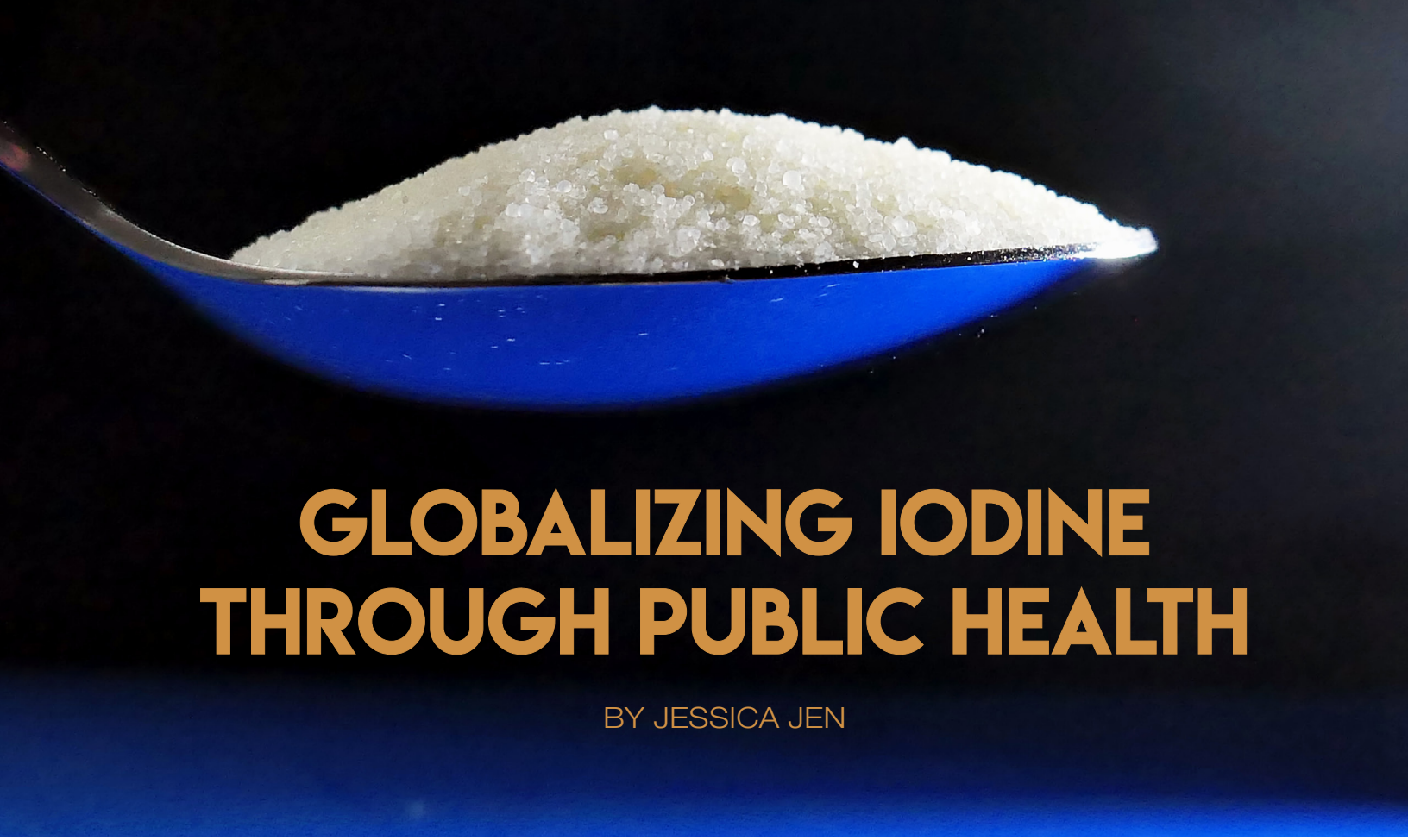

GLOBALIZING IODINE THROUGH PUBLIC HEALTH

BY JESSICA JEN

By early spring of 2020, the SARS-CoV-2 outbreak, also known as COVID-19, was reaching an unprecedented scale. Amidst the stressful unease, massive efforts were undertaken to contain and combat the pandemic. In-person contact was decreasing, events were cancelled, and it seemed that to handle the outbreak, the world was on pause. Researchers were scrambling to develop vaccines and hospitals were at their tipping points, evidence of the lengths being taken to preserve as many lives as possible. Numerous public health interventions were taking effect worldwide, with nations executing a number of distinct responses.

Public health is the union of science, policy, and community acting in harmony to minimize the onset of disease in the largest number of people.[1] In other words, public health is about protecting people's health at the population level.[2] This union becomes evident during a widespread outbreak when containment, epidemiological analysis, pharmaceutical development, economic effects, and even policy changes become familiar aspects of the outbreak response.

But beyond outbreak responses is the cooperation between disciplines to tackle issues and implement solutions. Such responses have been crucial in managing public health crises for a number of centuries, becoming more complex with advances in scientific thought such as epidemiology in the nineteenth century.[3] The global introduction of iodized salt to resolve iodine deficiencies in particular illustrates the complexity and ramifications of public health interventions.

IODINE SUPPLEMENTATION

Iodine is an essential mineral in the human diet. Those with iodine deficiencies experience thyroid disruptions manifesting as impaired brain development in the fetal stage and otherwise as goiter, an abnormally enlarged thyroid (Fig. 2).[4,5] The link between iodine deficiencies and goiter was first hypothesized in 1852 by French chemist Adolphe Chatin, leading scientists to begin advocating for iodine supplementation over the following decades.[6] The introduction of iodized salt beginning in the early 20th century resulted in a sharp drop in cases of iodine deficiency disorders (IDD) and the rise of salt as a primary source of iodine.

The success of salt iodization, however, was in part colored by geographical location: programs were more effective in some regions of the world than in others. Ensuring the success of any preventative measure, after all, involves more than creating a product (such as iodized salt). The political agreement that public health programs rely on to be successful is dependent first on recognition of the problem, and second, on

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epidemiological data and community backing, according to prominent IDD researcher Basil Hetzel.[7] Hetzel studied this process of developing effective public health initiatives in Indonesia where the use of steady community feedback to pull continued political interest was widely successful.

Indonesia's salt iodization efforts first emerged for a brief two decades under Dutch colonization in the early 1900s, but the end of Dutch administration in the 1940s caused these efforts to phase out.[8] In the 1970s, renewed efforts at widespread iodized salt distribution and iodized oil injections appeared promising. Levels of detected iodine in individuals increased to a healthy range in two years; the percentage of children born with thyroid-related neurological disorders fell from seven percent to zero; and Indonesian legislators proscribed non-iodized salt in 1983. Nevertheless, the program ultimately failed due to a lack of internal government coordination and accurate population data.[7,8] A third attempt in the 1990s also showed some success—with assistance from UNICEF and the World Bank, the Indonesian government established a nationwide program to increase access to iodized salt and monitor iodine levels in the population. As a result of this program, child goiter rates fell by 30 percent between 1980 and 1998, and the consumption of iodized salt at the household level rose by three percent from 1995 to 1999. However, despite clear improvements in people's health, this initiative's effects were limited by inadequate enforcement of salt legislation and a financial crisis. The overall failure in achieving nation-wide salt iodization was most likely due to both a lack in coordination between trade and health departments and a lack of incentive for salt producers to iodize their products, as it was more profitable to sell raw salt directly than through a middleman who could iodize it.

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Indonesia was not alone in losing iodization efforts to political and economic stumblings, as evidenced by a drop in Brazil's salt iodization in 1974.[9] A lack of widespread awareness, funding, and poor control over proper salt production led to a sharp rise in endemic goiter rates, forcing Brazil's Ministry of Health to renew its salt iodization programs in 1983. In an effort to combat this increase in disease, salt producers were offered proper equipment, inspectors were trained to manage the process of iodization, and laboratories were set up to monitor iodine levels; as a result, average iodine levels in the tested population increased to a healthy range over 10 years.

The late 20th century saw similar salt iodization programs emerging across the globe. The International Council for Control of Iodine Deficiency Disorders, now known as the Iodine Global Network (IGN), has assisted countries in eradicating IDD since its inception in 1985 by communicating research on IDD's severe health impediments to health ministries.[10] Once governments realized that suitable iodine levels boosted productivity, quality of life, and therefore the economy, many established national standards and enforcement practices for salt iodization.

The IGN has frequently partnered with organizations such as the WHO and UNICEF to act as a bridge between scientific research on IDD and the implementation of global solutions like iodized salt.[9] In China, salt iodization programs have also shown positive results.[8] China's health of-

Figure 1: The Khewra Salt Mine, *a major producer of rock salt and brine, is a popular tourist destination and the second largest salt mine worldwide.*

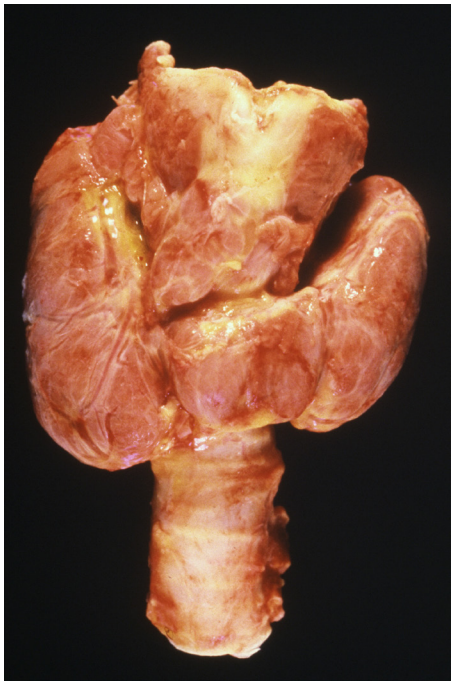

***Figure 2: An enlarged thyroid** that would have resulted in a goiter, extracted during an autopsy.*

ficials and salt producers advocated IDD awareness in tandem with local governors monitoring iodine production and enforcing sales of proper salt. As a result, both the quantity and quality of iodized salt consumption increased from 1995 to 1999. National consumption of iodized salt rose to nearly 95 percent, parts per million of iodine in salt nearly tripled, and goiter rates were slashed in half in the four-year period. These positive results were largely due to improved iodine availability, centralized salt production, and close surveillance by health officials and local governments. The various methods of salt iodization efforts in Indonesia, Brazil, and China have shown the adroitness required to implement public health interventions and the coordination necessary for their successes.

BEYOND IODINE

Global efforts to provide adequate access to iodine have overcome a myriad of obstacles to reduce IDD. Most programs established in the 20th century have shown some measure of success, yet there is always work to be done. Two billion people worldwide still suffer from IDD as of 2017.[11] However, the stories of preventing IDD using salt iodization provide uplifting testimonials of success, evidence that large-scale execution of preventative public health measures can be effective with political, technical, and societal changes.[8]

While the ongoing COVID-19 pandemic is more urgent than IDD, similar tactics are being applied to current public health interventions. Just as governments endorsed iodized salt, they are encouraging citizens to self-quarantine; instead of salt refining, funds are being directed towards hospital equipment. Although the pressing nature of the viral outbreak garners more media coverage than a chronic nutritional deficiency, both crises demonstrate the intricacy and scope of public health measures necessary for effectively preserving global health.

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IMAGE REFERENCES

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