Impact of the COVID-19 pandemic on the volume of mammography examinations in Southern Taiwan

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COVID-19 (coronavirus disease 2019) has spread rapidly in China and other parts of the world since December 31, 2019. The first reported COVID-19 case in Taiwan was confirmed on January 21, 2020. Previously, Taiwan experienced hospital-acquired severe acute respiratory syndrome (SARS) infections in 2003, so people hesitated to come to hospitals and risked SARS transmission then. Similar to the SARS outbreak, many people in Taiwan have been afraid to visit hospitals during the COVID-19 pandemic.

Taiwan implemented a mammography-based nationwide screening for breast cancer in July 2004 that provides free biennial mammography to women between the ages of 45 and 69 years. Self-paid/self-requested health checkups are also relatively prevalent in Taiwan. There was no official recommendation about mammography examinations in Taiwan during the pandemic. Mammography examinations for different purposes have continued during this pandemic in all Taiwan's hospitals. Since there is little evidence for an optimum mammography...
policy for either symptomatic or screening women during the COVID-19 pandemic, we investigated the impact of the COVID-19 pandemic on mammography utilization in southern Taiwan.

The hospital institutional review board approved this retrospective study. This study retrieved records for patients receiving mammography services in a 1455-bed public, academic medical center that provides screening and diagnostic mammography in southern Taiwan. The test period (22 weeks) of the COVID-19 pandemic was between the 1st and 22nd week in 2020. The pre-COVID-19 pandemic control period was between the 1st and 22nd week of 2019, when there was no evidence about the virus. COVID-19 data were retrieved from Taiwan’s National Health Command Center. We further categorized mammography data as self-requested, national screening, and diagnostic based on procedure code. Self-requested mammography refers to women schedule herself for a self-paid mammography without an order from her physician. Screening mammography for women aged 45–69 years is further divided into five age groups. A recall rate refers to the percentage of screening mammography that is interpreted as suspicious.

As of May 31, 2020, Taiwan had 442 confirmed cases and seven deaths from COVID-19 (Figure 1). About 37% fewer total mammography examinations were found in the COVID-19 pandemic than 1 year earlier (3041 vs 4816, P < .001). Among 22 weeks, only 2 weeks had less total mammogram examination than previous years due to two long weekend holidays in 2019. The difference of 22 weekly mammography examinations (pre-COVID-19 minus COVID-19) showed a high positive correlation with new weekly COVID-19 cases (r = .30, P = .17) (Figure 2). Above a selected threshold (>20 new COVID-19 cases/week), the difference of weekly mammography (pre-COVID-19 minus COVID-19) showed a high positive correlation with weekly new COVID-19 cases.

**Key Messages**

1. Self-requested, screening, and diagnostic mammography examinations decreased 96%, 51%, and 6%, respectively, from pre-COVID-19 to COVID-19.

2. Above a threshold (>20 new COVID-19 cases/week), the difference of weekly mammography (pre-COVID-19 minus COVID-19) showed a high positive correlation with weekly new COVID-19 cases.

![FIGURE 2](Color figure can be viewed at wileyonlinelibrary.com)

**TABLE 1** Age subgroups of women receiving screening mammography during pre-COVID-19 and COVID-19

| Age subgroup | Pre-COVID-19 (N = 3254) | COVID-19 (N = 1774) |
|--------------|------------------------|---------------------|
| 45-49        | 997 (30.1)             | 563 (31.7)          |
| 50-54        | 656 (20.1)             | 366 (20.6)          |
| 55-59        | 592 (18.2)             | 343 (19.3)          |
| 60-64        | 557 (17.1)             | 284 (16.0)          |
| 65-69        | 452 (13.9)             | 218 (12.3)          |

Note: Numbers in parentheses are percentages.
the COVID-19 period remained similar to the pre-COVID-19 period. Diagnostic mammography showed less impact from the pandemic. We found that women were weighing the benefits of mammography examinations against the risks of virus exposure.

The risk of delayed breast cancer diagnosis with worse outcomes should be very carefully weighed against the risk of virus exposure for patients and physicians. The American Society of Breast Surgeons and European breast specialists recommend that all medical facilities should postpone all breast screening.4,5 However, diagnostic mammography in symptomatic women should be continued to avoid delayed diagnosis and worse cancer outcomes.5 As Taiwan's hospital resources and medical staff were not limited during this pandemic, triage of breast cancer patients is not critical.

In summary, COVID-19 has influenced the volume of mammography examinations, especially in self-requested and screening mammography, more prominent above a threshold number of weekly new COVID-19 cases.

CONFLICT OF INTEREST
Meng-Yuan Tsai and other co-authors have no conflict of interest.

AUTHORS’ CONTRIBUTION
Dr Chou, Pan, Yang, Chiang, Huang, and Tsai all contributed to the research and writing of this manuscript.

ETHICAL APPROVAL
The study was approved by the institutional review board (IRB) of Kaohsiung Veterans General Hospital(KSVGH20-CT7-26). Written informed consent was waived.

DATA AVAILABILITY STATEMENT
The data that support the findings of this study are available on reasonable request from the corresponding author. Some data are not publicly available due to their containing information that could compromise the privacy of research participants.

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