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Comparison of different novel COVID-19 swab testing devices

To Dear Editor

Since coronavirus disease 2019 (COVID-19) was reported in December 2019 and rapidly developed into global pandemic, Taiwan kept excellent performance via strict border control measures. However, local epidemic outbreak in two municipalities of northern Taiwan since May 2021, and Centers for Disease Control (CDC) announced to elevate the epidemic alert to level 3. CDC and local governments took large-scale COVID-19 screen testing strategy as one of epidemic control measures.

In this period, some hospitals in epidemic hot area invested large amounts of personnel and resource for large-scale COVID-19 screen testing, how to protect medical staffs from aerosol transmission risk and decrease the consumption of personal protective equipment (PPE) are significant issues^{1,2}. For these reasons, many kinds of novel swab testing equipment were designed and manufactured in Taiwan and utilized by many hospitals (Fig. 1).

Because of the large-scale screen strategy, large amounts of testing demands occurred in traditional markets, parks and shopping malls. It is very important to apply suitable device in specific situation. We will compare these novel screen equipments in this article based on actual use experience in a hot area COVID-19 specialized hospital (Table 1).

A. Intubation box.³

It is made of acrylic and can provide simple aerosol blocking ability. It is portable because of its small size and can be used at bedside for patient lying in bed. However, it is not completely sealed, therefore examiner needs to wear PPE when performing swab testing.

B. Movable swab shield.⁴

This shield was composed by acrylic plate and long rubber glove. It provides basic physical blocking ability from

aerosol particles. It can be used not only at bedside but also at outdoor space. However it's not sealed either, examiner still needs to don PPE.

C. Extended swab shield.⁵

It is similar to movable swab shield but provides augmented physical blocking ability. It is foldable, and easy to storage and move. Therefore, it can cope with a variety of outdoor occasions, such as park and parking lot outside the hospital.

D. Swab vehicle

It is modified from the original van for pap smear examination by adding acrylic plate and long rubber glove. The vehicle provides complete safety and comfort. It is highly maneuverable and site-adaptable for different places such as large shopping malls and traditional markets.

E. Swab station

The swab station is completely sealed and can block the external aerosol risk. There is a power supply inside, and it can provide air-conditioning. The examiner can work comfortably and do not need to change the PPE frequently for large amount COVID-19 screen tests. However it is not movable, only can be set in one fixed site.

F. Positive pressure testing booth

It is manufactured by Taiwan Industrial Technology Research Institute (ITRI). It is like swab station but provided positive pressure function inside additionally. There is a fan-filter unit outside with pre-filter and HEPA filter function. It can provide examiner a comfortable work place and decreased the consumptions of PPE.

<https://doi.org/10.1016/j.jfma.2021.10.019>

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Figure 1 A. Intubation box utilized at bedside, B. Movable swab shield utilized in negative pressure room, C. Extended swab shield in a park, D. Swab vehicle in a shopping mall, E. Swab station in the outside of emergency department, F. Positive pressure testing booth in the parking lot of hospital, and G. Swab container in a large outdoor parking lot.

Table 1 The comparison of seven different swab testing devices.

	Blocking Ability	Cleaning Method	Estimated Cost (NTD)	Mobility	Air-conditioning
Intubation box	+	75% alcohol PPE replacement	1000	+++	No
Movable swab shield	+	75% alcohol PPE replacement	20,000	+++	No
Extended swab shield	++	75% alcohol PPE replacement	50,000	++	No
Swab vehicle	+++	75% alcohol for external ^a UV light for internal	10,000	+++	Yes
Swab station	+++	75% alcohol for external ^a UV light for internal	200,000	+	Yes
Positive pressure testing booth	+++	75% alcohol for external ^a UV light for internal	640,000	+	Yes
Swab container	+++	75% alcohol for external ^a UV light for internal	600,000	+	Yes

^a External part includes acrylic plate and long rubber gloves.

G. Swab container

It is modified from a shipping container to provide airtightness and air-conditioning, and can provide multiple personnel to perform swab testing at the same time, which improves the efficiency of COVID-19 testing. However, it is lack of the ability of mobility, and requires a larger space for its installation. Therefore it is limited to

be installed in a large open outdoor space such as park and square.

Authorship conformation form

All authors have participated in (a) conception and design, or analysis and interpretation of the data; (b) drafting the

article or revising it critically for important intellectual content; and (c) approval of the final version.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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8 July 2021