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# **Education for children about donning instruction of Respiratory Protection Device to prevent harmful dust exposure at the time of a pandemic outbreak of COVID-19 - Sustainability of educational effect -**

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# INTRODUCTION

At the time of a pandemic, donning mask is the only methods protecting the exposure of harmful dust at outdoors. When using Respiratory Protection Developments (masks) in industry is recommended to receive education. Mask donning education is designed for workers.

Table 1 Fit test word wide

country	Japan	China	Korea	Singapore	Australia	Brazil	Canada	America	Britain	France	EU
law				○	○	○	○	○	○		
recommend	○	○	○							○	○
standard	JIST8150	GB/T18664-2002	KOSHA H-29-2008	SS548-2009	AS/NZS1715:2009	FPFRP	CSA Z94.4-02	29CFR 1910	HSE282/28	INRS, ED6106	EN529
frequency of fit test	-	-	-	each year	each year	each year	each two years	each year	each year	-	each year

However, when conducting mask donning education for children, there is no research report that verifies how often and how to do it.





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# OBJECTIVE

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The objective of this study was to examine sustainability of educational effect on donning mask for children.

# METHOD

## Target masks

Fig.1 shows the appearance of the masks.

No.	The outside appearance	The inside appearance	Product (Manufacturer)
A			Fitty 7DAYS Mask (Tamagawa-Eizai Co.,Ltd)
B			BMC Kids Fit Mask (BMC Inc.)
C			Hi-luck Kids Kakaranzo (KOKEN Ltd.)
D			DD01-N95-2 (SHIGEMATSU WORKS CO., LTD.)
E			Vflex 9105JS (3MLTD.)

Fig.1 The outside appearance of 5 RPEs



# METHOD

## Fit test method

We Used a Mask Fitting Tester MT-03 (Shibata Science, Japan) . Air sampling in the mask was performed by the guide method. The guide is a thin vinyl tube shown in Figure 2. It can sample the inside air of a mask without making hole to the mask.



Fig.2 The appearance of fit test with the Mask Fitting Tester Model MT-03™, Roken type

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# METHOD

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The PF was measured with 2 times of normal breathing for one child by one mask.



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# METHOD

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## Calculation of protection factor (PF)

$$= \frac{\text{( the concentration of dust outside of the mask)}}{\text{( the concentration of dust inside of the mask)}}$$

# METHOD

## Subjects

13 subjects (9 girls and 4 boys). The age of subjects is 4-12 years old.





# METHOD

## Fit test panel and face size

(A) is the respirator fit test panel developed by the U.S. NIOSH.

(B) is the panel for youths representing respirator users in mid-Taiwan.

The black dots shows subjects face size.

Because the subjects were children, observed the face width was narrower and the face length tended to be shorter.

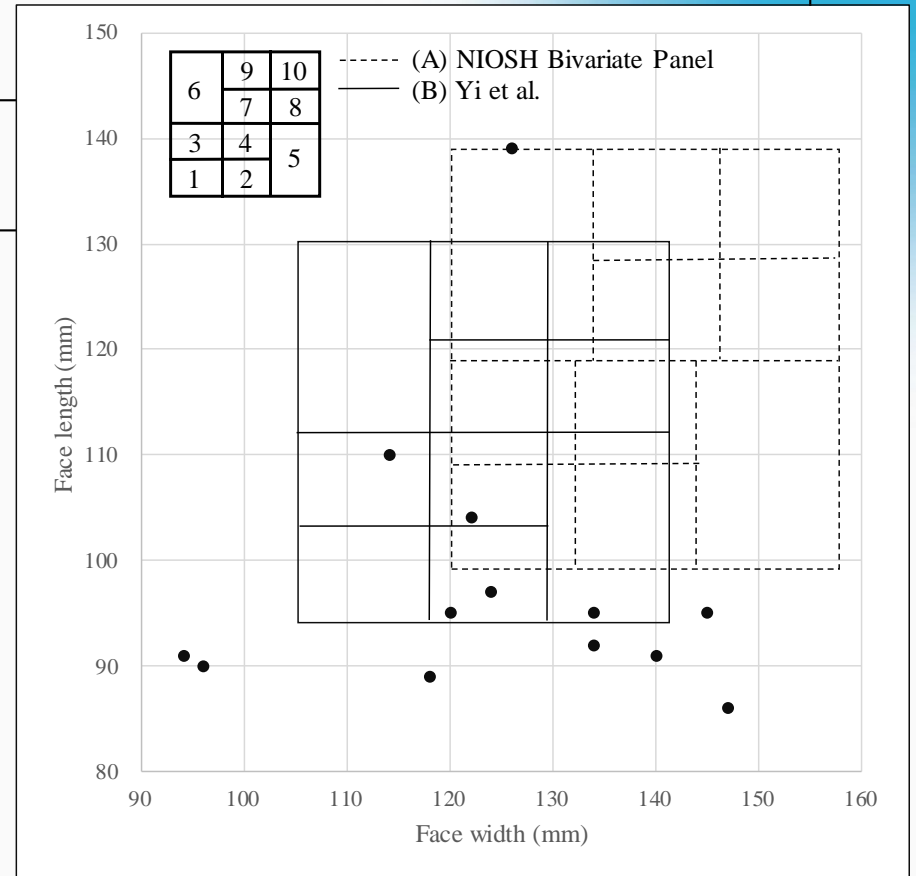


Fig.5 Face size of children  
 (A) The respirator fit test panel developed by the U.S. National Institute for Occupational Safety and Health [13].  
 (B) The panel developed by Yi et al. [14].

# METHOD

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## Instruction

We conducted two way instructions on how to don masks.

- 1) A subject was given masks and instruction manuals.  
Measured the PF after the subject read the instruction manual and donned a mask. And then, the PF was measured.
- 2) Teacher showed demonstration on how to don, subject donned a mask.  
And then, the PF was measured.

1.5 month later and 3 month later from the first education, the PF was measured again.

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# METHOD

The instruction manuals

Fig.6 mask donning method described in instruction manuals

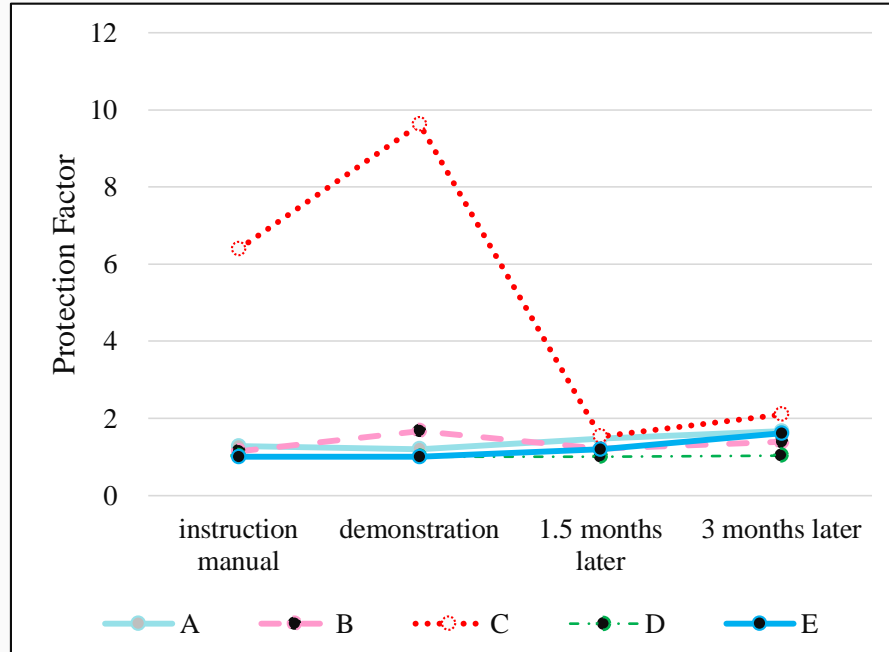
No.	Donning instruction manual	No.	Donning instruction manual
A	<p>注意と裏を確認し、鼻かかけゴムが鼻裏に当たるよう鼻にかけます。                  ノーズフックを鼻の間に渡ります。                  両側にフックを耳かきか、両側の手でマスクを調整します。                  両側の水玉を上下に動かして調整します。</p>	D	<p>1 係用テープ アジャスター                  しめひもをほどく。                  しめひもをほどく。                  係用テープ(---)部分を平らにする。係用テープ(---)部分の折り目や歪みを直す。                  アジャスターをもち、しめひもを引っ張り、長さ調整する。                  係用テープを両手の指で押し入れ、顔に合わせる。</p> <p>2 マスク内側                  係用テープ                  係用テープを平らにする。係用テープ(---)部分の折り目や歪みを直す。</p> <p>3 しめひも上側                  係用テープ                  しめひも下側を顔にかけ、片手でマスクを押さえ、もう一方の手でしめひも上側を頭頂部にかける。</p> <p>4 アジャスター                  係用テープ                  アジャスターをもち、しめひもを引っ張り、長さ調整する。</p> <p>5 係用テープ                  係用テープを両手の指で押し入れ、顔に合わせる。</p> <p>6 密着性の良否の検査                  マスク全体を両手で握り、息を吐き、マスクと顔の隙から空気の漏れがなければ、密着性は良好。</p>
B	<p>1 マスクを顔に当てて、鼻のテープを合わせます。                  2 マスクを顔にフィットさせるのが正しい位置を合わせます。                  3 鼻の両側を両手で握り、アジャスターを上下に動かして調整します。</p>	E	<p>係用方法の図</p> <p>図1 マスクの裏面を内側に折り、鼻かかけゴムを鼻にかけ、両側のフックを耳かきか、両側の手でマスクを調整します。                  図2 上唇を上、下唇を下に引っ掛けて、マスクを顔に押し付け、両側のフックを耳かきか、両側の手でマスクを調整します。                  図3 下唇を口に当て、鼻かかけゴムの間に、マスクを押し付け、両側のフックを耳かきか、両側の手でマスクを調整します。                  図4-a 2本のしめひもを両手で握り、息を吐き、マスクと顔の隙から空気の漏れがなければ、密着性は良好。</p> <p>図4-b 両方のしめひもを、両側の鼻も両側に引っ掛けます。                  図4-c 両側のフックを両側の耳かきか、両側の手でマスクを調整します。また必要に応じて、両側の鼻も両側に引っ掛けます。                  図5 マスク全体を両手で握り、息を吐き、マスクと顔の隙から空気の漏れがなければ、密着性は良好。</p> <p>図6 マスク全体を両手で握り、息を吐き、マスクと顔の隙から空気の漏れがなければ、密着性は良好。</p>
C	<p>係用方法の図</p> <p>図1 しめひもを鼻の中央に押し、鼻かかけゴムの間に、マスクを押し付け、両側のフックを耳かきか、両側の手でマスクを調整します。                  図2 しめひもを鼻の上側に引っ掛けます。                  図3 マスクを上下左右に動かして、鼻かかけゴムの間に、マスクを押し付け、両側のフックを耳かきか、両側の手でマスクを調整します。</p>		



# RESULT

Using PF as an index, Fig. 7-9 show the changes of the educational effect of donning mask by age group.

# RESULT



Age 4-6 (n=4)  
Only mask C showed educational effect.

PF was 6 and 10.

Demonstration is more effective than instruction manual.

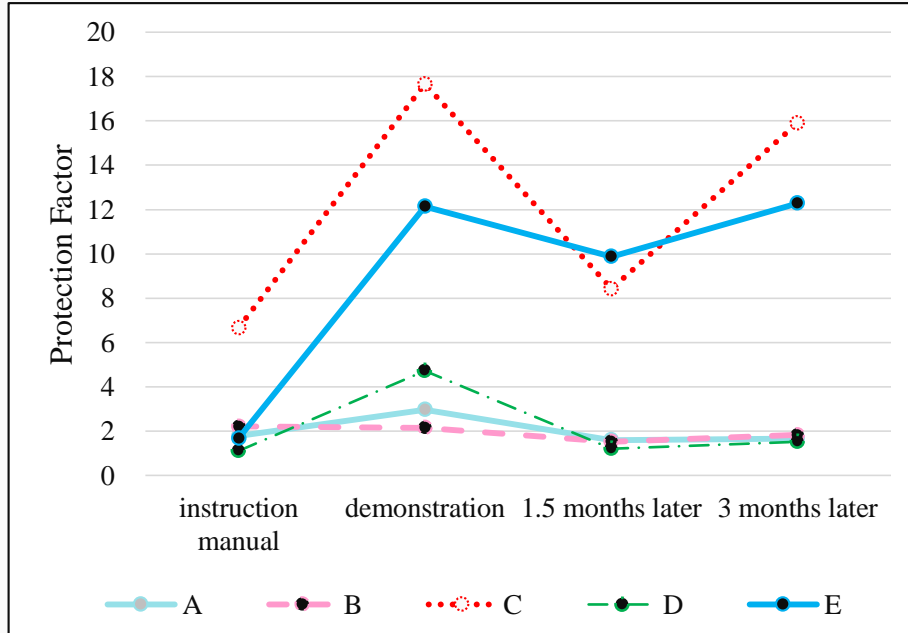
1.5 month later, the PF downed.

Fig.7 The change with time of the educational effect of donning mask at age 4-6 (n=4)



# RESULT

Age 8-9 (n=5)



Mask C and E showed educational effect clearly.

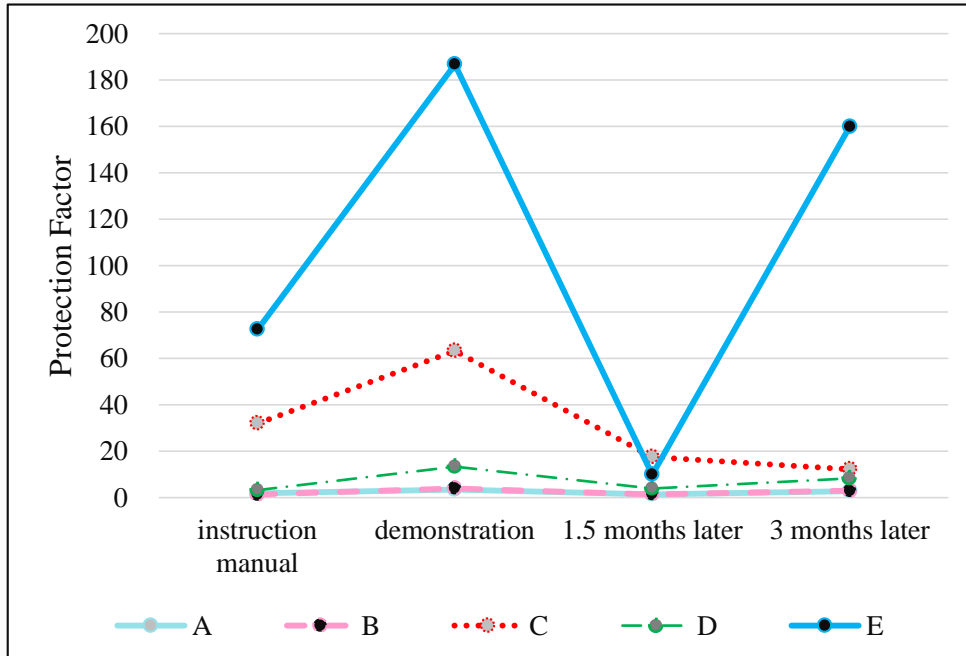
Demonstration is more effective than instruction manual.

1.5 month later, the PFs showed a little down.  
3 month later, mask C and E's PF showed up again.

Fig.8 The change with time of the educational effect of donning mask at age 8-9 (n=5)



# RESULT



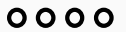
Age 10-12 (n=5)

Mask C and E showed educational effect clearly.

Demonstration is more effective than instruction manual.

1.5 month later, the Pf showed down  
3 month later, mask C and E's Pf showed up again.

Fig.9 The change with time of the educational effect of donning mask at age 10-12 (n=5)



## DISCUSSION

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- The mask donning demonstration was more effective as a education method than the instruction manual.
- However, it is impossible to show a demonstration of how to don a mask to every child who have to don it.
- It is necessary to upload animations of how to don mask on the Internet. So that children can watch freely when they need it on smartphones etc.



# DISCUSSION

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- We expected that children forget how to don masks 1.5 month later. However, it was unexpected that the PF increased again at 3 month later. The change in the PF with the passage of time was considered to be affected by the following two.

- ① For masks that are difficult to don, subjects will quickly forget how to don them.
- ② It was inferred that subjects get used to how to don by repeatedly donning masks

# DISCUSSION

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- But, about the phenomenon of PF becoming high again, we could not over the consideration based on only this examined data. We plan to do an additional examine about this theme in the future.



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# THANKS!

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Q & A