



# The impact of school heavy metal exposure on children's gut microbiota: the mediating role of environmental microorganisms.

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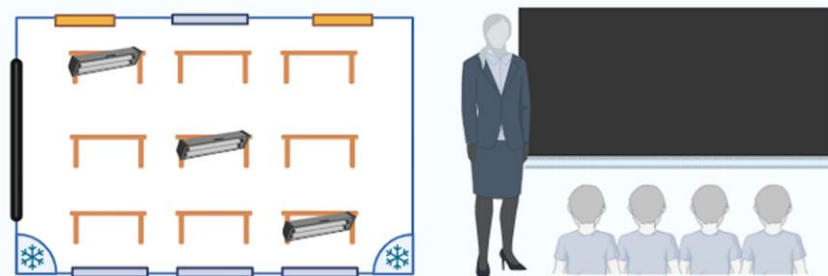


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# Introduction and Highlights

## Classroom

Samples from 67 classrooms, including indoor, outdoor, and air-conditioning samples



Exposed children fecal samples collection



Fecal samples

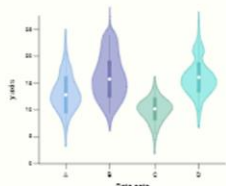
Dust samples collection

## Environment



Dust samples

Inductively coupled plasma mass spectrometry



According to indoor heavy metal pollution level divided slight pollution, moderate pollution, and heavy pollution groups



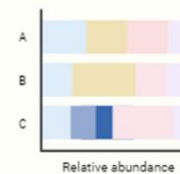
Heavy metals

Metagenomic sequencing

Redundancy analysis and XGboost

Environmental microorganism

Environmental microorganisms is an intermediate link in the impact of heavy metals on gut microbiota



The impact of heavy metals on environmental microorganisms

## Gut microbiota

Redundancy analysis and XGboost

The impact of heavy metals on gut microbiota

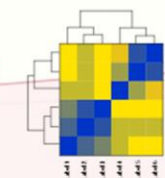


Gut microbiota

Relative Length Quadrant and Fourth-corner analysis

Weighted gene co-expression analysis

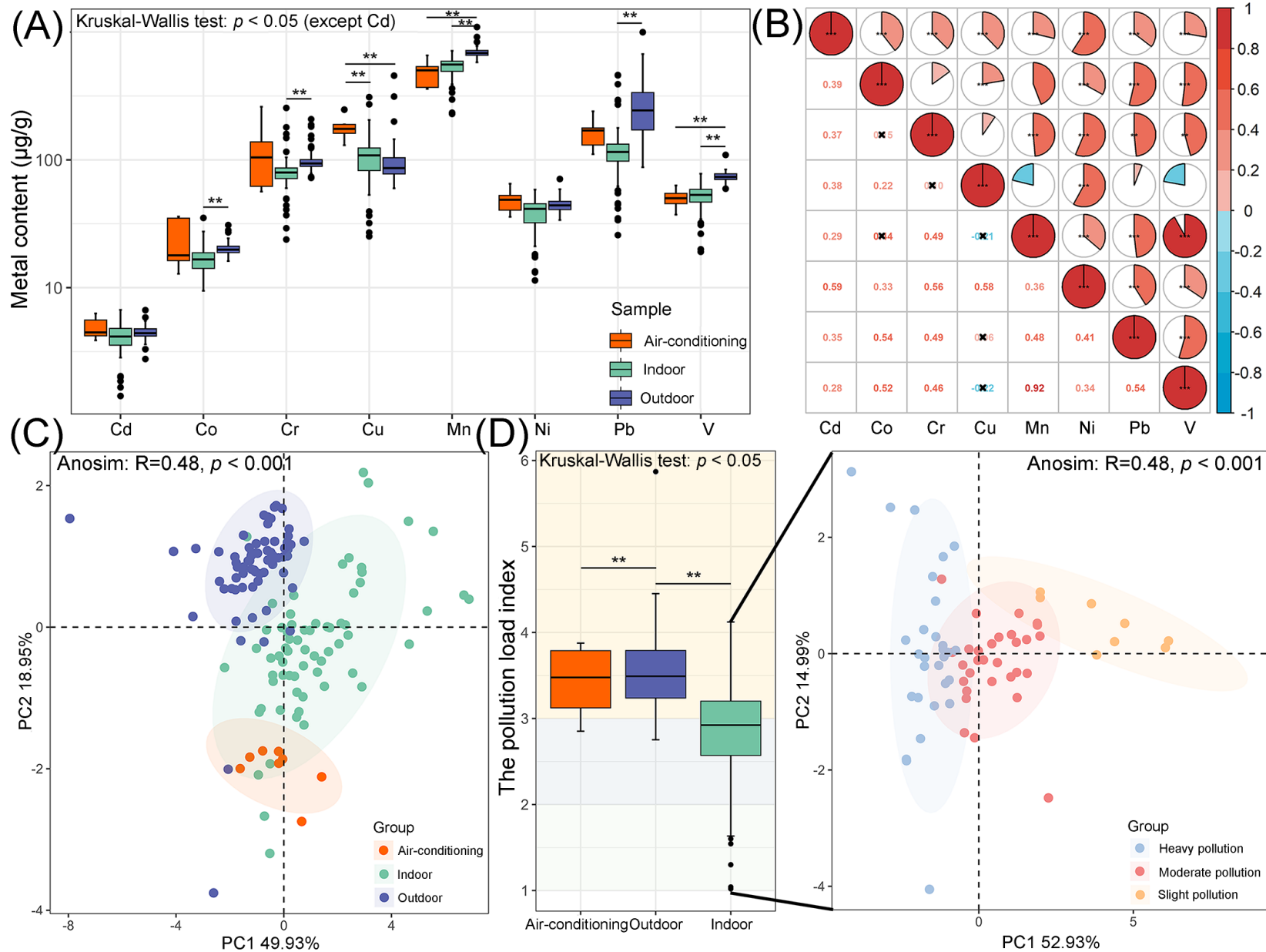
WGCNA explores the association between environmental microorganisms and gut microbiota



16S rRNA and Metagenomic sequencing

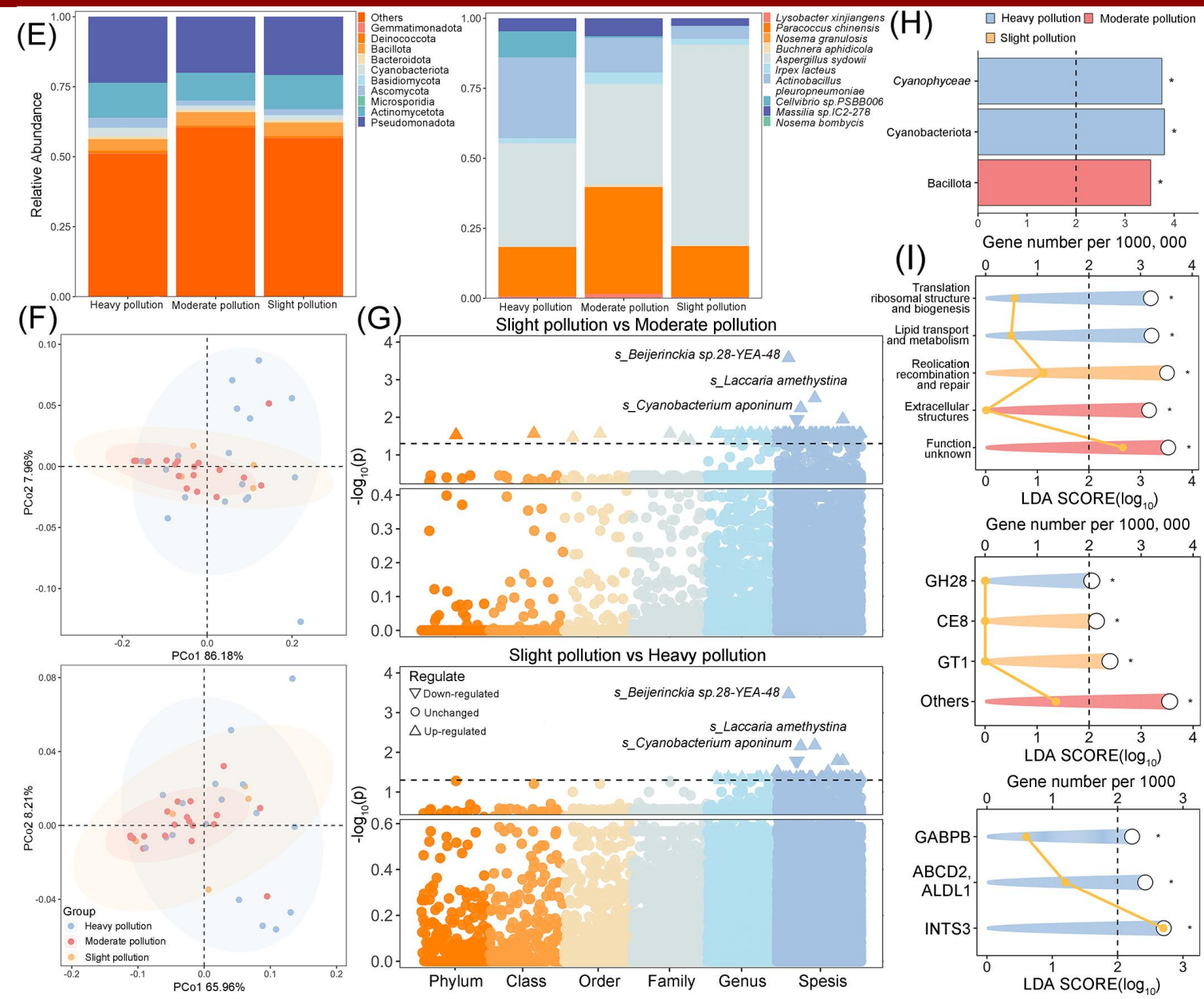


# Heavy metal pollution existed in classroom environment



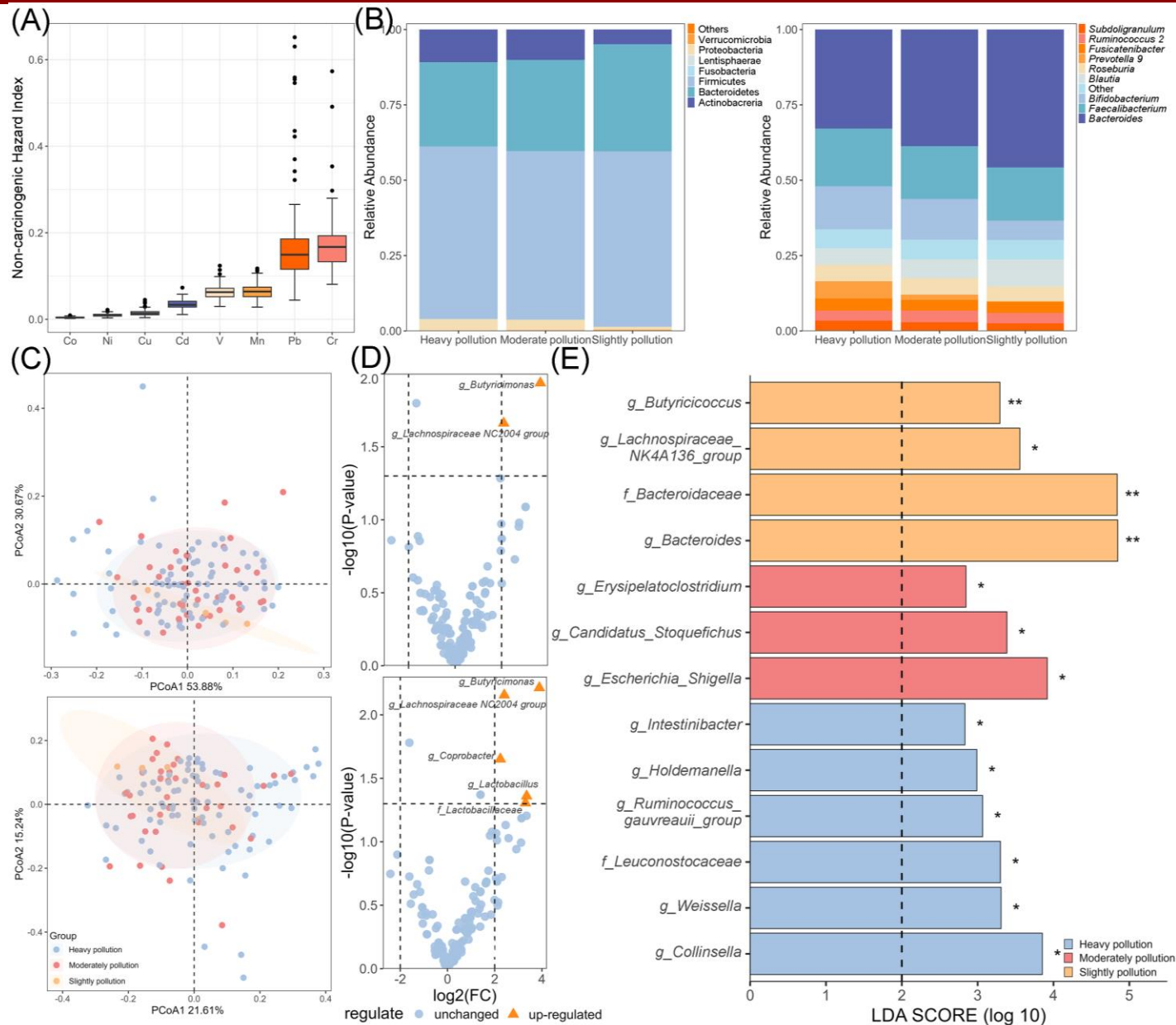
**Figure 1. Heavy metal and indoor microorganisms' distribution (part1)**

# Environmental microorganisms exhibited changes across varying pollution level



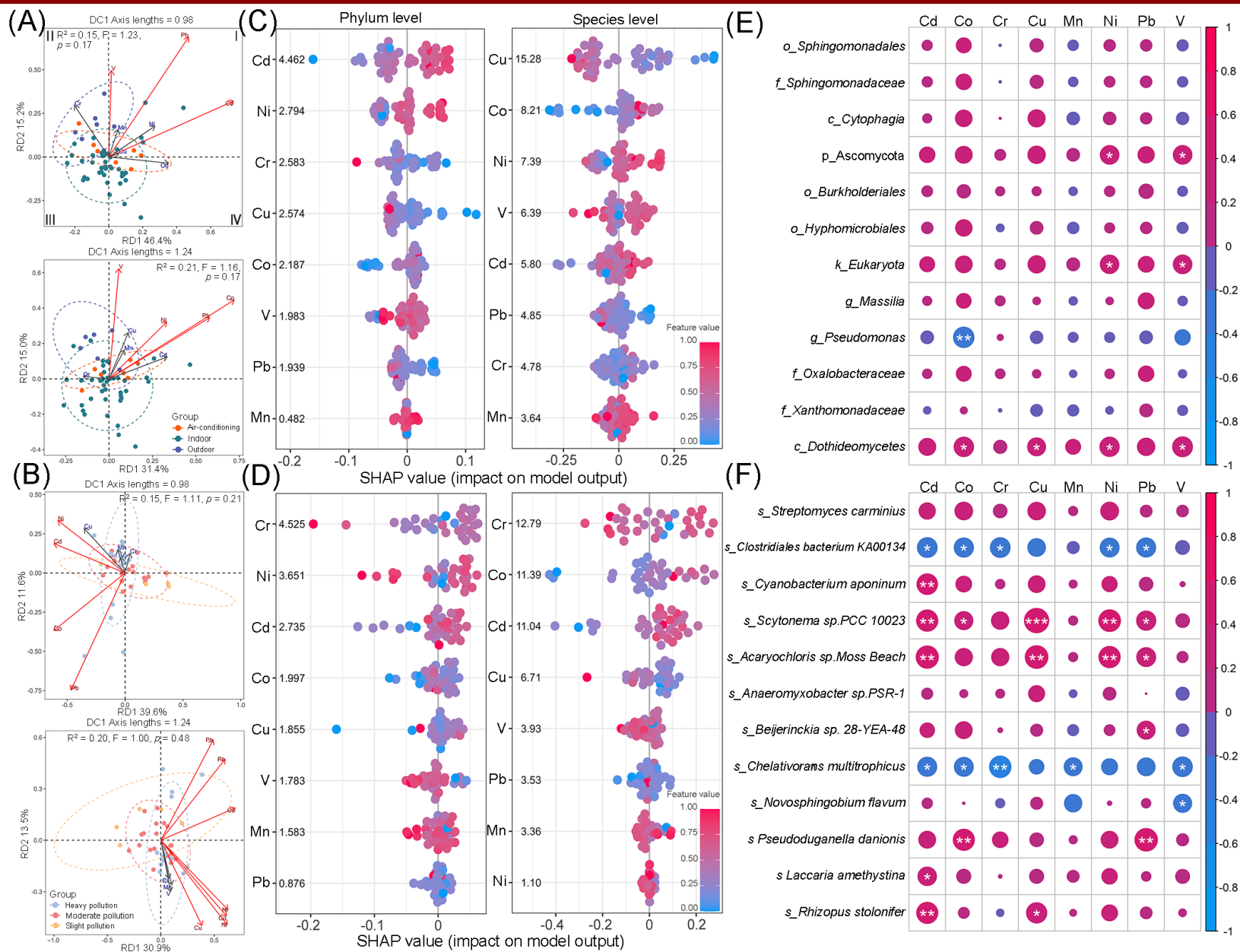
**Figure 1. Heavy metal and indoor microorganisms' distribution (part2)**

# Gut microbiota exhibited changes across varying pollution levels



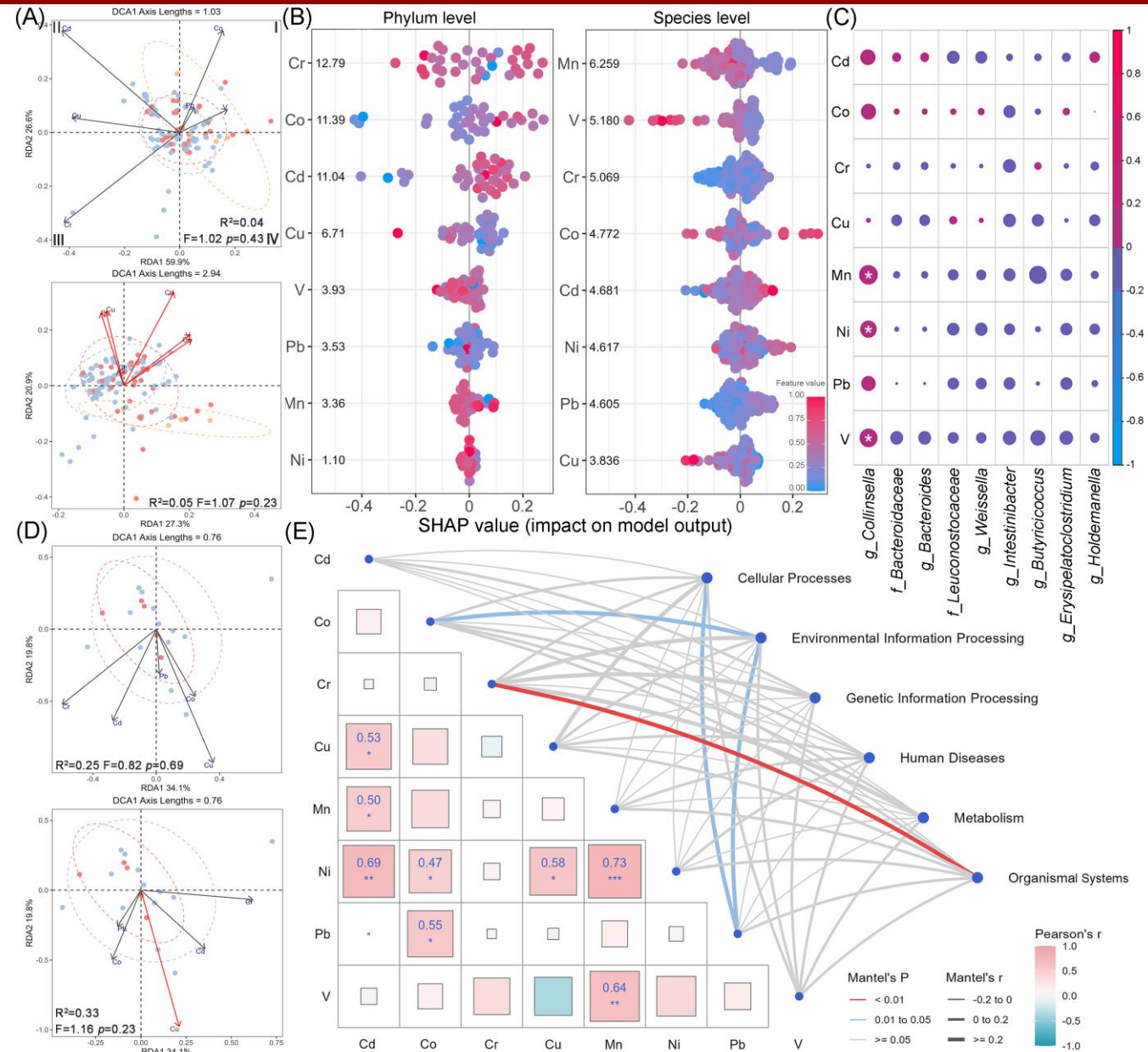
**Figure S8. Differences in gut microbiota among children exposed to different levels of pollution**

# Heavy metals affect environmental microorganisms' structure and diversity



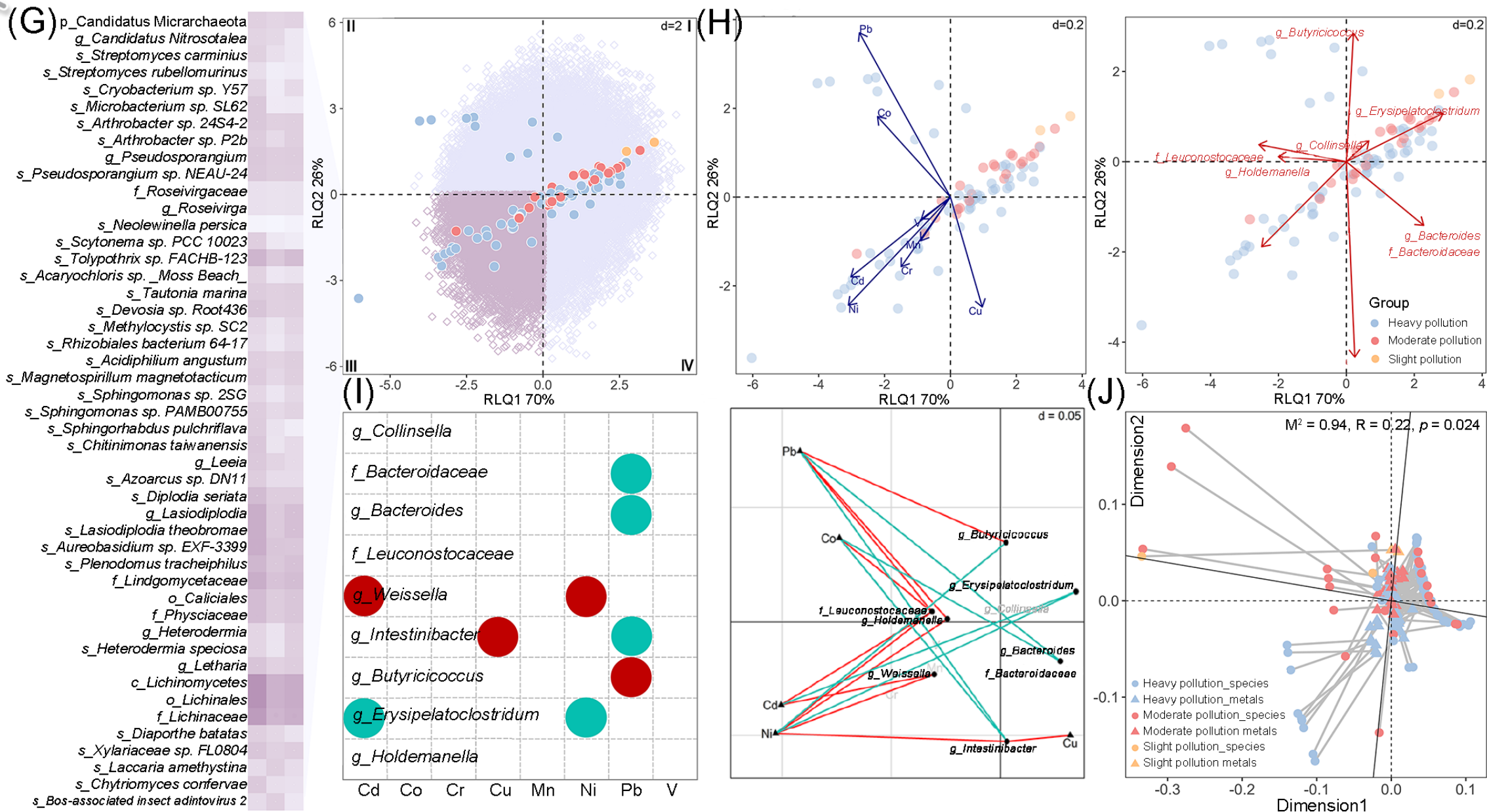
**Figure 2. The impact of heavy metals on environmental microorganisms and exposed children gut microbiota (part1)**

# Heavy metals affect gut microbial community structure and diversity



**Figure S11. The impact of heavy metals on gut microbiota and functions**

# Environmental microorganism was the mediator between heavy metals and gut microbiota



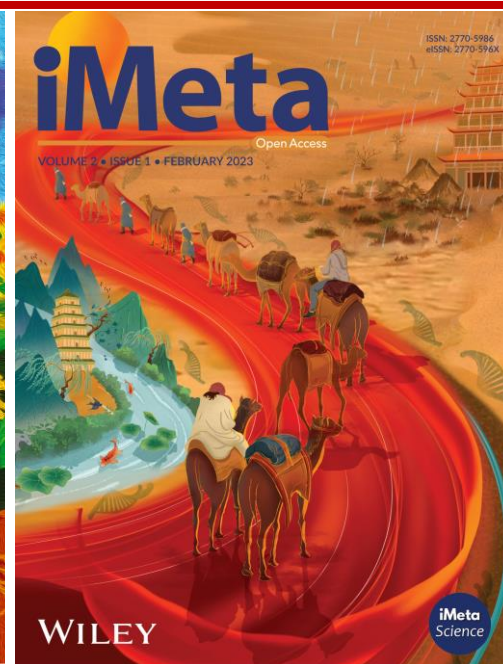
**Figure 2. The impact of heavy metals on environmental microorganisms and exposed children gut microbiota (part2)**



# Summary


- ❑ This study indicates the presence of heavy metal pollution in schools, and its significant impact on the structure of environmental microbial community;
- ❑ Pb and Cd were found to have pronounced effects on environmental microorganisms;
- ❑ Heavy metals and environmental microorganisms jointly affect the gut microbiota structure of exposed children, with environmental microorganisms playing a crucial intermediary role;
- ❑ Promoting healthy school construction is vital to establish and enhance monitoring systems for heavy metal pollution, raise environmental health awareness, and protect children's well-being.


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