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オセアニア島嶼地域における
生活習慣病 (non-communicable diseases: NCD) とその危険因子
—低中所得国の保健医療分野における新たな開発課題—

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1. Non-communicable diseases (NCD) — 保健医療分野の新たな開発課題

低中所得国では、経済発展に伴う生活環境・栄養状態の変化や、母子保健・感染症対策などの進展に伴い、1990 年代以降、心血管疾患をはじめとする生活習慣病 (non-communicable diseases: NCD) の問題が顕在化してきた。虚血性心疾患は世界の成人死因第 1 位であり、推定死亡者 730 万人の 8 割は、低中所得国における死亡である。低中所得国における NCD 増加によって、全世界の NCD 疾病負荷は、現在の 43 %から 2020 年には 60 %まで増加すると予測されている。2011 年には、国連ハイレベル会合、WHO 閣僚会合において NCD が取り上げられ、その対策は国際的課題となっている。

また、ミレニアム開発目標に続く国際的な保健医療分野イニシアティブとして、国連、WHO は、ユニバーサル・ヘルス・カバレッジ (universal health coverage: UHC) を推進しており、日本政府もそれを支援している。低中所得国において UHC を達成するには、従来からの母子保健・感染症対策のみならず、主要死因であり長期的ケアが必要とされる NCD 対策を充実させる必要がある。

しかし、多くの低中所得国においては、NCD の実態すら十分把握されておらず、予防対策や長期的診療体制は整っていない。加えて、低中所得国においては、周産期・幼少期の栄養不良などが、成人期に糖尿病などの NCD 発症リスクを増加させることも指摘されている。世界各地における NCD 危険因子の実態を調査するため、WHO は、比較的簡便で標準化された NCD 危険因子疫学調査 [WHO STEPwise approach to surveillance (STEPS)] を開発し、各国での実施を進めている。

2. オセアニア島嶼地域・パラオにおける NCD に関する状況

オセアニア島嶼地域には、肥満者がきわめて多く、NCD は主要死因となっている。2000 年代以降、STEPS 調査がオセアニア諸国でも順次行われるようになった。2010 年、NCD 健康非常事態宣言 (State of Health Emergency on NCD) が、太平洋島嶼地域保健担当官連合により出され、ミクロネシア諸国の行政長官・大統領、太平洋島嶼地域議員連合、ミクロネシア伝統首長協議会、およびミクロネシア諸国の最高裁判所長官によって承認された。

パラオはオセアニア西部の島嶼国で、2011 年 1 人当り所得 6,510 米ドルの中所得国である。総人口約 2 万人、うち約 1 万 3 千人がコロール地域に集中している。国内唯一の国立病院では、二次レベルの医療サービスが提供されている。国内各地に保健センターが 6 ヵ

所あり、地域住民に一次医療サービスを提供している。他に、コロール地域には、民間クリニックが3ヵ所ある。三次医療が必要な場合は国外に紹介するが、そのような患者の83 %が NCD 関連である。予防的保健サービスは米国から支援を受けていて、治療サービスは保健省予算から支出しており、保健省の医療費の 55 %が NCD 関連である。

平均寿命は 72 歳、死因の 74 % が NCD 関連であり、NCD 関連死亡者の約 4 割は 60 歳未満である。保健省の推定では、成人の約 80 %が BMI 25 以上の過体重、約半数が BMI 30 以上の肥満であり、肥満が多いのはパラオ人の遺伝的形質にも関係しているとされている。保健省は、肥満・NCD を重要課題と捉えており、食生活の変化、すなわち、低カロリー低脂質であるタロ芋などの伝統的食品を家庭で調理しなくなり、脂質の多い肉類缶詰などを多食し、野菜・果物を摂らないようになったことや、運動不足が、その要因と考えられている。2011 年、NCD 増加は国家の緊急事態であるとする大統領令も発令されたが、NCD の実態調査に基づいた、科学的で有効な対策を実施するには至っていなかった。

3. パラオにおける NCD 疫学調査

保健省と WHO は、2011～2013 年、25～64 歳のパラオ住民から無作為抽出した 2,200 人を対象として、STEPS 調査を実施した。調査は、基本的に WHO の標準調査方法に従って以下の 3 ステップに沿って行われたが、パラオの状況に適合させ、例えばビンロウの使用に関する質問を追加するなど、一部変更を加えた。

[ステップ 1] 構造化質問票による面接調査：質問内容は、年齢、教育、結婚状況、世帯構造、収入、食事の状況、飲酒、タバコおよびビンロウの使用、身体活動など。

[ステップ 2] 身体計測：身長、体重、腹囲、腰囲、血圧。

[ステップ 3] 血液検査：ポータブル測定器による、空腹時血糖、血中総コレステロール、HDL コレステロール、中性脂肪の測定。

加えて、保健省と筆者らの研究チームが協力して、2013 年、18～24 歳の住民に対する同様の調査を行った。2012 年の簡易国勢調査によると、18～24 歳住民の人口は 1,681 人であり、パラオ唯一の高等教育機関であるパラオ・コミュニティ・カレッジ (PCC) に在籍する 18～24 歳の学生は 473 人であった。調査対象者は、調査に自主的に協力してくれた人としたが、PCC 学生を中心に社会人も含め 356 人が参加した。上記 25～64 歳を対象とした STEPS 調査方法に沿って実施したが、若年層を対象とするため、野菜果物の摂取量はじめやや詳しい食事内容や、違法薬物使用、メンタルヘルスなどに関する質問を追加した。

4. パラオにおける NCD とその危険因子の状況

WHO・STEPS (25～64 歳対象) 調査対象者 2,171 人のうち、男性は 1,040 人、女性は 1,131 人で、平均年齢は 45.4 歳であった。教育水準は、44 %が高等教育を受けていたのに対し、16 %が初等教育のみであった。全員が、[ステップ 1] 面接調査と[ステップ 2] 身体計測に参加したが、うち 13 名 (3.7 %) は[ステップ 3] 血液検査に参加しなかった。空腹時血糖値測定のため、血液検査は翌日朝に行われており、勤務時間などの都合により 13 名が調査の全段階を完遂できなかったと考えられる。

表1に、調査結果を示した。25～64歳の平均BMIは、男性29.4kg/m^2、女性30.0 kg/m^2と男女とも極めて高く、肥満者 [BMI≥30 kg/m^2] は、男性40.6 %、女性45.8 %にのぼった。また、

高血圧 [収縮期血圧≥140 mmHg / 拡張期血圧≥90 mmHg または治療中] は、男性55.4 %、女性49.5 %と高く、45～64歳の中高年層では、男性65.6 %、女性63.5 %にのぼった。高血糖 [空腹時血糖値≥7.0 mmol/L (126 mg/dl)] の割合は、男性20.8 %、女性20.1 %と高く、また脂質異常症 [総コレステロール値≥5 mmol/L (193.4 mg/dl)] も、男性20.6 %、女性24.8 %と、極めて高かった。喫煙率は、男性24.5 %、女性9.6 %であったが、ビンロウを噛む習慣は、男性54.5 %、女性61.1 %と高く、そのうち、約85 %がビンロウとタバコを一緒に噛んでおり、その割合は、男性43.3 %、女性53.8 %に達していた。

18～24 歳を対象とした調査では、対象者の 48.9 % が肥満もしくは過体重 [BMI≥25 kg/m^2] であることが明らかになった。高血圧 [収縮期血圧≥140 mm Hg / 拡張期血圧≥90 mm Hg] は、対象者の 13.5 %、男性 21.2 %、女性 6.1 % であった。高血糖値 [空腹時血糖値≥126 mg/dl] を示した者は、3.5 % (12 名) であった。脂質異常症 [総コレステロール値≥200 mg/dL] は 20.9 % に認められ、7.6 %が高い中性脂肪値 [≥150 mg/dL]であった。喫煙率は 26.1 %で、周辺国と同等であったが、噛みタバコを含めたタバコ使用は 70.2 %と高かった。過去 30 日以内に飲酒した者は 51.1 %、野菜果物を殆ど摂取しない [<1 サービング/日] 者は 24.1 %であり、一日 5 サービング以上摂取している者は 9.2 %にすぎなかった。また、身体活動が殆どない者は 20 %に近いことがわかった。

表 1: パラオにおける NCD 危険因子疫学調査結果

	25～64 歳		18～24 歳	
	男性	女性	男性	女性
対象者数	1,040	1,131	174	182
BMI ≥ 25 kg/m2 (過体重・肥満)	75.6 %	76.3 %	46.7 %	50.8 %
BMI ≥ 30 kg/m2 (肥満)	40.6 %	45.8 %	20.1 %	22.9 %
収縮期血圧 ≥ 140 mmHg / 拡張期血圧 ≥ 90 mmHg	55.4 %	49.5 %	21.2 %	6.1 %
空腹時血糖値 ≥ 126 mg/dl (糖尿病域)	20.8 %	20.1 %	6.7 %	0.6 %
総コレステロール値 ≥ 5 mmol/L (193.4 mg/dl)	20.6 %	24.8 %		
総コレステロール値 ≥ 200 mg/dl			20.1 %	21.6 %
飲酒 (過去 30 日以内)	49.0 %	22.7 %	66.7 %	36.3 %
喫煙 (紙巻タバコなど)	24.5 %	9.6 %	40.8%	12.1 %
ビンロウ (ビンロウのみ、ビンロウ+タバコ)	54.5 %	61.1 %		
ビンロウ+タバコ	43.3 %	53.8 %	62.6 %	53.1 %
野菜・果物摂取量 <1 サービング/日			20.0 %	27.9 %
野菜摂取頻度	4.2 日/週	4.8 日/週		
果物摂取頻度	2.5 日/週	3.0 日/週		

5. パラオにおける NCD に関する社会的要因

パラオの人々のライフスタイルと社会的背景を調べ、NCD に関する社会的要因を明らかにするため、学識経験者・社会的リーダー8 名に対するキーインフォーマントインタビューと、グループインタビュー (8 グループ各 5 名) を実施した。グループインタビューは、コロール (都市) とアルコロン (村落) にて、地域、職業、宗教など偏らないよう参加者を

選び、年齢層別 (18～30 歳、31～45 歳、46～60 歳、61 歳以上) グループとした。健康・運動・食に関する伝統的価値観や実践、生活様式・食生活の変遷などについて、現地語で質的情報を収集し、英語に翻訳して解析した。

食生活面では、比較的高価な地元産の伝統的食品の利用が減り、より安価なコンビーフ缶詰などの輸入食品、酒類、ソーダ類などの嗜好品が、日常的な食事に多く消費されていた。また、伝統儀式では、量が多く脂肪分が多い食事が提供され、その食事を拒むことが難しいとわかった。缶詰や加工食品の多用はよくないと認識しているが、どのように対処すればよいかわからないとのことであった。

身体活動面では、かつては竹筏と竿を使った移動、漁労、農作業など身体的運動を伴う労働に従事していたが、現在は殆ど行っていないことが判明した。自動車をはじめとする先進技術の普及のほか、現金収入が増え、身体的運動を伴う作業に、主にフィリピン人・バングラデシュ人の外国人労働者を雇用するようになったためであった。

また、第二次世界大戦後の米国統治時代以降、伝統的リーダーが弱体化し、コミュニティ自体も結束力を弱め、コミュニティ成員が、自分や他人の子どもに対してかつてのように教育や躾をすることが難しくなっていることがわかった。

4. NCD 対策の課題・今後の展望

パラオでの疫学調査の結果、予想を超える NCD 危険因子の実態が明らかとなった。BMI 30 kg/m^2 以上の肥満は、成人で約半数、若年層で 2 割に及んでおり、高血圧は、成人で約半数、若年層で 14 %、糖尿病域の高血糖は、成人の 2 割、若年層の 4 %、高コレステロール血症は、2～3 割に達していた。また、ビンロウとタバコを一緒に噛む習慣があること、野菜果物をあまり摂取しないこと、身体活動が乏しいことなども明らかとなった。

質的調査では、安価で便利な缶詰などを多用していることや、身体活動が少ないといった問題点が明らかとなった。食生活に問題があると自覚していても対処方法がわからないことや、コミュニティの弱体化によって、健康に関する知識･情報の普及や実践が困難になっていることも示された。

NCDは保健医療の課題ではあるが、医療費増大のように経済的インパクトも大きい。NCD 危険因子は、生活習慣や文化慣習と密接に関連しており、社会文化的に受け入れられる対策が必要とされる。今後は、保健省はじめパラオ政府や地域コミュニティと協力し、調査結果に基づいて、社会的文化的に適正で有効な戦略・対策を策定する必要がある。

まず、大統領、議員、政府職員、学校の教師、伝統的リーダーなど、指導的立場にある人々に、調査結果とその重大性を十分理解してもらう必要がある。米国の援助が大きいため輸入食品規制は容易でないであろうが、野菜の流通を増やしたり、街の構造を歩きやすくしたりするなどの政策を実施していくべきである。学校や地域では、NCD の重大さと NCD リスクを減らすための具体的実践方法を教育する必要がある。

生活習慣改善に一人で取り組むのは難しいので、地域コミュニティでグループを作り助け合いながら取り組むのが望ましい。以前より弱体化したとはいえ、パラオにはなお伝統とコミュニティの結束が強く残っている。生活習慣改善に協力して取り組むことにより、コミュニティの結束力を再び活性化させる効果も期待される。地域社会の文化を尊重する戦略は、他の低中所得国が NCD 対策を策定するときの参考になるであろう。

Profile of Non-communicable Disease (NCD) Risk Factors among Young People in Palau

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ABSTRACT

Background: Although non-communicable diseases (NCDs) have become the predominant health problems of Palauan society, there was no comprehensive data of NCD risk factors available to develop effective control strategies. The first Palauan national STEPwise approach to risk factor Surveillance (STEPS) was, therefore, completed in mid-2013 to provide information for its adult population aged 25 to 64 years. This study aims at obtaining the data from the younger adults aged 18 to 24 years, which remained yet to be surveyed.

Methods: We conducted an epidemiological study, targeting the 18-24 age group. A survey station and a mobile team were established to recruit voluntary participants dwelling in Koror. A slightly modified WHO STEPS instrument was used, including a structured questionnaire for behavioral risk factors, physical measurements and blood tests.

Results: A total of 356 young people had been recruited during the survey. In both sexes, nearly half of the participants were overweight/obesity. The prevalence of hypertension was higher in men than that in women (17.6% vs. 1.7%). Raised blood glucose and impaired fasting glucose were observed in 3.5% and 5.2% of the total participants, respectively. About 36% of the subjects were observed as raised levels of total cholesterol. More than 70% of the young people were current tobacco users in terms of all kinds of tobacco products.

Conclusions: The current survey, for the first time, revealed a high prevalence of NCD risk factors, especially of overweight/obesity and tobacco use among young people in Palau. It

20 indicates that swift measures against NCDs are required even from the young age group.

21

22 **Key words**: Non-communicable disease, WHO STEPS, obesity, tobacco use, Pacific islanders

INTRODUCTION

Over the past decade, the increasing burden of non-communicable diseases (NCDs) in Palau has been recognized as a serious public health threat. As early as the 1970s, notable shifts in dietary patterns and lifestyle changes often associated with NCDs were already reported.[1-3] In 2011, the national mortality data showed that four leading causes contributed to more than two thirds of all deaths, namely cardiovascular disease (24.3%), cancer (21.4%), chronic respiratory disease (12.7%) and diabetes (9.8%),[4] indicating that NCDs are the predominant health problems of the islanders.

Several population-based surveys for adult NCD risk factors have been conducted, *i.e.* the Palau Community Health Assessment (PCHA) completed in 2003, and the behavioral risk factor surveillance system (BRFSS) initially piloted in 2010, conducted in 2012, and presently adopted as an annual surveillance tool. Although information on various NCD related behavioral risk factors were collected from PCHA and BRFSS, physical and biochemical measurements were not included. Accordingly, the Palauan Ministry of Health collaborated with the World Health Organization (WHO) to launch the first comprehensive nationwide survey, *i.e.* STEPwise approach to risk factor Surveillance (STEPS), in late 2011 and completed the entire data collection in mid-2013.

The WHO STEPS approach has been developed as a simple and standardized method, which can be implemented in all countries to monitor NCD risk factors. Using the same standardized

42 questions and protocols to collect small amounts of useful information, makes it possible not
43 only to observe within-country trends but also to make comparisons across countries. Its
44 sufficiently flexible framework allows each country to expand on the core modules, and to
45 incorporate optional modules to meet local and regional interests. For low and middle income
46 countries, the WHO STEPS offers an entry point to begin NCD surveillance activities, and
47 helps them develop the capacity of their surveillance systems.[5-6]

48 In Palau, the national STEPS survey was targeted at all adult residents aged 25 to 64 years.
49 However, the younger adults aged 18 to 24 years were not its targeted population. This young
50 age group was also not included in various school health surveys conducted in Palau, and
51 therefore this study was carried out to investigate major NCD risk factors among the young
52 people of 18-24 years of age.

53

54 **METHODS**

55 The STEPS instrument includes three levels, or 'Steps', and within each level, risk factor
56 assessment is divided into core, expanded and optional items. The Palauan national STEPS
57 covered the core and expanded items of three Steps for eight major behavioral and biological
58 risk factors, *i.e.* tobacco use, harmful alcohol consumption, unhealthy diet, physical inactivity,
59 overweight and obesity, raised blood pressure, raised blood glucose, and abnormal blood lipids.
60 As given below, we slightly modified the STEPS instrument to fit the characteristics of the

young people population and other specific interests and needs in Palau for the current study.

Step 1: questionnaire-based assessment

In addition to basic socio-economic information and all standard modules for self-report behavioral measurements, extra questions were added to assess mental health, sleep habits and illicit drug use. Moreover, adaptations were made to the standard modules of the STEPS to address specific health priorities and concerns in Palau. For example, findings from PCHA 2003 showed that over half (58.4%) Palauan adults were betel nut chewers, and the majority of those individuals (84.3%) chewed with tobacco. Questions about betel nut use and betel nut with tobacco were added to the tobacco use module accordingly. The module of dietary behaviors for Palauan national STEPS merely included the consumption of fruits, vegetables, and fats and oils. In order to overview the nutritional status of the public, we posed questions about the consumption of meat, fish, dairy products, processed/canned foods, and sugar-sweetened beverages.

Step 2: physical measurements

This Step included measurements of weight and height, waist and hip circumferences, and blood pressure. The anthropometric examination was performed without shoes and any heavy clothing. Before measuring blood pressure, participants were asked to sit quietly for about 5

80 minutes and place their elbows on the table so that the cuff is the level with their hearts. Each
81 participant's blood pressure measurement was taken three times in the upper arm by using
82 automatic digital blood pressure monitors (Omron HEM-7200). The three readings of blood
83 pressure were recorded, and the arithmetic mean of the second and third readings was used for
84 the analysis.
85
86 Step 3: biochemical measurements
87 Capillary whole blood sample were drawn using the fingertip lancing technique, immediately
88 followed by biochemical tests conducted on portable devices. We adopted ACCU-CHEK Aviva
89 blood glucose meter (Roche Diagnostics K.K., Japan) for measuring fasting blood glucose
90 levels, and POCket Lipid (Techno Medica Co., Ltd., Japan) for blood lipids. In addition to total
91 cholesterol and fasting triglycerides, HDL-cholesterol was measured, and LDL-cholesterol was
92 calculated via Friedwald Equation in the Step 3.
93
94 *Study population and the setting*
95 We referred to data from the Palau Mini-Census 2012 for the study design, because the latest
96 population and housing censuses of Palau, carried out in 2005, might not be able to accurately
97 reflect the current population composition. The national population between 18 and 24 years
98 old was reported as 1,681 (793 females and 888 males), and more than 80% of this age group

99 reside in Koror, the most populated urban area in the country. Thus, we defined the study
100 population as adults 18-24 years living in Koror, and roughly half of the total population within
101 this age group, 600, was expected and considered as the feasible sample size for our study. We
102 established a survey station at Palau Community College (PCC), located in the center of Koror
103 to provide superior geographical access to all potential participants. In addition, PCC is the only
104 institution for college-level education in Palau, and the single organization which contains the
105 most members of the target age group (473 students). In order to reach as many potential
106 participants as possible, we had also dispatched a mobile survey team to a few local
107 communities and major employers in Koror.
108
109 *Staff training*
110 A total of 8 staff members of the Ministry of Health joined our study team. Six of them were
111 trained as interviewers for the Step 1 and the staff of physical measurements for the Step 2. As
112 well as role-playing interviews between staff members, we recruited a few voluntary students
113 from PCC as interviewees of the questionnaire pretest. According to the feedback from the staff
114 during the training, the questionnaire was revised a number of times. In the end of the training,
115 all of the staff members were confirmed to be able to confidently complete the questionnaire-
116 based interview in English within 35 minutes. For the biochemical measurements (Step 3), the
117 other two members, who have plenty of experience on blood tests with the Palauan national

118 STEPS, were trained to be in charge of the biochemical station. Because all of the biochemical
119 devices and their reagents were purchased from Japan, we translated the manuals into English
120 for the instruction. Under the supervision, these two members repeated calibration, sample
121 loading, result reading, and error shooting on the devices until they could handle the operations
122 independently.
123
124 *Participant recruitment and informed consent*
125 Before the study began, this research project was reported in the local press, Island Times,
126 describing the aims and the importance of monitoring the risk factors of NCDs. Promotion and
127 recruitment fliers were distributed to all faculties of PCC and posted up on the periodical, PCC
128 Newsletter, and bulletin boards throughout the campus before and during the survey. Outside
129 the campus, information was accessible through public and private informational boards,
130 government offices in Koror, as well as all popular online social networking groups. The
131 recruitment lasted for a period of one month from the beginning of October, 2013. A prepaid
132 cell phone card to the value of ten dollars was given as an incentive measure for voluntary
133 participation in this survey.
134 New participants of the survey were asked to go to the interview room first (Step 1). Prior
135 to the interviews, adequate explanations of the purpose and the procedures of the study were
136 given from the staff, and written consent forms were obtained from each of the entrants. After

137 the face-to-face interviews, participants were directed to the room for physical measurements
138 (Step 2). Following previous two Steps, all participants were instructed to fast overnight starting
139 at 8 pm and return the next morning to complete biochemical measurements (Step 3). Those
140 who failed to return next morning for the final step were reminded via the given phone numbers
141 or emails.
142
143 *Data entry*
144 The data entry was conducted by using the standard software, EpiData Entry 3.1. A
145 programmed data entry template was developed and pretested by technical staff of the Ministry
146 of Health, and the accuracy of the data entry was verified using a double-entry method.
147
148 *Data analysis*
149 We categorized all continuous readings taken from both physical and biochemical
150 measurements according to well-defined standards (see Table 2). Body mass index (BMI) was
151 calculated as weight in kilograms divided by height in meters squared, and then grouped as
152 underweight, normal weight, overweight and obese, by applying the WHO criteria.
153 Hypertension was defined as systolic blood pressure ≥140 mmHg, diastolic blood pressure ≥90
154 mmHg, or use of antihypertensive medication, based on the Seventh Report of the Joint
155 National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood

Pressure (JNC 7).[7] According to WHO 2006 criteria, fasting blood glucose levels were classified into three groups as normal (<110 mg/dL), impaired fasting glucose: IFG (110-125 mg/dL) and diabetes mellitus (≥126 mg/dL).[8] Fasting glucose levels were also categorized using American Diabetes Association (ADA) criteria with a lower cutoff value of 100 mg/dL for normal, and 100-125 mg/dL for prediabetes. The classification of blood lipids was performed using the cutoffs, as in the following, presented by the Third Report of the National Cholesterol Education Program Expert Panel on Detection, Education, and Treatment of High Blood Cholesterol in Adults (NCEP ATP III).[9] Categories for triglyceride levels were normal (<150 mg/dL), borderline-high (150-199 mg/dL) and high (≥200 mg/dL). For total cholesterol levels, desirable (<200 mg/dL), borderline-high (200-239 mg/dL) and high (≥240 mg/dL) were adopted. As for HDL-cholesterol, low (<40 mg/dL) and high (≥60 mg/dL) levels were defined. Because the portable device employed in our survey had a lower limit of detection of 50 mg/dL for triglycerides, assays below the limit were assigned a value of 50 mg/dL for subsequent analyses. We conducted all data analyses using the statistical software, IBM SPSS Statistics 21.

Ethical considerations

This study was reviewed and approved by the Bioethics Review Committee of Nagoya University School of Medicine and Institutional Review Board of the Ministry of Health, Republic of Palau. Written informed consent was obtained from all of the participants after

175 adequate explanations of the study.

176

177 **RESULTS**

178 A total of 356 adults between 18 and 24 years, with a mean age of 20.2 years, voluntarily
179 participated in the survey. Although all participants completed the questionnaire-based
180 interviews and physical measurements, 13 of them (3.7%) failed to come back for the
181 biochemical measurements. The majority (n=268) of the participants were PCC students, and
182 46 entrants to the survey (12.9%) were non-Palauan nationals. Pregnancies were reported from
183 two females, and consequently their biological data were excluded from the analyses for this
184 paper. Across the survey, distinct gender differences in participation were not observed.

185 Table 2 displays the percentages of biological indicators classified by appropriate criteria. In
186 both sexes, nearly half of the participants were found to be overweight or obese. About one in
187 six male subjects was hypertensive. The prevalence of hypertension was much higher in males
188 than in their female counterparts (17.6% vs. 1.7%: $P < 0.001$). Among the normotensive young
189 people, one male reported his antihypertensive use during the past two weeks. According to the
190 WHO criteria, 3.5% and 5.2% of the total participants showed fasting blood glucose levels of
191 diabetes mellitus and IFG, respectively; however, prevalence of prediabetes by ADA was 24.2%.
192 Of the 340 valid subjects, 20.9% had borderline-high or high total cholesterol levels (≥200
193 mg/dL). If the WHO recommended classification (≥190 mg/dL) was adopted, 123 (36.2%)

young people had raised levels of total cholesterol. Borderline-high or high level of triglycerides (≥150 mg/dL) was 7.6%, and low level of HDL-cholesterol was 1.2%.

Approximately 40% of male and 12% of female respondents answered that they currently smoke cigarettes (Table 1). As regards the use of all kinds of tobacco products, 80% males and 61% females were current tobacco users at the time of the survey. A quarter of the participants did not eat fresh fruit and vegetables at least one serving a day. It was only 9.2% that they ate 5 servings of fresh fruit and vegetables or more per day, a WHO recommended lower limit. About 8% of the young population responded that they did not have any vigorous- or moderate-intensity physical activities, including activities at work, traveling to and from places and recreational activities in their daily life.

DISCUSSION

This is the first comprehensive survey for NCD risk factors, targeting the young age group of 18-24 years in Palau. Not only the information on behavioral risk factors collected via questionnaire-based interviews but also the biological data taken from physical measurements and blood tests can provide the baseline data for the population burdened with NCDs.

Our findings revealed an alarming high prevalence of overweight/obesity in both male and female subjects of the survey. The percentage was even higher than the statistics reported from a previous national NCD STEPS carried out in another Micronesian country, the Marshall

213 Islands.[10] As compared with that survey, in which 23.9% of the age group of 15-24 years was
214 overweight and 10.6% was obese, Palau might have a double percentage of obesity (BMI ≥30
215 kg/m^2) in the young people. Given that Palau and the Marshall Islands are at the same income
216 level, upper middle income, further studies to investigate the potential related risk factors in
217 lifestyle of these two populations could provide useful clues for NCD prevention and control
218 in this region. With regard to the prevalence of hypertension, male subjects were higher than
219 females (17.6% vs. 1.7%). Such distinct gender difference has not been reported from other
220 previous surveys, *e.g.* that in the Marshall Islands (15-24 years, 2.2% vs. 1.7%) or in the USA
221 (20-34 years, 5.8% vs. 3.9%).[11] Interpretation of this result might require further analysis or
222 additional studies on this specific age group. The prevalence of raised blood pressure, raised
223 blood glucose or abnormal blood lipids was not as high as that of overweight/obesity. This
224 might be due to the young age of the participants; however, as they become middle-aged, the
225 problems connected with these risk factors are expected to gradually begin coming to light. The
226 most pressing need for this young age group is, therefore, to have effective public health
227 interventions in body weight control or further obesity prevention.

228 Among behavioral risk factors for the young people, tobacco use is the most obvious and
229 serious problem based on our findings. The proportion of cigarette-smoking in the current
230 survey was almost at the same level with that in the Marshall Islands or in Japan,[12] of which
231 22.7% (40.8% of males and 4.5% of females) in the group aged 15-24 and 24.5% (39.2% of

232 males and 12.8% of females) in the group aged 20-29, respectively, were reported as current
233 smokers. However, if we took account of all types of tobaccos, including smoking and chewing,
234 Palau had an extremely high proportion (70.2%) of tobacco use. Betel nut chewing, a local
235 custom in Palauan society, accounts for the high proportion, because almost all of the young
236 chewers (96.3%) added tobacco to their betel nuts. Thus, to deal with the high rate of tobacco
237 use in Palau, which was rarely observed in other countries of the region, a higher priority should
238 be attached to targeting the population of betel nut chewers. With regard to the other behavioral
239 risk factors, *i.e.* excessive alcohol drinking, infrequent consumption of fresh fruit and
240 vegetables and physical inactivity, subsequent analyses of the association with biological risk
241 factors are required to examine their impacts on the population's health status.

242 The young people aged 18 to 24 years old are the population always omitted from most of
243 the surveys in Pacific island countries, despite many of the NCD risk factors might be
244 manifested in the young stage of life. By targeting at the young age group of adults, our study
245 might provide comparative information for the authorities to combat NCDs in the region. In
246 Palau, there is no continuous health monitoring system, such as a regular health checkup in the
247 college or workplaces, available for adults. Hence, our survey also made the first attempt to
248 introduce a health checkup system into PCC, the only college-level educational institution in
249 this country. Based on the high turnout (57% of PCC students) in this survey, a regular health
250 checkup system with the WHO STEPS instrument was considered feasible in the college