60,61,62,63], and complications of the retina [64] and testes, the latter possibly affecting fertility [65].

All this underscores the importance of studies to measure the burden of disease in COVID-19, since temporary and permanent comorbidities place a growing demand on health services for follow-up of these patients, both in primary and medium-complexity care, which historically display limits to patients' access, with an impact on diagnosis, monitoring, and rehabilitation.

To date, the lack of knowledge on COVID-19 determinants and complications hinders the decision-making process for determining clinical and epidemiological parameters to calculate YLDs and to define the associated weights of severity, which have such great influence on the indicator's sensitivity.

Mental health burden from COVID-19: where are we heading?

In addition to the acute and chronic complications cited in the previous section, the COVID-19 pandemic also creates a global scenario of risk factors for short and long-term mental health problems. This situation impacts both patients (due to social isolation, quarantine, and/or medical treatment of COVID-19, especially prolonged hospitalization and intensive care) and the population under social distancing [7], creating an environment prone to mental health problems such as anxiety, depression, and feelings of helplessness and uncertainties about the future [66,67].

A special focus is thus needed on the mental health of target groups with heightened risks: healthcare workers, patients with prior psychiatric diagnoses, patients recovered from COVID-19, or the general population without mental health diagnoses but subject to becoming clinical cases [68].

Essential workers, especially in healthcare, will be overburdened by an environment of stressful work, contributing to the development of mental disorders like anxiety, post-traumatic stress disorder (PTSD), and burnout [66,67,69]. This scenario means a major increase in the demand for psychiatric care, as well as care for individuals diagnosed with COVID-19, leading healthcare workers to require mental health care for themselves, to the extent that they are burned out from the work. This can lead to absenteeism and presenteeism, reducing the health system's capacity to provide care when healthcare workers themselves fall ill. Care for the health of essential workers in the pandemic is essential for minimizing their burnout and thereby guaranteeing better conditions for them to perform their work.

Patients with mental disorders who were in psychiatric treatment before COVID-19 experience difficulty in accessing mental health services due to the pandemic, due to social distancing and the overload on the health system, and may have their clinical status aggravated by the feeling of loneliness and isolation [66,67,69]. Especially for severe patients, chronic or permanent sequelae may occur, leading in turn to mental disorders related to loss of physical capacity [70].

From the population perspective, especially in developing countries like Brazil, the economic impacts of measures to prevent transmission of the disease are being felt and will continue to be reflected in the rise in poverty, unemployment, and the homeless population [69]. Untreated preexisting mental health conditions may be aggravated and new conditions may emerge, leading us in turn to infer the increase in depression, anxiety, psychoactive substance abuse, self-harm, and suicide attempts [69,71]. That is, worsening socioeconomic conditions can lead to an increase in the prevalence of mental complications in the post-pandemic scenario.

The current scenario with the COVID-19 control strategy can exacerbate family conflicts and isolate the family from external environments, fueling an increase in domestic violence and abuse of vulnerable family members [66,69,70,71], producing hostile environments that can be prone to the development of psychological traumas.

A potential strategy is to restructure the dynamics of mental health care during pandemics, with online psychological care and collective care approaches as possible alternatives for dealing with the increase in this demand [72,73].

COVID-19 thus affects all of society, generating a favorable space for mental disorders [66,67,68,69,70,71,74], and one can logically expect a pandemic of mental disorders during and after the COVID-19 pandemic.

Considering that the burden on mental health historically adds the largest share of YLDs (an estimated 50%) [8,10,14,18] and that the current COVID-19 pandemic intensifies this group of chronic diseases, it is essential to investigate the clinical and epidemiological parameters for measurement of these conditions (YLDs).

Importantly, the DALY indicator, as discussed above, consists of two components, mortality (YLLs) and morbidity (YLDs). However, health system programming and administration traditionally uses only the mortality indicator, which is not effective for mental health. This highlights the need for measurement of YLDs, which will impact programming of human resources and installed capacity for care for these disorders, since the construction of this indicator is capable of evoking this component's weight, so relevant in these groups.

Future challenges for dealing with COVID-19 in the SUS and reflections on DALYs

The literature on estimates of the global burden of disease emphasizes the importance of the DALY indicator in measuring mortality and morbidity in the same metric. The component that measures temporary and permanent disabilities even represents the strategic thrust to support planning, programming, and the economic impact on the health system, where it is possible to identify the differences between the public SUS and the private healthcare system.

Studies on burden of disease in Brazil for the reference years 1998 [14] and 2008 [17] and the estimates by the WHO for the years 2000, 2010, and 2016 [12] presented results for the morbidity component (YLDs) of some 50% [12,13,75]. This percentage means that half of the burden of disease in Brazil expresses the weight of living with the temporary and permanent sequelae from the diseases included in the studies. A major share of the sequelae are complications from chronic noncommunicable diseases, which however does not rule out the complications related to chronic infectious diseases such as Chagas, AIDS, Zika, and particularly those related to COVID-19 and still not completely defined, given the partial knowledge on the natural history of this novel disease.

Complications from diseases vary in the degree of impairment to the persons' autonomy, and they influence quality of life, often leading to early retirement and increased demand for medium and high-complexity care, which in turn show unequal distribution across the country's territory, furthering limiting access to services and resulting in late diagnosis and limited capacity for rehabilitation, even though the public SUS guarantees universal and comprehensive access to the health system [76]. The passage of *Constitutional Amendment n. 95* (EC95, Portuguese) by the Brazilian Congress further reduced the investment in health for an already chronically underfunded SUS [77], reducing the quality of public health services and further limiting patients' access. This scenario was aggravated by the reduction of budget funding for policies in social protection and promotion, besides closing family health clinics and fueling the resurgence of previously eliminated diseases like measles [78].

The COVID-19 epidemic has hit Brazil in a scenario of unemployment, impoverishment, and other risk factors related to transmissibility of the disease. Economic crises can facilitate the transmission of infectious diseases and hinder the implementation of control measures which, in the context of a pandemic, can express mortality comparable to that of wartime situations, further exacerbating the economic crisis [78]. According to Sands et al. [79], infectious diseases are one of the greatest risks to economic growth, although the economic recession's impact on the control of infectious diseases depends on the context, mapping of risk areas, the situation of vulnerability, and political decisions on financing, for example in the case of a possible repeal of the budget freeze implemented by EC95 in order to increase the funds needed to bolster the budget for health and social protection [80].

The individual and collective conditions (socioeconomic and demographic) for dealing with the public health crisis caused by COVID-19 are heavily unequal in Brazil. According to data from a Brazilian study [81], while the South and Southeast proportionally concentrate the majority of specialized human resources (critical and respiratory care physicians) and hospital equipment (ICUs and mechanical ventilators), the North and Northeast have lower parameters in relation to their shares of the national population. The study thus suggests that given this discrepancy in the availability of installed capacity and human resources, the response to the crisis is unequal, impacting the COVID-19 case-fatality rates and the collapse of the SUS.

In addition, in relation to sociodemographic differences in the response to the pandemic, the national seroprevalence sample survey EPICOVID [82] demonstrates the significant differentiation according to self-reported race: 0.7% prevalence in whites, 2.3% in browns, and 4.3% in indigenous people.

In the more specific context, in the city of Rio de Janeiro, COVID-19 case-fatality was 12%, ranging from 9.2% in neighborhoods "without favelas" to 19.5% in those with an "extremely high concentration of favelas" (more than 50% of favelas in the neighborhood). High COVID-19 case-fatality in these vulnerable territories may indicate low testing and higher severity associated with preexisting diseases or risk factors, besides difficult access to healthcare [83].

Measures to control the pandemic will have substantial short and long-term consequences; the restrictions from physical distancing and quarantine will reduce physical activity and increase other unhealthy lifestyles, leading to an increase in risk factors (smoking, alcohol consumption, sedentary

behavior, and obesity) for chronic noncommunicable diseases, with the exacerbation of clinical symptoms. Alterations in routine outpatient and inpatient care, such as [84]: cancellation/ postponement of appointments or prenatal follow-up and/or postponement of elective surgeries, reduction of coverage, and delays in the vaccination calendar, among others, will have important implications for health of the population as whole, overloading the health system.

Even after overcoming the pandemic's emergency phase, when the number of cases and deaths wanes, there is still the challenge of dealing with the increased demand on the SUS for diagnosis, treatment, and rehabilitation of recovered patients from the possible chronic complications of COVID-19, such as: increased demand for rehabilitation services due to respiratory complications; consultations and psychotherapies both for "new" and prior psychiatric cases aggravated by difficult access during the pandemic; overload on care by cardiologists due to the accumulated consultations postponed in the protocol for control to avoid transmission and increased incidence of cardiovascular conditions from COVID-19, with increased risk of stroke and heart attack; and aggravation of the scenario of drug therapy and elective surgeries for chronic diseases due to rescheduling of prescriptions.

This all underscores the enormous current and future effects of the COVID-19 pandemic on the SUS, and the metrics to be constructed need to consider these aspects. Thus, the timing and natural history of the disease are essential elements for constructing the components (YLL and YLD) of DALY. Without this, the uncertainty can compromise the indicator's estimates. The complications associated with COVID-19 not only add to those related to other diseases, but represent an even greater burden for health services and families [85]. The focus on the importance of the burden of morbidity (YLDs) will thus be strategic in organizing networks of care and planning and programming health actions.

Currently, considering the debate on the control measures deployed thus far, it is necessary determine which epidemiological surveillance actions in the territory represent a structuring strategy, together with primary healthcare (PHC), for monitoring COVID-19 infection [84,85,86]. Proper monitoring of the disease in the country also provides essential information for estimating the classical epidemiological parameters needed to construct the DALY.

A suggested strategy for dealing with the pandemic and post-pandemic to generate more precise clinical and epidemiological parameters of the disease and its sequelae, necessary for the DALY, is to guarantee appropriate action by PHC in screening and monitoring infected individuals and their contacts, applying social distancing strategies recommended by family health teams and work by community health agents, according to guidelines from the Department of Primary Health Care (SAPS, in Portuguese), Brazilian Ministry of Health [86,87]. That is, recommendations for organization of COVID-19 care in PHC in the SUS [88] should be followed, based on identification of suspected cases, with household contacts and if possible community contacts in the previous 14 days to orient home isolation for 14 days, reducing transmission and avoiding simultaneous generation of serious cases and overload on the SUS.

The system requires strong PHC in order to flatten the pandemic's curve and ensure sufficient ICU beds [89] and a safer and more efficient alternative path for dealing with the pandemic. As for the current control strategies' effectiveness, the longer person-to-person transmission is stretched out, the more manageable the situation will be for the SUS.

According to Vitória & Campos [89], adequate guidelines for PHC in dealing with the pandemic consist of: (1) guaranteeing safe access to basic healthcare units (UBS in Portuguese) with adjustment of the physical infrastructure and online PHC (with separation of an exclusive entrance for COVID patients or use of tents); (2) guaranteeing safety in immunizations; (3) protecting healthcare workers (orienting and providing use of personal protective equipment); (4) guaranteeing continuity of care over time; (5) strengthening the family approach; and (6) strengthening the community approach.

On the specific item (4) concerning continuity of care over time, the following are crosscutting strategies: telecare, which avoids public circulation of symptomatic individuals who only require orientation; and keeping the family health teams alert to the evolution of patients with low oxygen saturation (but without symptoms) and/or aggravation of their clinical condition. In item (5), on the family approach, PHC should orient families on caring for their patients, providing adequate nutrition, sufficient liquids, and medication for fever and avoiding transmission to others. In item (6), the community approach, the UBS know the vulnerable families in their respective territories, those with heavy indoor crowding, for whom alternative places for quarantining are necessary to avoid further

transmission. The family health teams thus have key elements that allow better analysis and interpretation of risks and vulnerabilities of individuals, families, and the community.

Finally, failures in access to diagnosis have an important impact on the morbidity and mortality profile, expressed in the increased demand on medium and high-complexity services. And based on an accurate diagnosis of COVID-19's epidemiology and particularly that of its chronic complications via estimation of DALYs, it is possible to provide backing to draft new strategies and policies to deal with the pandemic. However, this goal will only be achieved with the appropriate knowledge, appreciation, and financing of the SUS and its workers, especially in primary healthcare.

Contributors

M. R. Campos, J. M. A. Schramm, I. C. M. Emmerick, J. M. Rodrigues, F. G. Avelar and T. G. Pimentel participated in the study's conception and design, writing of the article, and critical revision of the final content.

Additional informations

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Resumo

A COVID-19 é uma síndrome respiratória aguda grave (SRAG) infecciosa, causada por coronavírus. A doença tem alta transmissibilidade e ocasiona sintomas leves a graves, gerando elevada demanda por cuidados intensivos e milhares de óbitos. Em março de 2020, a COVID-19 foi caracterizada como pandemia e já soma mais de 5 milhões de casos e 300 mil óbitos pelo mundo. A história natural da doença ainda não é bem estabelecida, dificultando a elaboração de protocolos clínicos eficazes e medidas de prevenção. Apesar disso, pode-se afirmar que é uma doença de abordagem sistêmica, já que há evidências de complicações agudas e crônicas, além de efeitos catastróficos na saúde mental da população. Destaca-se então a necessidade de uma metodologia que capte de forma mais efetiva os efeitos da COVID-19, considerando aspectos como sua gravidade, duração e potencial de gerar complicações crônicas que aumentarão as demandas no Sistema Único de Saúde (SUS). Nesse sentido, é de extrema utilidade o indicador DALY, ou anos de vida perdidos por morte prematura ajustados por incapacidade (DALY), que agrega a (1) mortalidade – estimativa dos anos de vida perdidos (YLL) e (2) morbidade – estimativa dos anos vividos com incapacidade (YLD). Este artigo discute a relevância e as dificuldades de estudar a carga da COVID-19 e de suas complicações, no contexto brasileiro, ressaltando a importância de caracterizar a história natural da doença e estimar indicadores como o YLD, que considerem a alta carga de morbidade no planejamento de estratégias para lidar com as consequências da COVID-19 pós-pandemia. Discute-se também os desafios futuros para o enfrentamento da doença no SUS e reflexões sobre o cálculo do DALY.

Infecções por Coronavírus; Anos Potenciais de Vida Perdidos; Indicadores de Morbimortalidade; Atenção Primária à Saúde

Resumen

La COVID-19 es un síndrome respiratorio agudo grave (SRAG) infeccioso, causado por coronavirus. La enfermedad posee una alta transmisibilidad y ocasiona de síntomas leves a graves, generando una elevada demanda de cuidados intensivos y millares de fallecimientos. En marzo de 2020, la COVID-19 se caracterizó como pandemia y ya suma más de 5 millones de casos y 300 mil fallecimientos por el mundo. La historia natural de la enfermedad todavía no ha sido bien establecida, dificultando la elaboración de protocolos clínicos eficaces y medidas de prevención. A pesar de eso, se puede afirmar que es una enfermedad de abordaje sistémico, ya que existen evidencias sobre complicaciones agudas y crónicas, además de efectos catastróficos en la salud mental de la población. Se destaca entonces la necesidad de una metodología que capte de forma más efectiva los efectos de la COVID-19, considerando aspectos como su gravedad, duración, potencial de generar complicaciones crónicas que aumentarán las demandas en el Sistema Único de Salud (SUS). En este sentido, es de extrema utilidad el indicador DALY o años de vida perdidos por muerte prematura ajustados por incapacidad, que agrega la (1) mortalidad – estimación de los años de vida perdidos (YLL) y (2) morbilidad – estimación de los años vividos con incapacidad (YLD). Este artículo discute la relevancia y las dificultades de estudiar la carga de la COVID-19 y sus complicaciones, en el contexto brasileño, resaltando la importancia de caracterizar la historia natural de la enfermedad y estimar indicadores como el YLD, que consideren la alta carga de morbilidad en la planificación de estrategias para lidiar con las consecuencias de la COVID-19 pospandemia. Se discuten también los desafíos futuros para el combate de la enfermedad en el SUS y reflexiones sobre el cálculo del DALY.

Infecciones por Coronavírus; Años Potenciales de Vida Perdidos; Indicadores de Morbimortalidad; Atención Primaria de Salud

Submitted on 02/Jun/2020
Final version resubmitted on 21/Jul/2020
Approved on 24/Jul/2020