

Empowering low-income communities to self-manage bedbug (*Cimex lectularius* and *Cimex hemipterus*) infestations by early detection and eradication: A health promotion campaign

[REDACTED]

Supervisor: Dr Thomas Hugh
Course code: GEYS4010
Group: D04

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Context of this final report

The project team will be applying for funding from the strategic partner, I.CARE. The structure of this report is adapted from the I.CARE Social Service Project Scheme 2020/21 funding application form. The aim of this written report is to get as close to the content that will appear in the actual application form while satisfying the requirements of the final report for the course GEYS4010 College Senior Seminar. The overall project consists of three parts: 1. Public education, 2. Policy brief, and 3. Research. After deliberation with I.CARE, the project team was advised to only focus on the public education component in the application form, thus only the public education component will be covered in this final report.

The project team

Table 1 shows the details of the project team members. The project team consists of local and international students from multidisciplinary backgrounds, including public health, chemistry and engineering. Members of the project team have had hands-on experience providing bedbug extermination services and education to low-income communities in collaboration with the CUHK Hong Kong Anti-Bed Bug Research Action Group, pest control companies, and non-government organizations (Table 2).

Relevant experience of the project team

The following describes 3 sites visits made by the project team to bedbug infested places during the planning of the project.

Site visit 1

Location: Home of bedbug victim in Wong Tai Sin district

Date of visit: 13/9/2020

Bedbug infestation severity: Very severe

Description: This case was referred to the project team by the Kwun Tong Methodist Social Service. The project team performed thorough inspection to identify the presence of bedbugs, collected live bedbug samples, assisted with decluttering, and provided education on self-applied integrated pest management (IPM) i.e. physical and chemical methods to eradicate bedbugs. The pesticide, Dustmitex, was provided by Tranquilaid Canada (Hong Kong) Limited. Collected bedbugs were delivered to the CUHK Hong Kong Anti-Bed Bug Research Action Group for their research. Table 3 shows some images taken during this site visit.

Site visit 2

Location: Caritas Hostel Hung Hom

Date of visit: 10/11/2020

Bedbug infestation severity: Mild

Description: This case was referred to the project team by the CUHK Hong Kong Anti-Bed Bug Research Action Group. Caritas Hostel provides residential services to ‘men in crisis’ i.e. men who are facing life difficulties including financial, marital, residential, etc. The crowded setting and high turnover of residents facilitates the spread of bedbugs. Hostel staff have hired pest control companies before but have failed to eradicate bedbugs, they utilised diatomaceous

earth (pesticide) which limited bedbugs from spreading from one bed to another by crawling. However, live bedbugs and eggs were discovered on the personal belongings of residents, they may still spread when residents share infested belongings. In addition to treating the environment using pesticides, the project team recommended the staff to eradicate bedbugs on personal belongings e.g. using a steamer, which was available at the hostel, to heat treat personal belongings, and implement policies to prevent incoming and outgoing residents from spreading bedbugs in the community via visual inspection and treating of infested belongings. Table 4 shows some images taken during this site visit.

Site visit 3

Location: Home of bedbug victim in Yuen Long district

Date of visit: 21/11/2020

Bedbug infestation severity: Mild

Description: This case was referred to the project team by the Kwun Tong Methodist Social Service. The project team handled this case similarly to the case from the first site visit. Table 5 shows some images taken during this site visit.

Background

Bedbugs in Hong Kong

Bedbugs (*Cimex lectularius* and *Cimex hemipterus*) are hematophagous nocturnal ectoparasites.¹ An adult bedbug is around 5mm in length, their small and flat shape allows them to hide in cracks in walls, furniture, and loose wallpaper.² Bedbugs are a “pest of significant public health importance” according to the United States Environmental Protection Agency (US EPA).³ A single inseminated female bedbug can start an infestation herself by laying eggs at a rate of 5-15 a day, and over 200-500 eggs in a lifetime.⁴ Bedbug infestations occur when their populations grow out of control resulting in adverse physical, psychosocial, and financial health effects to the host.^{1,4,5}

Physical health effects

Bedbug bites usually occur at night or when the host is otherwise still. The bites usually follow a linear pattern as bedbugs probe multiple sites for a blood vessel. The frequency the bites scale with the level of infestation. Bedbug bites usually cause 2-5mm itchy sores and occur on exposed skin such as the limbs or the neck, but excessive scratching may lead to secondary infections such as impetigo or ecthyma.⁵ Severe bedbug bites may result in bullous eruptions⁶ and excessive blood lost to bloodmeals may result in anaemia, children and elderly are especially vulnerable due to lower tolerance to blood loss.⁷ Bedbugs have the potential to transmit over 40 diseases including hepatitis B and yellow fever, however no outbreak has been reported so far.⁷⁻⁹ Nonetheless, bedbugs themselves are an infectious disease agent (Figure 1).

Psychosocial health effects

Many psychosocial disorders ranging from mild to severe are associated to bedbug infestations.¹⁰ Insomnia is common as the itchiness results in interrupted sleep, bedbug victims may avoid sleeping or going home to prevent bedbug bites. Bedbug victims may feel stressed from the financial burden of hiring exterminators and replacing infested items, and from the social stigma associated with having bedbugs, such as being poor or unhygienic. Social

isolation may result from their friends and families avoiding to meet them or visit their homes in fear of contracting bedbugs. To avoid being labelled as having bedbugs, victims may avoid seeking help, further worsening the bedbug infestation.^{5,10}

Financial burden of bedbug infestations

Depending on the severity, bedbug infestations are expensive to manage as they require hiring exterminators and replacing infested personal belongings and furniture. Even after extermination, bedbugs may return as they may have migrated to neighbouring housing units or be hidden in cracks in walls or clutter, requiring multiple treatments and making exterminations more expensive.^{2,8,11} Pesticide resistance also makes eradication difficult as existing pesticides become ineffective and require the use of new and usually more expensive pesticides.¹²

Bedbug situation in Hong Kong

The prevalence of bedbug infestations in Hong Kong is around 30%.¹³ Hong Kong is an international city, trading port, and has a high population density – this urban biome is ideal for the spread of bedbug infestations. The crowded and dilapidated living environments of many housing buildings in Hong Kong, such as caged homes or subdivided flats, facilitate the spread of bedbug infestations. Low-income households who occupy most of these dwellings are especially vulnerable due to their inability to afford hiring exterminators or replacing infested belongings. To avoid bedbug bites, bedbug victims may sleep in 24-hour fast-food restaurants.¹³

Significance of the project

Existing research and services for controlling bedbug infestations overwhelmingly focus on bedbug extermination. Such approaches are reactive, utilised after infestations occur; top-down, led by exterminators and other professionals; and often unaffordable to low-income households. There is a need for proactive services, focused on prevention rather than the treatment of bedbugs; bottom-up approach, focused on empowering multiple stakeholders from the individual to community levels; and affordable and effective strategy for bedbug early detection and eradication to minimise the expensive cost of its management.¹⁴⁻¹⁹

Summary of the project

The project aims to increase public knowledge on bedbug prevention and control by conducting a health promotion campaign aimed at low-income communities, hence reduce the occurrence of bedbug infestations in Hong Kong which disproportionately affects low-income communities. The key message of the health promotion campaign is the early identification and eradication of bedbug infestations. Thus, our education materials will be on the signs of bedbug infestations and the affordable and effective eradication methods via integrated pest management (IPM). The education materials will use a multimodal approach, it will include paper-based and online materials, live or online seminars, and going to infested places for inspections and provision of expert advice. We will collaborate with community agents including bedbug victims, social workers, and pest control companies to develop and deliver the content to our target audience. Our educational materials will be made freely accessible.

Schedule of the project

The project duration is 8 months and will occur between the 1st of December 2020 and end on the 31st of July 2021. Figure 2 shows the project timeline.

Contingency plan for COVID-19

The project team will abide by the public health measures for COVID-19 from the Hong Kong Government and CUHK. Depending on their recommendations, face-to-face activities will be postponed, and educational materials will be delivered online. Previous communication with the cooperating organisations suggests that online conferencing applications including Zoom and Skype are feasible platforms. Written materials and videos will be mobile compatible and may be distributed online.

Measurable outcomes of the project

The project is expected to increase the bedbug victims and building managers' knowledge on sign of bedbugs and self-management methods. This will be measured by self-reports and bedbug traps used to monitor the bedbug situation.

The project is expected to shift the services of pest control companies from reactive pest control to proactive public education. NGOs are also expected to become empowered deliver such public education. This will be measured by their pledge to provide public education on bedbugs, and any evidence of them organising and providing public education on bedbugs.

Protection of CUHK students

To protect CUHK students from COVID-19, if face-to-face activities are conducted, face mask, and hand sanitizers will be used. Social distancing will be maintained during the activities. For visit to known bedbug infested locations, full cover personal protective equipment (PPE) will be worn. Visual inspection and alcohol spray down will also be performed on personal belongings and clothing before leaving the site. Clean-dirty separation will be achieved by placing personal belongings in a plastic bag and tying it up securely before entering the infested area. The project team is aware of the risk of bedbug infestation in this project and are psychologically prepared to conduct the activities.

Limitations and remedies

As with any health promotion campaign or education, knowledge does not always translate into behaviour. The delivery of our educational materials will employ a multimodal approach, repetition, live demonstrations, and other techniques that increase the instructiveness of the delivery. Furthermore, the message of the campaign is kept simple, as with any good health promotion campaign, which revolves around the signs of bedbugs and self-management strategies. This message is repeated in all our educational materials. These techniques in delivery improve retention of the information, thus improve translation into behaviour.

Bedbug victims will be encouraged to discard the infected items. However, if discarded inappropriately, may lead to those infested items being in contact with someone else such as through rummaging. This hazard is covered in our educational materials, beneficiaries will learn how to safely discard infested items by tying them up securely in a garbage bag, labelling

them as being infested with bedbugs, and discarding in a secluded area (e.g. not in shopping mall, but in the building waste management system).

Sustainability and continuation

Sustainability and continuation of the project will be achieved in the following 3 ways:

1. Members of our project team have stated their interested to continue working on the bedbug issue in Hong Kong beyond the duration of the project, for their post-graduate research for example.
2. Our educational materials will be made freely available. Thus, the public education will continue either through the project team or any interested third-party organization (e.g. pest control company, NGOs).
3. Our project will result in one or more scientific publication in peer reviewed journals, which will inform policy and efforts to address the bedbug issue in Hong Kong, continuing the project effort.

Overall budget of the project

Table 6 shows the budget plan. The total requested amount is 7110HKD, it does not exceed the 20,000HKD limit of the funding scheme. All items in the budget plan are disposable and are for the protection of CUHK students and the production of the educational materials.

(1996 words)

Abbreviations used in this report

Abbreviation	Meaning
CUHK	The Chinese University of Hong Kong
IPM	Integrated pest management
NGO	Non-government organisation
PPE	Personal protective equipment

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Tables

Table 1: Details of the project team members

Name	SID	Major (BSc in)
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]

Table 2: Collaborating organisations

Organisation	Type of organisation
CUHK Hong Kong Anti-Bed Bug Research Action Group	University research group
Tranquilaid Canada (Hong Kong) Limited	Pest control company
Kwun Tong Methodist Social Service	Non-government organisation

Table 3: Images taken during site visit 1

	
<p>[REDACTED] in a full cover personal protective equipment.</p>	<p>[REDACTED] inspecting the site for signs of bedbugs.</p>
	
<p>[REDACTED] (far) collecting bedbugs. [REDACTED] (hand) holding two tubes of collected bedbugs.</p>	<p>[REDACTED] (left), [REDACTED] (middle), bedbug victim (right). The bedbug victim is holding Dustmitex pesticide provided by Tranquilaid.</p>

Table 4: Images taken during site visit 2



■■■■ (left) and ■■■■ (right) collecting bedbugs.



■■■■ performing visual inspection for bedbugs.



■■■■ ■■■■ ■■■■ ■■■■ (left) providing specific recommendations for bedbug management to hostel staff and manager (middle and right).



Live bedbug and eggs (green circle) found on a bible belonging to a resident at Caritas Hostel.

Table 5: Images taken during site visit 3

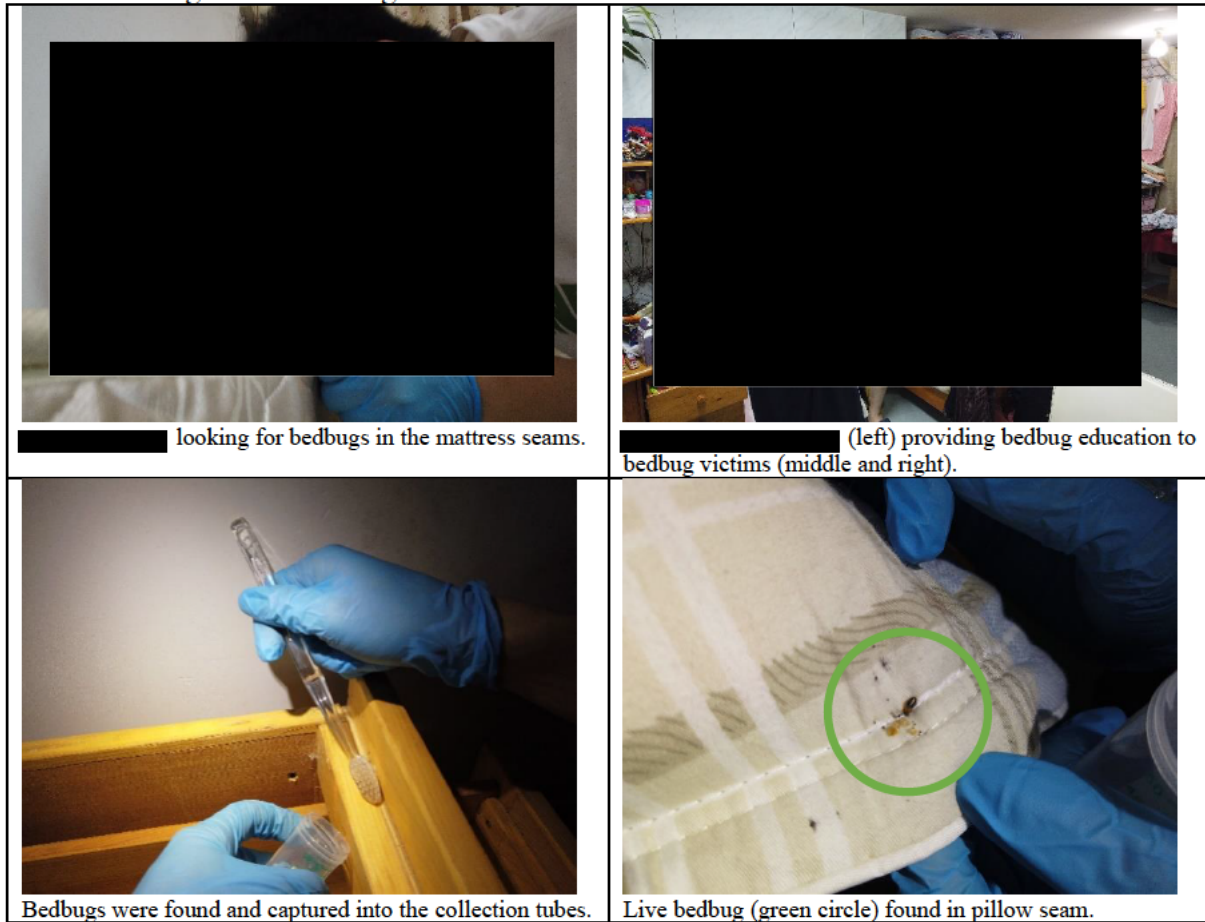


Table 6: Budget plan

Item	Unit	Unit Cost (HK\$)	Subtotal (HK\$)
Face mask	1	200	200
Full cover PPE	30	80	2400
Shoe cover (100 per unit)	1	100	100
Latex glove (100 per unit)	2	100	200
Rubbing alcohol (100ml)	2	80	160
Black plastic bag	50	1	50
Bedbug interceptors/traps	100	20	2000
Printing cost of printed educational materials	N/A	N/A	2000
Total			7110

Figures

Figure 1: Epidemiological triad for bedbug infestation

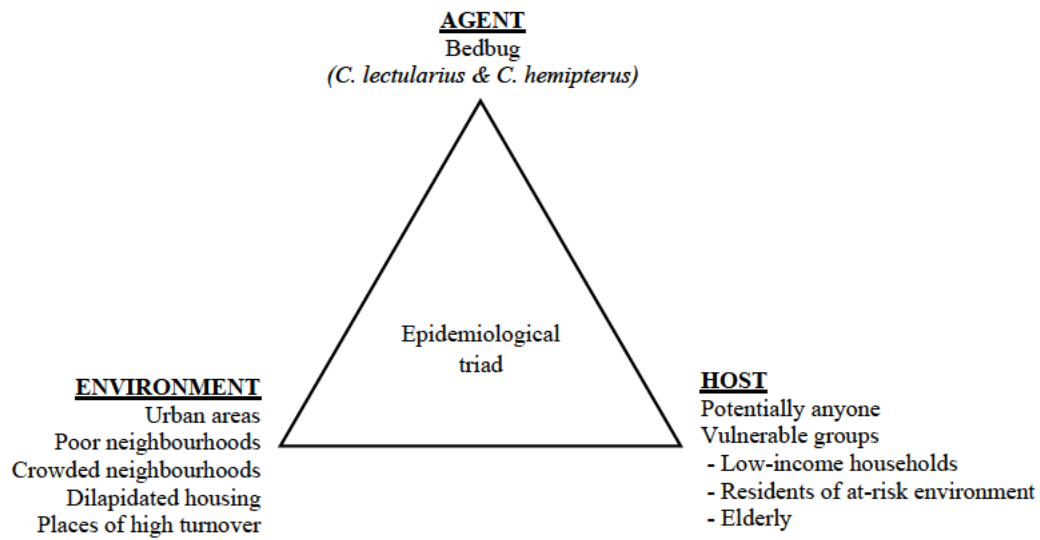


Figure 2: Project timeline

