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Early-life antibiotic exposure, gut microbiome, and colonization resistance

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ABSTRACT

Antibiotics are chemical compounds that inhibit the growth of microorganisms to fight bacterial infections and, therefore, have been a central pillar of modern medicine. In recent years, there has been increasing awareness of the rising rate of their global consumption, especially in younger age groups. Exposure to antibiotics could happen not only during the first few months of newborns, but also indirectly through maternal consumption during pregnancy as well as during delivery. Indeed, epidemiological findings and meta-analyses have confirmed the association between early antibiotic exposures and risks for allergenic diseases and obesity. Recent gut microbiome studies have provided mechanistic evidence supporting the role of antibiotic-induced dysbiotic gut microbiota in developing those diseases. However, no mechanistic evidence is available to convince restorative powers of breastfeeding on the disrupted gut microbiome and intestinal barrier function following antibiotic exposures in early-life. To address the fundamental questions related to complex traits of both exposure to antibiotic and breastfeeding's impacts in early-life, new experimental models are needed to differentiate short- and long-term effects of prenatal vs early postnatal exposure to antibiotics on gut microbiome and resistome (i.e., the collection of antibiotic resistance genes) of newborns.

Keywords: *gut microbiota, antibiotic exposure*

Introduction

Antibiotics, anti-infective agents, first discovered in the early twentieth century, have been widely applied in modern medicine and their global consumption has increased markedly over time [1]. In recent years, there has been increasing awareness of the rising rate of their global consumption, especially in younger age groups [2]. Antibiotics are commonly prescribed to children during respiratory tract and urinary tract infections [3-5]. Penicillins, cephalosporins, and macrolides are the antibiotic compounds commonly dispensed to children [6]. A study reported that broad-spectrum antibiotics, especially third-generation cephalosporins, are frequently prescribed for children in Eastern and Southern Europe, Asia, North America, and Latin America [7]. Another overlooked source of early-life antibiotic exposure is their administration to the mother during pregnancy or at birth [8]. Antibiotic exposure in early-life has been associated with later development of allergic conditions and obesity in childhood with positive associations confirmed by meta-analyses [9-11], although published evidence is not entirely consistent.

In recent years, gut microbiome studies have provided mechanistic evidence supporting the role of antibiotic-induced dysregulation of gut microbiota (termed dysbiosis) in developing those diseases [12]. An additional concern is the potential emergence of antibiotic resistance in the gut microbiome of newborns, following exposures to antibiotics in early-life [13]. Pregnancy is a critical period usually characterized by concurrent changes of endocrine, metabolic and immune functions intended to support the normal growth and development of the fetus [14]. During pregnancy, the maternal microbiota mainly vaginal and intestinal microbiota undergo drastic changes [15]. Maternal antibiotic use during pregnancy is known to affect the vaginal microbiota and, consequently, could hamper the vertical transfer of microbes to newborns during delivery [16]. Maternal microbiota during gestation plays a significant role in programming the future immune system of the offspring [17]. Although WHO and UNICEF have established recommendations to exclusively breastfeed newborns until their 6-month of age [18, 19], the decision of every mother is mainly influenced by economic, environmental, social, and political factors.

Current challenges and future directions

To address the fundamental questions related to complex traits of both exposure to antibiotic and breastfeeding's impacts in early-life, new experimental models are needed to differentiate short- and long-term effects of prenatal vs early postnatal exposure to antibiotics on gut microbiome and resistome (i.e., the collection of antibiotic resistance genes) of newborns. This knowledge will fill current gaps and contribute to develop a framework for antibiotic stewardship in perinatal and neonatal care. Importantly, breastfeeding itself and/or microbial biomarkers related to breastfeeding are of potential future interventions and policy implementation in infants in order to maintain a healthy gut microbiota development. We posit that microbiome sequencing efforts will contribute to potential selection of biomarkers that may be used in future interventions and will contribute to mechanistic understanding by highlighting potential mechanisms of how maternal breast milk restores gut microbiota and intestinal barrier functions in newborns under the pressure of antibiotics.

In addition to birth mode and neonatal diet, others and we have confirmed that early-life exposure to antibiotic has a profound impact on the composition and functions of the gut microbiota [20-22]. Animal experimental studies focused in early-life are providing a growing body of evidence that early antibiotic exposure leads to gut dysbiosis, and subsequent impairments in metabolic and immune functions as well as behavior [23-32]. Several human studies have reported a reduced abundance of *Bifidobacteria* and an increased *Enterobacteriaceae* in neonates who exposed antibiotics in early-life [20, 33-35]. Among them, some studies have indicated that the dysbiotic gut microbiota cannot fully recover months after cessation of antibiotic treatment. Furthermore, a single dose of antibiotics during birth, known as intrapartum antibiotic prophylaxis (IAP), often used in caesarean section, can significantly alter the infant gut microbiota and this effect has been shown to persist until at least three months of age [20].

A serious consequence of antibiotic-induced alternations in gut microbiome is the emergence of resistome and its links to colonization resistance against multidrug-resistant bacteria [36]. Surprisingly, limited data are available on the impact of early-life antibiotics in the development of resistome by the gut microbiota. Antimicrobial resistance is an important concern for global public health authorities. The enrichment in the resistome may increase the risk for transfer of resistance genes towards potential pathogens, further compromising the clinical management of infections. Some studies have demonstrated the existence of resistance genes in the early-life microbiota [37, 38]. A recent report demonstrated the enrichment of genes conferring resistance to β -lactam antibiotics together with increased *Proteobacteria* and *Firmicutes* following

maternal IAP [39]. The association between maternal IAP and expression of β -lactam resistant genes in the oral microbiome of both mother and neonates has been previously reported [40]. Well-established findings also indicate that gut microbiota plays a crucial role in the host's defense against pathogens such as *Clostridium difficile* [41, 42]. This can be a concern particularly relevant to hospital settings where antibiotic use and antibiotic-resistant exposure are more frequent. Antibiotic-induced perturbations in gut microbiome disrupt bacterial metabolic functions and colonization resistance against *C. difficile* but this appears to be dependent on antibiotic type [43]. In contrast, there is limited data available to link antibiotic-induced gut microbiome changes with subsequent colonization resistance against multidrug-resistant (MDR) *Escherichia coli*. The emergence of MDR *E. coli* is a fast-rising concern in children, due to its high prevalence mainly in resource-limited countries, where contaminated environment might be the source of infection [44].

Studies in animal models have shown that antibiotic exposure during pregnancy provides a dysbiotic microbiota with a reduced diversity in the gut of offspring [28]. Furthermore, antibiotic-induced gut dysbiosis can lead to a disruption in colonization resistance against bacterial pathogens [45-47]. Several efforts, therefore, have been undertaken to investigate how to restore altered gut microbiome. Although fecal microbiota transplant (FMT) is a promising approach to restore disrupted gut microbiome in adults, there are challenges to apply it in younger children. In this context, scores of studies have confirmed that breastfeeding is a natural remedy to restore beneficial microbes of early microbiome in children and protect against negative health outcomes later in life [48, 49]. However, no mechanistic evidence is available to support the restorative powers of breastfeeding on the disrupted gut microbiome and intestinal barrier function following antibiotic exposures in early-life.

Breast milk, a natural diet of newborns, contains a diverse population of microbe that may colonize the infant gut through breastfeeding. Colonization of the infant's gut is a complex trait depending on multiple factors including gestational age, birth mode, type of feeding, and environmental exposures [50]. Multiple studies have reported differences in gut microbiota profile of breastfed vs non-breastfed individuals during infancy as well as adulthood [51]. Our recent study confirmed that breastfeeding has a beneficial impact on early gut microbiota development and subsequent protection against childhood overweight [52]. Another study also showed that breastfeeding is highly associated with reduced abundances of specific antibiotic resistant genes and mobile genetic elements through modulation of microbial community in the gut [53]. Furthermore, breastfeeding has been known to provide higher colonization resistance against *Enterobacteriaceae*

compared to the formula-feeding (54). Notwithstanding these few and far between reports, data on the role of breastfeeding in the context of antibiotic-induced gut dysbiosis is largely missing.

We prone a stepwise approach to dissect in mechanistic terms how breastfeeding provides restorative effects on antibiotic-induced gut dysbiosis in early-life and subsequent colonization resistance. Our preliminary data point to a beneficial effect of breastfeeding, which restores the abundance of a probiotic bacterium whose abundance was diminished by early antibiotic exposure. We are confident that this strategy will generate translational findings that could also be applicable in implementing and developing policies and guidelines in pediatric care and management.

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References

- [1] Van Boeckel TP, Gandra S, Ashok A, Caudron Q, Grenfell BT, Levin SA, et al. Global antibiotic consumption 2000 to 2010: an analysis of national pharmaceutical sales data. *Lancet Infect Dis.* 2014;14:742-50.
- [2] Youngster I, Avorn J, Belleudi V, Cantarutti A, Díez-Domingo J, Kirchmayer U et al. Antibiotic use in children—a cross-national analysis of 6 countries. *J Pediatr.* 2017;182:239-244.
- [3] Shulman ST, Bisno AL, Clegg HW, Gerber MA, Kaplan EL, Lee G, et al. Clinical practice guideline for the diagnosis and management of group A streptococcal pharyngitis: 2012 update by the Infectious Diseases Society of America. *Clin Infect Dis.* 2012;55:1279-82.
- [4] Robinson JL, Finlay JC, Lang ME, Bortolussi R, Canadian Paediatric Society ID, Immunization Committee CPC. Urinary tract infections in infants and children: diagnosis and management. *Paediatr Child Health.* 2014;19:315-25.
- [5] Obiakor CV, Tun HM, Bridgman SL, Arrieta MC, Kozyrskyj AL. The association between early life antibiotic use and allergic disease in young children: recent insights and their implications. *Expert Rev Clin Immunol.* 2018;14:841-55.
- [6] Steinman MA, Gonzales R, Linder JA, Landefeld CS. Changing use of antibiotics in community-based outpatient practice, 1991-1999. *Ann Intern Med.* 2003;138:525-33.
- [7] Versporten A, Bielicki J, Drapier N, Sharland M, Goossens H, group Ap. The Worldwide Antibiotic Resistance and Prescribing in European Children (ARPEC) point prevalence survey: developing hospital-quality indicators of antibiotic prescribing for children. *J Antimicrob Chemother.* 2016;71:1106-17.
- [8] Persaud RR, Azad MB, Chari RS, Sears MR, Becker AB, Kozyrskyj AL, et al. Perinatal antibiotic exposure of neonates in Canada and associated risk factors: a population-based study. *J Matern Fetal Neonatal Med.* 2015;28:1190-5.
- [9] Murk W, Risnes KR, Bracken MB. Prenatal or early-life exposure to antibiotics and risk of childhood asthma: a systematic review. *Pediatrics.* 2011;127:1125-38.
- [10] Penders J, Kummeling I, Thijs C. Infant antibiotic use and wheeze and asthma risk: a systematic review and meta-analysis. *Eur Respir J.* 2011;38:295-302.
- [11] Shao X, Ding X, Wang B, Li L, An X, Yao Q, et al. Antibiotic exposure in early life increases risk of childhood obesity: a systematic review and meta-analysis. *Front Endocrinol (Lausanne).* 2017;8:170.
- [12] Blaser MJ. Antibiotic use and its consequences for the normal microbiome. *Science.* 2016;352:544-5.
- [13] Yassour M, Vatanen T, Siljander H, Hämäläinen AM, Härkönen T, Ryhänen SJ. Natural history of the infant gut microbiome and impact of antibiotic treatment on bacterial strain diversity and stability. *Sci Transl Med.* 2016;8:343ra81-343ra81.
- [14] Kumar P, Magon N. Hormones in pregnancy. *Niger Med J.* 2012;53:179-83.
- [15] Nuriel-Ohayon M, Neuman H, Koren O. Microbial changes during pregnancy, birth, and infancy. *Front Microbiol.* 2016;7:1031.
- [16] Stokholm J, Schjorring S, Eskildsen CE, Pedersen L, Bischoff AL, Følsgaard N, et al. Antibiotic use during pregnancy alters the commensal vaginal microbiota. *Clin Microbiol Infect.* 2014;20:629-35.
- [17] Gomez de Agüero M, Ganai-Vonarburg SC, Fuhrer T, Rupp S, Uchimura Y, Li H, et al. The maternal microbiota drives early postnatal innate immune development. *Science.* 2016;351:1296-302.
- [18] Unicef. Breastfeeding: a mother's gift, for every child. Unicef. 2018.
- [19] WHO. Guideline: protecting, promoting and supporting breastfeeding in facilities providing maternity and newborn services (No. 9789241550086). WHO. 2017.
- [20] Azad MB, Konya T, Persaud RR, Guttman DS, Chari RS, Field CJ, et al. Impact of maternal intrapartum antibiotics, method of birth and breastfeeding on gut microbiota during the first year of life: a prospective cohort study. *BJOG.* 2016;123:983-93.

- [21] Yassour M, Vatanen T, Siljander H, Hamalainen AM, Harkonen T, Ryhanen SJ, et al. Natural history of the infant gut microbiome and impact of antibiotic treatment on bacterial strain diversity and stability. *Sci Transl Med*. 2016;8:343ra81.
- [22] Yasmin F, Tun HM, Konya TB, Guttman DS, Chari RS, Field CJ, et al. Cesarean section, formula feeding, and infant antibiotic exposure: separate and combined impacts on gut microbial changes in later infancy. *Front Pediatr*. 2017;5:200.
- [23] Yoshimoto A, Uebanso T, Nakahashi M, Shimohata T, Mawatari K, Takahashi A. Effect of prenatal administration of low dose antibiotics on gut microbiota and body fat composition of newborn mice. *J Clin Biochem Nutr*. 2018;62:155-60.
- [24] Russell SL, Gold MJ, Hartmann M, Willing BP, Thorson L, Wlodarska M, et al. Early life antibiotic-driven changes in microbiota enhance susceptibility to allergic asthma. *EMBO Rep*. 2012;13:440-7.
- [25] Leclercq S, Mian FM, Stanisz AM, Bindels LB, Cambier E, Ben-Amram H, et al. Low-dose penicillin in early life induces long-term changes in murine gut microbiota, brain cytokines and behavior. *Nat Commun*. 2017;8:15062.
- [26] Cho I, Yamanishi S, Cox L, Methe BA, Zavadil J, Li K, et al. Antibiotics in early life alter the murine colonic microbiome and adiposity. *Nature*. 2012;488:621-6.
- [27] Candon S, Perez-Arroyo A, Marquet C, Valette F, Foray AP, Pelletier B, et al. Antibiotics in early life alter the gut microbiome and increase disease incidence in a spontaneous mouse model of autoimmune insulin-dependent diabetes. *PLoS One*. 2015;10:e0125448.
- [28] Tormo-Badia N, Hakansson A, Vasudevan K, Molin G, Ahrne S, Cilio CM. Antibiotic treatment of pregnant non-obese diabetic mice leads to altered gut microbiota and intestinal immunological changes in the offspring. *Scand J Immunol*. 2014;80:250-60.
- [29] Lynn MA, Tumes DJ, Choo JM, Sribnaia A, Blake SJ, Leong LEX, et al. Early-life antibiotic-driven dysbiosis leads to dysregulated vaccine immune responses in mice. *Cell Host Microbe*. 2018;23:653-60 e5.
- [30] Jin S, Zhao D, Cai C, Song D, Shen J, Xu A, et al. Low-dose penicillin exposure in early life decreases Th17 and the susceptibility to DSS colitis in mice through gut microbiota modification. *Sci Rep*. 2017;7:43662.
- [31] Gonzalez-Perez G, Hicks AL, Tekieli TM, Radens CM, Williams BL, Lamouse-Smith ES. Maternal antibiotic treatment impacts development of the neonatal intestinal microbiome and antiviral immunity. *J Immunol*. 2016;196:3768-79.
- [32] Nobel YR, Cox LM, Kirigin FF, Bokulich NA, Yamanishi S, Teitler I, et al. Metabolic and metagenomic outcomes from early-life pulsed antibiotic treatment. *Nat Commun*. 2015;6:7486.
- [33] Greenwood C, Morrow AL, Lagomarcino AJ, Altaye M, Taft DH, Yu Z, et al. Early empiric antibiotic use in preterm infants is associated with lower bacterial diversity and higher relative abundance of *Enterobacter*. *J Pediatr*. 2014;165:23-9.
- [34] Tanaka S, Kobayashi T, Songjinda P, Tateyama A, Tsubouchi M, Kiyohara C, et al. Influence of antibiotic exposure in the early postnatal period on the development of intestinal microbiota. *FEMS Immunol Med Microbiol*. 2009;56:80-7.
- [35] Stokholm J, Schjorring S, Pedersen L, Bischoff AL, Folsgaard N, Carson CG, et al. Prevalence and predictors of antibiotic administration during pregnancy and birth. *PLoS One*. 2013;8:e82932.
- [36] Gibson MK, Crofts TS, Dantas G. Antibiotics and the developing infant gut microbiota and resistome. *Curr Opin Microbiol*. 2015;27:51-6.
- [37] Gosalbes MJ, Valles Y, Jimenez-Hernandez N, Balle C, Riva P, Miravet-Verde S, et al. High frequencies of antibiotic resistance genes in infants' meconium and early fecal samples. *J Dev Orig Health Dis*. 2016;7:35-44.
- [38] Gueimonde M, Salminen S, Isolauri E. Presence of specific antibiotic (tet) resistance genes in infant faecal microbiota. *FEMS Immunol Med Microbiol*. 2006;48:21-5.
- [39] Nogacka A, Salazar N, Suarez M, Milani C, Arbolea S, Solis G, et al. Impact of intrapartum antimicrobial prophylaxis upon the intestinal microbiota and the prevalence of antibiotic resistance genes in vaginally delivered full-term neonates. *Microbiome*. 2017;5:93.
- [40] Gomez-Arango LF, Barrett HL, McIntyre HD, Callaway LK, Morrison M, Dekker Nitert M. Antibiotic treatment at delivery shapes the initial oral microbiome in neonates. *Sci Rep*. 2017;7:43481.
- [41] Chang JY, Antonopoulos DA, Kalra A, Tonelli A, Khalife WT, Schmidt TM, et al. Decreased diversity of the fecal microbiome in recurrent *Clostridium difficile*-associated diarrhea. *J Infect Dis*. 2008;197:435-8.
- [42] Reeves AE, Theriot CM, Bergin IL, Huffnagle GB, Schloss PD, Young VB. The interplay between microbiome dynamics and pathogen dynamics in a murine model of *Clostridium difficile* infection. *Gut Microbes*. 2011;2:145-58.

- [43] Schubert AM, Sinani H, Schloss PD. Antibiotic-induced alterations of the murine gut microbiota and subsequent effects on colonization resistance against *Clostridium difficile*. *MBio*. 2015;6:e00974.
- [44] Bartoloni A, Pallecchi L, Benedetti M, Fernandez C, Vallejos Y, Guzman E, et al. Multidrug-resistant commensal *Escherichia coli* in children, Peru and Bolivia. *Emerg Infect Dis*. 2006;12:907-13.
- [45] Hendrickx AP, Top J, Bayjanov JR, Kemperman H, Rogers MR, Paganelli FL. Antibiotic-driven dysbiosis mediates intraluminal agglutination and alternative segregation of *Enterococcus faecium* from the intestinal epithelium. *MBio*. 2015;6:e01346-15.
- [46] Buffie CG, Pamer EG. Microbiota-mediated colonization resistance against intestinal pathogens. *Nat Rev Immunol*. 2013;13:790-801.
- [47] Kim S, Covington A, Pamer EG. The intestinal microbiota: antibiotics, colonization resistance, and enteric pathogens. *Immunol Rev*. 2017;279:90-105.
- [48] Rautava S. Early microbial contact, the breast milk microbiome and child health. *J Dev Orig Health Dis*. 2016;7:5-14.
- [49] Mueller NT, Bakacs E, Combellick J, Grigoryan Z, Dominguez-Bello MG. The infant microbiome development: mom matters. *Trends Mol Med*. 2015;21:109-117.
- [50] Penders J, Thijs C, Vink C, Stelma FF, Snijders B, Kummeling I, et al. Factors influencing the composition of the intestinal microbiota in early infancy. *Pediatrics*. 2006;118:511-21.
- [51] Backhed F, Roswall J, Peng Y, Feng Q, Jia H, Kovatcheva-Datchary P, et al. Dynamics and stabilization of the human gut microbiome during the first year of life. *Cell Host Microbe*. 2015;17:690-703.
- [52] Forbes JD, Azad MB, Vehling L, Tun HM, Konya TB, Guttman DS, et al. Association of exposure to formula in the hospital and subsequent infant feeding practices with gut microbiota and risk of overweight in the first year of life. *JAMA Pediatr*. 2018;172:e181161.
- [53] Parnanen K, Karkman A, Hultman J, Lyra C, Bengtsson-Palme J, Larsson DGJ, et al. Maternal gut and breast milk microbiota affect infant gut antibiotic resistome and mobile genetic elements. *Nat Commun*. 2018;9:3891.
- [54] Bonang G, Monintja HE, Sujudi, van der Waaij D. Influence of breastmilk on the development of resistance to intestinal colonization in infants born at the Atma Jaya Hospital, Jakarta. *Scand J Infect Dis*. 2000;32:189-96.

A Common Scenario of Hypertension with Diabetes Mellitus in Rural Thai People: A Case Report

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ABSTRACT

The study aimed to understand both clinical critical points and socio-economic factors contributing to hypertension (HT) in patients with diabetes mellitus (DM) in rural Thailand. A case was selected from Chiang Sean Hospital who was diagnosed as HT with DM. Data were extracted from both medical records and interview with patients to determine the socio-economic factors. A Thai-men aged 52 years with body mass index (BMI) at 25.69 kg/m², waist 96 cm was diagnosed with HT and DM 4 years ago. He was under the cared for and treated at Chiang Sean Hospital with the blood pressure at 167/110 mmHg and oral enalapril 5 mg. was the first drug of choice. His blood glucose level at the beginning was 123 mg/dl and Metformin 500 mg was given. During the follow up at Chiang Sean Hospital, he still had a high blood pressure with uncontrolled blood sugar level. He also had dyslipidemia and gout with high cholesterol level (244 mg/dl), high triglyceride level (334 mg/dl), high level of low-density lipoprotein (121 mg/dl) and high uric acid level (12.1 mg/dl). He lived in a poor family and had low education. He also lived with poor family support. Health professionals should focus on holistic care approach in treating and caring for patients living with complicated Non-communicable disease (NCD) condition as this is essential to cover both individual pathological and socio-economic surrounding factors for proper case management.

Keywords: *Non-communicable disease, Hypertension, Diabetes mellitus, Rural Thailand*

Introduction

Non-communicable disease (NCD) is a major public health threat globally which is needs large investment for treatment and care [1, 2]. World Health Organization (WHO) reported that 41 million people were killed from NCD globally in each year which is equivalent to 71.0% of all deaths [3]. Every year, a NCD accounts for premature deaths of 15 million people aged 30-60 years with 85.0% of it occurring in low and middle income countries including Thailand. WHO also reported that tobacco use, physical inactivity, the harmful use of alcohol and unhealthy diet were the potential risk factors of NCD [3]. WHO indicated that poverty was closely related to and initiated NCD particularly in developing countries [4]. Nearly 30.0% of death related to NCD were reported in low-income countries [4].

Thailand's health care system has been recognized as one of the best health care service system among developing countries particularly in having great health insurance system to make sure that all citizens have met the basic medical and public health

care need by accessing health care services. Thailand However, is not excluded from the trend of NCD even in rural areas. Many NCD cases present a complicated pathology which is often related to other factors such as socio-economic and lifestyle [2].

In 2018, Chiang Sean District reported that the morbidity rate of HT and DM were 1,114 per 100,000 populations and 423 per 100,000 populations respectively. Meanwhile, the numbers of comorbidity of HT and DM with complicated cases are rapidly increasing [5-8]. Several standard drugs were used for treatment and its complication prevention purposes [9, 10] Therefore, the objective of this case report was to understand the significance of both the clinical critical points and the impact of socio-economic factors on patients with hypertension (HT) and diabetes mellitus (DM) and its management in persons who lived in rural Thailand.

Methods

A case report was conducted at Chiang Sean hospital which is a secondary hospital located in rural Thailand. A study and access to all medical records were permitted by the hospital director and the chief of chronic disease management clinic for completion of the case investigation. The investigators consisted of a medical doctor, nurse, and public health professional. A case diagnosed with HT and DM was selected from NCD clinic. A case was asked to obtain informed consent before extracting all relevant information from various sources including obtaining information from face-to-face interview. Data were collected from medical records, laboratory results, a doctor's view, and also interview to get data on socio-economic status.

Results

A Case

A married Thai-man aged 52 years was diagnosed as HT and DM. On 10th July 2019, he was asked to join the study. His body mass index (BMI) was 25.69 kg/m², waist was 96 cm. He had been diagnosed as HT with DM 4 years ago. His blood pressure when he began on treatment was 167/110 mmHg. and was treated with oral enalapril 5 mg. Oral metformin 500 mg. was given to control blood glucose level of 123 mg/dl at the first day of treatment. His last visit at Chiang Sean hospital found the uncontrolled both blood pressure and blood glucose (Table 1). He also was diagnosed as with dyslipidemia and gout eventually. Many biomarkers were presented over the standard levels; cholesterol (244 mg/dl), triglyceride (334 mg/dl), low density lipoprotein (121 mg/dl), and uric acid (12.1 mg/dl) (Table 1). High levels of these

biomarkers are resulting in the development of other health problems (Figure 1)

Personal behaviors

A case had no education and had several poor health behaviors including drinking alcohol for 27 years, and regular unhealthy diet. He also lived in poor economic conditions with 5 family members. He worked as a farmer and did unprofessional jobs in the village. Sticky rice was the main food with local salty and spicy food. Fermented fish and food were common. He claimed that he had no time and place for exercise but drinking alcohol every day. He says that it was too difficult to follow the advice of a doctor or nurse from hospital to maintain healthy diet since he has limited choices. He has lived in severe poverty with his family which makes him sad and stressed leading to the use of alcohol. Eventually, he was diagnosed with gout and dyslipidemia.

Discussion

Today, people in rural Thailand are facing a serious health problem, NCD, which is developed based on their personal behaviors and also socio-economic status. This problem needs to be addressed by the involvement of several sections; patient, family, and community. There is a large expense required for case management while attending a hospital. The patient needs to get several pills a day to control blood glucose, blood pressure, uric acid, and lipid levels. If a patient can not follow the advice from health professionals, severe complications will develop which would be difficult to manage later [11, 12]. However, the complications are not developed from only patients' personal characteristics but also from social and economic factors. To address this particular

Table 1 History of laboratory results

| Date | Uric acid (mg/dl) | Cholesterol (mg/dl) | LDL (mg/dl) | Triglyceride (mg/dl) | BP (mmHg) | FBS (mg/dl) | HbA1c (%) |
|------------------------------|-------------------|---------------------|-------------|----------------------|-----------|-------------|-----------|
| Feb 12 th ,2014 | 6.8 | N/A | N/A | N/A | 200/120 | N/A | N/A |
| Feb 19 th ,2014 | N/A | 244 | 121 | 334 | 167/110 | 90 | N/A |
| June 9 th ,2014 | 12.1 | N/A | N/A | N/A | 130/80 | N/A | N/A |
| Sep 1 st ,2014 | 9.2 | N/A | N/A | N/A | 149/103 | N/A | N/A |
| May 15 th ,2015 | N/A | 234 | 100 | 363 | 136/106 | 105 | N/A |
| Aug 7 th ,2015 | 9.7 | N/A | N/A | N/A | 130/90 | 109 | N/A |
| Oct 30 th ,2015 | N/A | 196 | 77 | 350 | 137/90 | N/A | N/A |
| April 18 th ,2016 | 10.8 | 204 | 400 | 667 | 129/90 | 133 | N/A |
| July 29 th ,2016 | N/A | N/A | N/A | N/A | 125/88 | 128 | N/A |
| Jan 27 th ,2017 | 9.3 | N/A | N/A | N/A | 152/97 | N/A | N/A |
| Sep 25 th ,2017 | 8.1 | N/A | N/A | N/A | 142/105 | 125 | N/A |
| Sep 21 st ,2018 | N/A | N/A | N/A | N/A | 130/91 | 186 | N/A |
| Sep 26 th ,2018 | N/A | N/A | N/A | N/A | 155/98 | 106 | 9.3 |
| Oct 24 th ,2019 | N/A | N/A | N/A | N/A | 153/97 | 184 | N/A |
| Jan 24 th ,2019 | N/A | N/A | N/A | N/A | 140/82 | 167 | N/A |
| April 18 th ,2019 | 6.7 | N/A | N/A | N/A | 161/94 | 183 | N/A |
| July 10 th ,2019 | N/A | N/A | N/A | N/A | 140/90 | 233 | N/A |

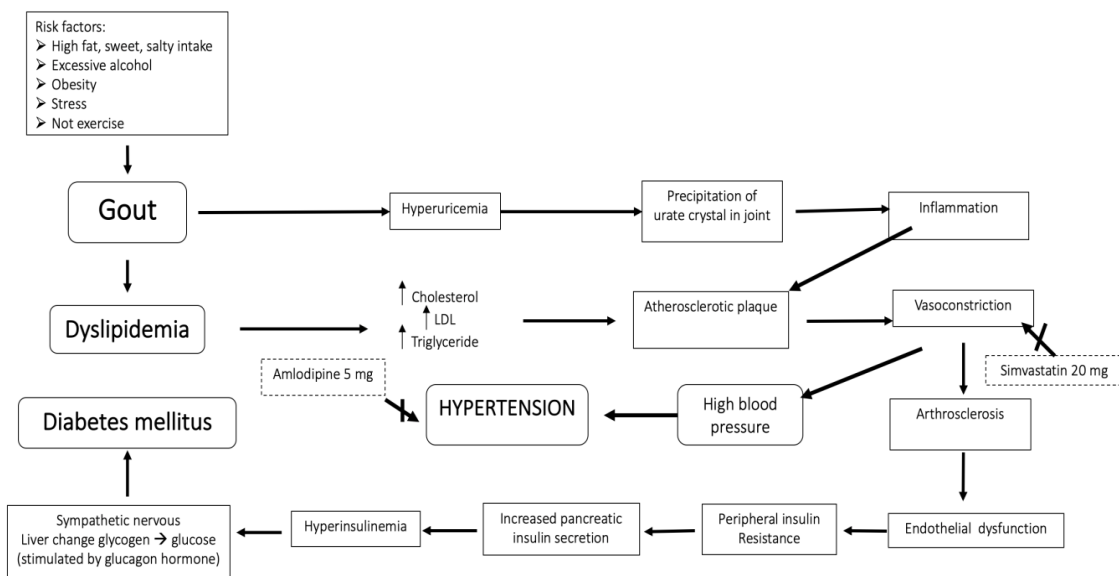


Figure 1 The development of health problem diagram

problem among people living in rural Thailand, it needs the cooperation from many organization and functions.

Boonprasan [13] reported that the HT development in Thai rural people stems from their culture related to food consumption, which is related to our study. Moreover, a case study had high body mass index, which was from his dietary behaviors and no exercise. This was consistent with the study of Legyam, et al. [14] which reported that rural people in Thailand had a problem of overweight due to lack of knowledge and poor attitude. In our study, we found that family and community roles were important for control of blood pressure and blood glucose level of a patient. Several studies reported family support had a positive impact on control of blood glucose among type 2 diabetes and on control of blood pressure among HT patients [15, 16, 17].

Since this is a case report which is selected from many complicated cases attending a NCD clinic in a hospital with long history in medical care and treatment, therefore, some medical records may not be complete. And also in the section of interview, some previous exposures or risk behaviors were not completely recalled.

Conclusion

Having HT and DM among the rural Thai people is becoming a common challenge with several driving factors including individual pathogenesis, personal behavior, family, and community. Living in a family with poor economic status with poor health behaviors puts many Thai rural people at risk for NCD particularly HT and DM. To address this certain problem, the cooperation among the health care givers who have different background such as medical doctor,

nurse, public health professional is needed to improve a patient approach skill which is focused on holistic care.

References

- [1] Centers for Disease Control and Prevention (CDC). Global non-communicable diseases. Available from: <https://www.cdc.gov/globalhealth/healthprotection/ncd/index.html>
- [2] World Health Organization (WHO). A global brief on hypertension: silent killer, global public health crisis. Geneva: World Health Organization. 2013; 3: 9-32.
- [3] World Health Organization (WHO). Non-Communicable Disease: key facts. Available from: <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>
- [4] World Health Organization (WHO). NCDs, poverty and development. Available from: <https://www.who.int/global-coordination-mechanism/poverty-and-development/en/>
- [5] Srivanichakorn S. Morbidity and mortality situation of non-communicable diseases (Diabetes type 2 and cardiovascular diseases) in Thailand during 2010-2014. *Disease Control Journal*. 2017; 43(4): 379-89.
- [6] Chiang Rai Health Data Center. Morbidity rate of hypertension in Chiang Saen district, 2018. Available from: <https://hdcservice.moph.go.th/hdc/reports/> Access on 20 April 2019
- [7] Chiang Rai Health Data Center. Morbidity rate of diabetes in Chiang Saen district, Chiang Rai, 2018. Available from: <https://hdcservice.moph.go.th/hdc/reports/> Access on 29 April 2019

- [8] Long AN, Dagogo-Jack S. Comorbidities of diabetes and hypertension: mechanisms and approach to target organ protection. *J Clin Hypertensions (Greenwich)*. 2011; 13 (4): 244-51.
- [9] Massimo V, Allegra B, Carmine S, Giuliano T. understnading and treating hypertension in diabetic populations. *Cardiovasc Diagn Ther*. 2015; 5(5): 353-63.
- [10] Alon G, Thud G. Blood pressure control in type 2 diabetic patients. *BMC Cardiovascular Diabetology*. 2017; 16(3): DOI= DOI 10.1186/s12933-016-0485-3
- [11] Ohishi M. Hypertension with diabetes mellitus: physiology and pathology. *Hypertension Res*. 2018; 41(6): 389-93.
- [12] Strain WD, Paldanius PM. Diabetes, cardiovascular disease and the microcirculation. *BMC Cardiovascular Diabetology*. 2018; 17(57): 1-10. DOI: 10.1186/s12933-018-0703-2
- [13] Boonprasan S. Health care plan of hypertension patients. [Adult and Gerontological Nursing]. Chiang Mai: Chiang Mai University. 2001.
- [14] Legyam S, et al. Knowledge, attitude, consumption behavior and nutritional condition of overweight people participating in a counseling program for nutrition and Community Relations. *Thai Journal of Nursing Council*. 2017; 32(2): 126-37.
- [15] Rian AP, Kanitta C, Paranee V. A systematic review: family support integrated with diabetes self-management among uncontrolled type II diabetes mellitus patients. *Behav Sci (Basel)*. 2017; 7(62): 1-17.
- [16] Miller TA, DiMatteo MR. Importance of family/social support and impact on adherence to diabetes therapy. *Diabetes, Metabolic Syndrome and Obesity: targets and Therapy*. 2013; 6: 421-6.
- [17] Birgitte BB, Michael ER, Dorthe O, et al. Supportive and non-supportive interactions in families with type 2 diabetes patient: an integrative review. *BMC Diabetology&Metabolic Syndrome*. 2017; 9(57): 1-9. DOI: 10.1186/s13098-017-0256-7

Burnout levels among housekeepers working in a university

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ABSTRACT

Currently, burnout is a problem that is more common than is generally believed. This research is a cross-sectional study that aimed to evaluate the levels of job burnout among housekeepers working in a university. A total of 130 housekeepers were randomized, with data collected between February and May 2019 using a self-administered questionnaire consisting of demographics, occupational factors and the Maslach Burnout Inventory (MBI). The result shows that 67.7% of participating housekeepers had a low level of emotional exhaustion, 74.6% had a low level of depersonalization, and 76.9% had a high level of personal achievement. Based on these results, the burnout levels of all workers should be assessed, particularly those who work in different sections and who have diverse responsibilities; ii) measures should be taken to reduce the exhaustion and tiredness of personnel; and iii) a shift work system should be applied.

Keywords: *Burnout levels, Housekeeper, University*

Introduction

Burnout is a medical problem that is more common than is generally believed. It manifests as a reaction to job stress, causing reduced motivation and effectiveness. Burnout has been reported as playing a role in work-related psychological distress among people working in service sectors. Stress, which is the reaction of individuals to demands (stressors) [1], is an integral part of all aspects of life and can play a positive role by increasing alertness among staff in the workplace. Burnout was first proposed in 1974 by Freudenberg, a psychologist; according to the definition of burnout, an individual suffers from burnout when he or she is unsuccessful, is worn down and becomes exhausted as a result of excessive demands on his or her energy, power, and resources [2]. Many studies have attempted to verify the relationship between stress and burnout, and they have also examined the relationship between burnout and employee satisfaction [3], burnout and gender, burnout and workload [4], and burnout and personality [5].

In general, professionals' function at high levels if their work provides positive feedback. Some authors describe burnout as the "progressive loss of idealism, energy, and purpose experienced by people in the helping professions as a result of their work" [6]. The term 'burnout' is not synonymous with 'job stress', 'fatigue', 'alienation' or 'depression', although the recent popularity of the term has led to some

confusion. Three main dimensions describe burnout syndrome: emotional exhaustion, depersonalization, and personal achievement. Some studies have found that emotional burnout and depersonalization had a negative impact on the life satisfaction of employees who worked in hotels in China [3].

Housekeepers face job stresses similar to those of other staff members because they strive to provide a clean, healthy, safe, comfortable, and satisfactory environment at the highest level possible. They also work closely and often face to face with people who influence the quality of the perceived service. Housekeepers are required to provide satisfaction directly and to endure long working hours, seven days a week. The risk factors that make the incidence of work-related stress highly relevant to housekeepers include heavy physical workloads and excessive bodily motions that present high risks of back injuries, forceful upper limb motions involving awkward positions that pose a high risk of neck or shoulder and arm injuries, and space limitations necessitating many uncomfortable postures. Interpersonal disharmony and heavy workloads in the workplace are factors that exacerbate burnout syndrome in housekeepers [7]. Here, the levels of burnout among housekeepers working in a university are determined.

Methods

Participants

The study population consisted of housekeepers working in a university; specifically, one of university in Chiang Rai Province, Thailand, was selected as the case study. A total of 190 personnel working in this university composed the population group. Data were collected between February and May 2019. Following Taro Yamane's (1973) [8] formula for $p=0.05$ and Krejcie & Morgan (1970) [9], 130 participants were determined to be a suitable sample size. The research instrument was a self-administered questionnaire that consisted of three parts. The first part contained 11 items and collected demographic data, including gender, age, marital status, the number of family members, the number of children, family caregiving roles, income per month, expenses per month, personal diseases, smoking history and history of alcohol consumption. The second part collected information on occupational factors such as work experience and work rules, while the last part included the Maslach Burnout Inventory (MBI) developed by Maslach and Jackson [10], which was translated into Thai [11]. The MBI is a tool for detecting and measuring the severity of burnout syndrome. It is a 22-item instrument that assesses the degree of burnout in terms of three subscales: i) emotional exhaustion and lack of energy; ii) depersonalization, which is an interpersonal relationship leading to cynicism with negative attitudes regarding patients or colleagues, feelings of guilt, avoidance of social contact and withdrawal into oneself; and iii) personal achievement, which is a feeling of incompetence. For purposes of simplification, regarding personal achievement, an individual has a negative outlook and feels unable to move the situation forward. For each question, scores were rated as low level, moderate or high level (Table 1). A high score in the first two sections and a low score in the last section may indicate burnout.

Table 1 Interpretation of the self-test Maslach Burnout Inventory

| Section | Low level | Moderate level | High level |
|----------------------|-----------|----------------|------------|
| Burnout | 17 | 18-29 | 30 |
| Depersonalization | 5 | 6-11 | 12 |
| Personal Achievement | 40 | 34-39 | 33 |

Statistical analysis

All items were coded and scored, and the completed questionnaires were subjected to data analysis. The distribution of demographic and occupational factors in the sampling group according to the respondents' demographic characteristics were

given together with frequency and percentage values. IBM SPSS was used to analyze the data.

Results

The housekeepers in this university were mostly female (89.2%), with 10.8% being male. The average age was 41 ± 10.29 years, and most were married (62.2%) with no personal diseases (76.2%) and with more than three people in their family (53.8%). A total of 46.2% had no children, while 29.2% had one child; 66.9% had special caregiving roles in their family such as those involving a baby, an elderly individual, a disabled person and a bedridden person. A total of 46.2% had a monthly income of 5,001-7,000 THB, and 34.6% had monthly expenses of 7,001-9,000 THB. Regarding health behavior, 91.5% were nonsmoking, and 65.4% did not consume alcohol. The average work experience was 4 (± 3.87) years, and 48.5% of the housekeepers thought that the rules of the workplace were moderately strict (Table 2).

Table 2 Distribution of participants according to their demographics

| Factor | n | % |
|---|------------|--------------|
| Total | 130 | 100.0 |
| Gender | | |
| Male | 14 | 10.8 |
| Female | 116 | 89.2 |
| Age (years) | | |
| ≤ 20 | 3 | 2.3 |
| 21-30 | 19 | 14.6 |
| 31-40 | 44 | 33.8 |
| 41-50 | 43 | 33.1 |
| 51-60 | 15 | 11.5 |
| > 60 | 6 | 4.6 |
| Min.=20, Max.=70, Mean=41.46, S.D.=10.29 | | |
| Marital status | | |
| Single | 26 | 20 |
| Married | 81 | 62.2 |
| Divorced | 11 | 8.5 |
| Widowed | 10 | 7.7 |
| Separated | 2 | 1.5 |
| Number of family members (persons) | | |
| 1-3 | 60 | 46.2 |
| >3 | 70 | 53.8 |
| Number of children (persons) | | |
| None | 64 | 46.2 |
| 1 | 38 | 29.2 |
| 2 | 27 | 20.8 |
| ≥3 | 1 | 0.8 |
| Family caregiving role | | |
| Yes | 87 | 66.9 |
| No | 43 | 33.1 |
| Income/month (THB) | | |
| ≤ 5,000 | 4 | 3.1 |
| 5,001-7,000 | 60 | 46.2 |
| 7,001-9,000 | 59 | 45.4 |
| > 9,000 | 7 | 5.4 |
| Expenses/month (THB) | | |
| ≤ 5,000 | 16 | 12.3 |
| 5,001-7,000 | 44 | 33.8 |
| 7,001-9,000 | 45 | 34.6 |
| > 9,000 | 25 | 19.2 |

Table 2 Distribution of participants according to their demographics (Cont.)

| Factor | n | % |
|---|-----|------|
| Having a medical condition or disease | | |
| Yes | 31 | 23.8 |
| No | 99 | 76.2 |
| Smoking | | |
| Yes | 6 | 4.6 |
| No | 119 | 91.5 |
| Quit | 5 | 3.8 |
| Alcohol consumption | | |
| Yes | 29 | 22.3 |
| No | 85 | 65.4 |
| Quit | 16 | 12.3 |
| Work experience (years) | | |
| < 1 | 5 | 3.8 |
| 1-3 | 71 | 54.6 |
| 4-6 | 29 | 22.3 |
| > 6 | 25 | 19.2 |
| Min.=0.33, Max.=17, Mean=4.1, SD.=3.87 | | |
| Housekeeper attitudes toward working rules | | |
| Workplace rules are mostly strict | 54 | 41.5 |
| Workplace rules are moderately strict | 63 | 48.5 |
| Workplace rules are not very strict | 13 | 10.0 |

Discussion and conclusion

A housekeeper's workload includes cleaning bathrooms, vacuuming and dusting, mopping floors, wiping windows, and collecting and disposing of garbage. Although the literature has explicated the relationship between job stress and burnout, few studies have focused on a housekeeper group, especially in a university environment.

Table 3 Burnout level among housekeepers

| Level | Emotional exhaustion | | Depersonalization | | Personal achievement | |
|----------|----------------------|------|-------------------|------|----------------------|------|
| | n | % | n | % | n | % |
| Low | 88 | 67.7 | 97 | 74.6 | 21 | 16.2 |
| Moderate | 28 | 21.5 | 12 | 9.2 | 9 | 6.9 |
| High | 14 | 10.8 | 21 | 16.2 | 100 | 76.9 |
| S.D. | 12.62 | | 7.19 | | 16.3 | |

Previous studies of burnout among housekeepers have found that part of job stress involved high workloads and repetitive tasks, which are common in the housekeeping departments of five-star hotels. Therefore, employees in repetitive jobs are more likely to suffer burnout, leading to a lower sense of accomplishment. In addition to the stress of repetitive work, assigning a large number of rooms and room type allocations inflicts the most stress on housekeepers [12].

In this study, a general assessment was made concerning the degree of burnout of housekeepers who worked in a university. The results indicated that most of the participating housekeepers had a low level of emotional exhaustion, a low level of depersonalization, and a high level of personal achievement, while most thought that the working rules in the university were

mostly strict or moderately strict. The work history survey showed that housekeepers worked for 8 hours, with a 30-60-minute break per day. Compared with previous similar research methods for different occupations with more accountability, such as psychiatrists, almost 80% of Thai psychiatrists had low levels of personal achievement [13]. Almost half of all sales representatives working in pharmaceutical companies had low levels of emotional exhaustion, moderate levels of depersonalization and high levels of personal achievement [14]. Thus, an increase in the daily working hours of housekeepers may increase their levels of burnout. The results suggest that the three items indicating the level of burnout gave no burnout signal among the housekeepers who worked in the university. According to the findings, the following suggestions are made: i) evaluate the results by carrying out studies to determine the burnout levels of housekeepers who work in different sections and who have diverse responsibilities; ii) take measures to reduce the exhaustion and tiredness of personnel that are frequently seen in people subjected to burnout [15], and iii) apply a shift work system.

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References

- [1] Bill Faulkner and Anoop Patiar (1997) Workplace induced stress among operational staff in hotel industry, *Int. J. Hospitality Management* Vol.16, No.1 pp 99-107
- [2] Freudenberg, H. (1974) Staff Burnout. *Journal of Social Issues*, 30, 159-165. <http://dx.doi.org/10.1111/j.1540-4560.1974.tb00706.x>
- [3] Shen, H. & Huang, C. (2012). Domestic Migrant Workers in China's Hotel Industry: An Exploratory Study of Their Life Satisfaction and Job Burnout, *International Journal of Hospitality Management*, 31: 1283-1291.
- [4] O'Neill, J. W. & Xiao, Q. (2010). Effects of Organizational/Occupational Characteristics and

- Personality Traits on Hotel Manager Emotional Exhaustion, *International Journal of Hospitality Management*, 29: 652–658.
- [5] Kim, H.J., Shin, K.H. & Umbreit, W.T. (2007). Hotel Job Burnout: The Role of Personality Characteristics, *Hospitality Management*, 26: 421–434.
- [6] Sturges, J., & Poulsen, A. (1983). The prevalence of burnout in occupational therapists. *Occupational Therapy in Mental Health*, 3(4), 47-60.
http://dx.doi.org/10.1300/J004v03n04_05
- [7] Aksu, M., and Temeloglu, E. (2015). Effects of Burnout on Employees' Satisfaction a Research at 3, 4 and 5 Star Hotels in Canakkale City Center. *International Journal of Business and Social Science [Online]*. Vol.15 No.1
- [8] Yamane T. *Statistics: an introduction analysis*. Harper & Row.1973.
- [9] Krejcie, R.V. and Morgan, D.W. (1970) Determining Sample Size for Research Activities. *Educational and Psychological Measurement*, 30, 607-610.
- [10] Maslach C, Jackson SE. The measurement of experienced burnout. *J Occup Behav* 1981; 2:99-113
- [11] Sammawart S. Burnout among nurses in Ramathibodi Hospital. Master of Science, Thesis. Faculty of Nursing, Mahidol University;1989.
- [12] Chun-Fang Chiang & Bang-Zhi Liu (2017) Examining job stress and burnout of hotel room attendants: Internal marketing and organizational commitment as moderators, *Journal of Human Resources in Hospitality & Tourism*, 16:4, 367-383, DOI: 10.1080/15332845.2017.1266869
- [13] Tiraya Lerthattasilp 2011, Burnout among psychiatrists in Thailand: National survey, *J Psychiatr Assoc Thailand* Vol.56. No.4 pp.437-448
- [14] Vanlop Vichanjalearnsuk and Soontorn Supamong, Job burnout and related factors among pharmaceutical representatives of international pharmaceutical company, *Thammasat Medical Journal*, Vol. 15 No. 2 pp.225-231, 2015
- [15] Erkal, S., Şahin, H. (2012). The level of burnout of Housekeeper personnel in accommodation facilities. *International Journal of Human Sciences [Online]*. (9)2, 969-980.

Prevalence and Factors Associated with Type 2 Diabetes Mellitus among Middle-Aged and Elderly Lisu Hill tribe People, Northern Thailand: A Cross-sectional Study

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ABSTRACT

Introduction: Type 2 diabetes mellitus (T2DM) is one of the most significant noncommunicable diseases (NCDs), and it is considered a major health threat for humans globally. Hill tribe people live in poor economic conditions, have low educational attainment and are vulnerable to T2DM, particularly the Lisu people, who have unique lifestyles and cooking styles. **Objective:** This study aimed to estimate the prevalence of and determine the factors associated with T2DM among the Lisu people aged 30 years and older in Chiang Rai Province, Thailand. **Methods:** A cross-sectional study was applied to collect information from Lisu participants aged 30 years and older who lived in five randomly selected Lisu villages in Chiang Rai Province. A validated questionnaire was used to collect information, and 5 mL blood specimens were drawn for laboratory testing. Data were collected in May–November 2018. Logistic regression was used to detect associations between variables at a significance level of $\alpha=0.05$. **Results:** A total of 282 Lisu people were recruited into the study; 61.3% were females, 69.5% were aged 40–69 years, and 72.7% were Buddhist. The majority were illiterate (74.1%), agriculturalists (57.4%), and had a family income of less than 50,000 baht per year (70.9%). The total prevalence of T2DM was 18.1%; 8.9% had a medical history of T2DM. Among those who had no medical history of T2DM, 10.1% were detected as new T2DM cases. After adjustments were made for age, sex, income, and marital status, only waistline measurements were found to be associated with T2DM among the Lisu people in Thailand. Those who had been identified as at risk for metabolic complications (≥ 90 cm in males and ≥ 80 cm in females) had a 2.20 time higher likelihood (95%CI=1.16–4.16) of developing T2DM than did those who were normal. **Conclusion:** Effective public health screening for T2DM should be urgently implemented in the Lisu population in Thailand. Moreover, a proper public health intervention for both men and women who have waistline problems should be initiated.

Keywords: Prevalence, associated factors, type 2 DM, Lisu, hill tribe

Introduction

Non-communicable diseases (NCDs) are clearly recognized as the main human health threat in the 21st century, particularly among people with modern lifestyles [1]. These diseases have also emerged as one of the most significant health problems in developing countries [2]. NCDs can lead to many problems, especially with respect to health system expenditures, concerning prevention among those

vulnerable to NCDs and care for those who have already been diagnosed with NCDs. Several studies have demonstrated that not only wealthy persons or those living in modernized areas but also those living in poor economic conditions are at risk of developing NCDs. The World Health Organization (WHO) has reported that more than 41 million people are killed by NCDs each year, and 85.0% of these deaths occurred in low- and middle-income countries. Among these

deaths, 37.0% occurred among those aged 30-69 years, which constitutes premature death [3].

In 2018, approximately 14 million people lived with at least one NCD among the Thai population, and the more than 300,000 deaths caused by NCDs accounted for 73.0% of the total number of deaths in Thailand [4]. The Department of Disease Control in the Ministry of Public Health in Thailand reported that in 2014, Thais lost a total of 14.7 million disability-adjusted life years (DALYs) due to NCDs [5]. Thailand uses more than 2,520 million baht per year of NCD prevention and control, including treatment and care for those who are already diagnosed [6]. There are several risk factors for NCD development, such as smoking [7], alcohol use [8], low engagement in exercise [9], and a high-salt diet [10]. NCDs are not limited to individuals from high economic backgrounds; rather, they are also reported among poor people, such as the hill tribe populations in Thailand [11].

Type 2 diabetes mellitus (T2DM) has been recognized as the leading threat among NCDs in the Thai population [12]. A five-year (2010-2014) study on the morbidity and mortality related to T2DM among the Thai population clearly showed that the number of deaths attributed to T2DM and related conditions increased significantly [13]. Both those who live in urban cities and rural villages are at risk of T2DM in Thailand [14].

The hill tribe people are a group of individuals who migrated from South China over two centuries into Thailand and who are currently living below Thailand's poverty line of 2,667 baht/person/month [15]. There are six main groups: the Akha, Lahu, Hmong, Yao, Karen, and Lisu. The Lisu is known as the smallest group among the hill tribes in Thailand [16]. Since they have a culture and lifestyle similar to those of the Chinese population, they consume many animal oils for cooking. Meanwhile, in their adaptation to Thai culture, they consume a large amount of salt and monosodium glutamate in their everyday diet. However, a large proportion of the Lisu still have low levels of education and live in poor economic conditions [17]. Given these multiple risk conditions for the Lisu in Thailand, the study aimed to estimate the prevalence of and determine factors associated with T2DM among the Lisu people aged 30 years and older.

Methods

A cross-sectional study design was used to elicit information from the participants. Participants were the Lisu people who lived in Chiang Rai Province. Those aged 30 years and older were eligible for the study. However, people who had been diagnosed with type 1 diabetes, who could not provide essential information regarding the study protocol and who could not identify themselves as the Lisu were excluded from the study. In 2018, there were 35 Lisu villages in Chiang Rai Province. Five (5) villages were

randomly selected as study settings. People who lived in the selected villages and who met the inclusion criteria were invited to participate in the study.

The sample size was calculated by the standard method [18] for a cross-sectional design, with $p=0.23$ [5], $q=0.77$, and $e=0.05$; therefore, 265 participants were required for the analysis.

A validated questionnaire was used to collect data from the participants. The questionnaire was divided into 4 parts. Part one (7 questions) was used to collect the general information of the participants. Part two (16 questions) was used to collect participants' behaviors that were related to T2DM development. Part three (40 questions) was used to collect data on knowledge and attitudes on T2DM prevention and control. Four items were used to collect laboratory results, including lipid profiles and HbA1c.

The questionnaire was tested and improved for validity and reliability before use. Three experts in relevant fields were asked to determine the validity of the questionnaire through the so-called item-objective congruence (IOC) technique. A pilot test was administered to 12 participants with similar characteristics from the Mae Fah Laung district, Chiang Rai province. In the pilot test, the feasibility and the sequence of the questions were evaluated. Moreover, the reliability was tested for the 10 questions on knowledge and for another 10 questions on attitudes regarding the prevention and control for T2DM, with an overall Cronbach's alpha of 0.73.

Several measurements were used in the study. First, stress was assessed with the standard questionnaire used for stress assessment, which was developed by the Department of Mental Health, Thailand. It is composed of five questions, with 4 ranked response options for each item (0-3) [19]. Those scored 0-4 were classified as low stress, 5-9 as moderate stress, and 10 or more as high stress. Second, body mass index (BMI) was classified into three categories: ≤ 18.5 kg/m² was underweight, 18.51-22.99 kg/m² was normal, and ≥ 23 kg/m² was overweight. Third, waistline measurements for males were classified into two categories: <90 cm was normal, and ≥ 90 cm was over the standard cutoff. Fourth, waistline measurements for females were classified into two categories: <80 cm was normal, and ≥ 80 cm was over the standard cutoff. Fifth, total cholesterol was classified into two categories: ≤ 199 mg/dL was normal, and ≥ 200 mg/dL was high. Sixth, triglycerides were classified into two categories: ≤ 149 mg/dL was normal, and ≥ 150 mg/dL was high. Seventh, high-density lipoprotein (HDL) cholesterol for males was classified into two categories: <40 mg/dL was low, and ≥ 40 mg/dL was normal. Eighth, high-density lipoprotein (HDL) cholesterol for females was classified into two categories: <50 mg/dL was low, and ≥ 50 mg/dL was normal. Ninth, low-density lipoprotein (LDL) cholesterol was grouped into two categories: <100 mg/dL was normal, and ≥ 100 mg/dL was high. Tenth,

the waist-to-hip ratio for males was classified into two categories: ≤ 0.90 was normal, and > 0.90 was obese. Eleventh, the waist-to-hip ratio for females was classified into two categories: ≤ 0.85 was normal, and > 0.85 was obese. Finally, glycated hemoglobin, or hemoglobin A1C (HbA1c), was classified into three categories: < 6.0 was normal, 6.0-6.4 indicated prediabetes, and ≥ 6.5 was classified as T2DM.

Permission to access to the villages was granted by the district government office. Villages were randomly selected from the list of Lisu hill tribe villages [20]. Selected village headmen were contacted to provide information regarding the research project. Participants who met the study criteria were contacted five days prior date of collecting data. At the date of data collection, participants were asked to obtain the informed consent form before physical examination, blood specimen collection, and completion of the questionnaire. The entire process of data collection lasted 30 minutes for each participant. Data collection was conducted between May and November 2018. The data from questionnaires were double-entered into an Excel spreadsheet before they were transferred to SPSS version 24 (SPSS, Chicago, IL) for data analysis. Both categorical and continuous data were sufficiently descriptive to present the general characteristics of the participants in terms of percentages, means, and SDs. Logistic regression was used to identify factors associated with T2DM at the significance level $\alpha=0.05$.

Table 1 General characteristics of participants.

| Characteristic | n | % |
|--------------------------------------|------------|--------------|
| Total | 282 | 100.0 |
| Sex | | |
| Male | 109 | 38.7 |
| Female | 173 | 61.3 |
| Age (years) | | |
| 30-39 | 46 | 16.3 |
| 40-49 | 61 | 21.6 |
| 50-59 | 69 | 24.5 |
| 60-69 | 66 | 23.4 |
| 70-79 | 33 | 11.7 |
| ≥ 80 | 7 | 2.5 |
| Religion | | |
| Buddhism | 205 | 72.7 |
| Other (Christianity and Islam) | 77 | 27.3 |
| Education | | |
| Illiterate | 209 | 74.1 |
| Primary school | 36 | 12.8 |
| Secondary school | 36 | 12.8 |
| High school | 1 | 0.4 |
| Occupation | | |
| Unemployed | 70 | 24.8 |
| Agriculturalist | 162 | 57.4 |
| Other | 50 | 17.7 |
| Family income per year (baht) | | |
| $\leq 50,000$ | 200 | 70.9 |
| 50,001-100,001 | 68 | 24.1 |
| $\geq 100,001$ | 14 | 5.0 |
| Debt | | |
| No | 220 | 78.0 |
| Yes | 62 | 22.0 |
| Marital status | | |
| Single | 9 | 3.2 |
| Married | 221 | 78.4 |
| Other | 52 | 18.4 |
| Family member (person) | | |
| 0-4 | 149 | 52.8 |
| 5-8 | 113 | 40.1 |
| ≥ 9 | 20 | 7.1 |
| Living situation | | |
| Alone | 13 | 4.6 |
| With spouse | 183 | 64.9 |
| With child | 61 | 21.6 |
| With relative | 25 | 8.9 |

Results

Two hundred and eighty-two (282) participants were recruited into the study. The majority were females (61.3%), married (78.4%), aged 40-69 years (69.5%), Buddhist (72.7%), and illiterate (72.7%). The majority of participants worked as agriculturalists (57.4%), followed by unemployed individuals (24.8%), and 70.9% had an income of less than 50,000 baht/family/year (Table 1).

According to a medical history and laboratory results, less than half (46.5%) had been screened for DM within the previous year, and a large proportion reported that they did not know their parents' diabetes status. The majority of participants (both men and women) were overweight (59.6%) and had a larger-than-normal waistline (51.1%). A large proportion of participants had noteworthy lipid profiles: 42.6% had a high level of triglycerides, and 67.4% had a high level of LDL cholesterol. Twenty-eight participants (9.9%) had HbA1C levels greater than 6.4% (Table 2).

There were 25 participants (8.9%) who were diagnosed with T2DM before the study began, and nobody could control their blood glucose properly. Among those who did not report a history of T2DM, 10.1% were new T2DM cases based on their HbA1c levels. Therefore, the total T2DM prevalence was 18.1%. Moreover, 56.0% had a low level of knowledge

Table 2 Medical history and laboratory results.

| Characteristic | n | % |
|---|-----|------|
| History of diabetes screening within the previous year | | |
| No | 151 | 53.5 |
| Yes | 131 | 46.5 |
| Father's history of diabetes | | |
| Yes | 14 | 5.0 |
| No | 161 | 57.1 |
| Unknown | 107 | 37.9 |
| Mother's history of diabetes | | |
| Yes | 12 | 4.3 |
| No | 167 | 59.2 |
| Unknown | 103 | 36.5 |
| Body mass index (BMI) | | |
| Normal (18.51-22.99) | 94 | 33.3 |
| Under standard (≤ 18.5) | 50 | 7.1 |
| Overweight (≥ 23) | 168 | 59.6 |
| Waistline | | |
| Normal (< 90 cm in males, and < 80 cm in females) | 138 | 48.9 |
| Risk of metabolic complication (≥ 90 cm in males and ≥ 80 cm in females) | 144 | 51.1 |
| Total cholesterol (mg/dL) | | |
| Normal (≤ 199) | 176 | 62.4 |
| High (≥ 200) | 106 | 37.6 |
| Triglycerides (mg/dL) | | |
| Normal (≤ 149) | 162 | 57.4 |
| High (≥ 150) | 120 | 42.6 |
| HDL cholesterol | | |
| Low (< 40 mg/dL for males, and < 50 mg/dL for females) | 154 | 54.6 |
| Normal (≥ 40 mg/dL for males, and ≥ 50 mg/dL for females) | 128 | 45.4 |
| LDL cholesterol (mg/dL) | | |
| Normal (< 100) | 92 | 32.6 |
| High (≥ 100) | 190 | 67.4 |
| Waist-to-hip ratio | | |
| Normal | 157 | 55.7 |
| Risk | 125 | 44.3 |
| HbA1c (%) | | |
| Normal (< 6.0) | 231 | 81.9 |
| Risk for diabetes (6.0- 6.4) | 23 | 8.2 |
| High/diabetes (≥ 6.5) | 28 | 9.9 |

regarding diabetes prevention and care, and 74.5% had

negative attitudes toward diabetes prevention and control (Table 3).

Table 3 T2DM among the participants.

| T2DM | n | % |
|--|-----|-------|
| Type 2 diabetes mellitus from medical history | | |
| Yes | 25 | 8.9 |
| No | 257 | 91.1 |
| Medical history and control of blood glucose | | |
| Yes | 0 | 0.0 |
| No | 25 | 100.0 |
| Type 2 diabetes mellitus from HbA1c with no medical history (new cases) | | |
| Yes | 26 | 10.1 |
| No | 231 | 89.9 |
| Total diabetes mellitus | | |
| Yes | 51 | 18.1 |
| No | 231 | 81.9 |
| Knowledge of diabetes prevention and control | | |
| Low | 158 | 56.0 |
| Moderate | 51 | 18.1 |
| High | 73 | 25.9 |
| Attitudes toward diabetes prevention and control | | |
| Negative | 210 | 74.5 |
| Neutral | 56 | 19.9 |
| Positive | 16 | 5.7 |

One-third smoked (30.9%), and used alcohol (26.2%). More than half (53.9%) reported that they did not exercise daily. A large proportion reported the use of salt (85.8% used moderate to high levels), monosodium glutamate (84.4% used moderate to high levels), and oil (82.6% used moderate to high levels) in their cooking. A total of 15.6% of the participants had a moderate to high level of stress (Table 4).

Table 4 Risk behaviors of participants.

| Behaviors | n | % |
|--|-----|------|
| Smoking | | |
| No | 195 | 69.1 |
| Yes | 87 | 30.9 |
| Alcohol use | | |
| No | 208 | 73.8 |
| Yes | 74 | 26.2 |
| Opium use | | |
| No | 275 | 97.5 |
| Yes | 7 | 2.5 |
| Methamphetamine use | | |
| No | 278 | 98.6 |
| Yes | 4 | 1.4 |
| Exercise | | |
| No | 152 | 53.9 |
| Sometimes | 92 | 32.6 |
| Everyday | 38 | 13.5 |
| Salt for daily cooking | | |
| Little | 40 | 14.2 |
| Moderate | 151 | 53.5 |
| High | 91 | 32.3 |
| Monosodium glutamate in daily cooking | | |
| Little | 44 | 15.6 |
| Moderate | 134 | 47.5 |
| High | 104 | 36.9 |
| Oil for cooking | | |
| Little | 49 | 17.4 |
| Moderate | 162 | 57.4 |
| High | 71 | 25.2 |
| Stress (ST-5) | | |
| Low | 238 | 84.4 |
| Moderate | 38 | 13.5 |
| High | 6 | 2.1 |

In the univariate model, five (5) variables were found to be associated with T2DM among the Lisu in Chiang Rai Province, Thailand: sex, oil use in cooking, stress, waistline measurement, and triglycerides. Compared to males, females had a 1.65 time greater likelihood (95%CI=1.01-3.18) of having T2DM. Those who used larger amounts of cooking oil had a 1.99 time greater likelihood (95%CI=1.16-2.55) of developing T2DM than those who used smaller amounts of oil in their cooking. Those who had high levels of stress had a 2.40 time greater likelihood (95%CI=1.19-3.56) of developing T2DM than those who had low stress levels. Those who had been categorized as at risk for metabolic complications based on waistline indicators had a 2.20 time greater likelihood (95%CI=1.16-4.16) of developing T2DM than those with a normal waistline. Those who had a high level of triglycerides had a 1.67 time greater likelihood (95%CI=1.09-3.07) of developing T2DM than those who had a normal level (Table 5).

After adjustments were made for age, sex, income, and marital status in the multivariate model, only waistline measurement was found to be associated with type 2 diabetes among the Lisu tribe in Thailand. Those who had been defined as being at risk for metabolic complications from waistline measurements (≥ 90 cm in males and ≥ 80 cm in females) had a 2.20 time greater chance (95%CI= 1.16-4.16) of developing type 2 diabetes than those who had a normal waistline measurement.

Discussion

The Lisu people in Thailand are have a low level of education and poor economic status. Most of them have unskilled jobs, such as agricultural workers, with low monthly family income. Less than a half were screened for T2DM within the previous year, and a large proportion did not know their parents' T2DM status. The majority are obese and at risk of metabolic complications due to their waistline measurements. Moreover, the Lisu people have high levels of indicators on their lipid profiles, such as high cholesterol and high LDL. The prevalence of T2DM among the Lisu was 18.1%, and among these individuals, 10.1% did not know their diabetes status. The main factor associated with T2DM among the Lisu was obesity or waistline measurement ≥ 90 cm in males and ≥ 80 cm in females.

The World Health Organization (WHO) reported that in 2018, the global prevalence of T2DM among people aged 18 years above was 8.5% [21]. In Thailand, the Ministry of Public Health reported that the prevalence of among people aged 30 years and older was 8.8% in 2018 [22]. Obviously, the Lisu people in northern Thailand have a greater risk of T2DM than the general Thai population or even people living in other regions or countries in the world. There are several risk factors for the development of T2DM among the Lisu people, such as low education and poor

Table 5 Univariate analysis of factors associated with type 2 diabetes mellitus among the Lisu.

| Factor | OR | 95%CI | p-value | Factor | OR | 95%CI | p-value |
|--|------|------------|---------|---|------|------------|---------|
| Sex | | | | Exercise | | | |
| Male | 1.00 | | | No | 0.63 | 0.27-1.50 | 0.301 |
| Female | 1.65 | 1.01-3.18 | 0.042* | Sometimes | 0.73 | 0.29-1.82 | 0.501 |
| Age (years) | | | | Everyday | 1.00 | | |
| 30-39 | 1.00 | | | Salt in daily cooking | | | |
| 40-49 | 0.45 | 0.15-1.37 | 0.158 | High | 0.79 | 0.31-2.05 | 0.627 |
| 50-59 | 0.87 | 0.33-2.26 | 0.768 | Moderate | 0.91 | 0.38-2.19 | 0.834 |
| 60-69 | 1.11 | 0.43-2.83 | 0.832 | Low | 1.00 | | |
| 70-79 | 1.54 | 0.54-4.44 | 0.422 | Monosodium glutamate in daily cooking | | | |
| ≥ 80 | 0.69 | 0.07-6.43 | 0.741 | High | 0.88 | 0.35-2.22 | 0.785 |
| Religion | | | | Moderate | 1.08 | 0.45-2.61 | 0.858 |
| Buddhism | 1.00 | | | Low | 1.00 | | |
| Other (Christianity and Islam) | 1.59 | 0.83-3.03 | 0.159 | Cooking oil | | | |
| Occupation | | | | High | 1.99 | 1.16-2.55 | 0.048* |
| Unemployed | 1.00 | | | Moderate | 0.97 | 0.42-2.22 | 0.941 |
| Agriculturalist | 0.84 | 0.41-1.71 | 0.622 | Low | 1.00 | | |
| Other | 0.88 | 0.35-2.22 | 0.784 | Stress (ST-5) | | | |
| Income per family per year (baht) | | | | Low | 1.00 | | |
| ≤ 50,000 | 1.00 | | | Moderate | 1.28 | 0.55-3.00 | 0.567 |
| 50,001-100,000 | 1.31 | 0.65-2.63 | 0.445 | High | 2.40 | 1.19-13.56 | 0.032* |
| ≥ 100,001 | 2.02 | 0.60-6.84 | 0.257 | Knowledge of T2DM prevention and control | | | |
| Family debt | | | | Low | 1.00 | | |
| No | 1.64 | 0.73-3.70 | 0.234 | Moderate | 1.36 | 0.60-3.08 | 0.459 |
| Yes | 1.00 | | | High | 1.70 | 0.85-3.40 | 0.137 |
| Marital status | | | | Attitudes toward T2DM prevention and control | | | |
| Single | 1.00 | | | Negative | 1.00 | | |
| Married | 1.61 | 0.20-13.25 | 0.659 | Neutral | 1.02 | 0.47-2.20 | 0.967 |
| Other | 2.67 | 0.30-23.39 | 0.376 | Positive | 1.56 | 0.48-5.10 | 0.463 |
| Family member (person) | | | | Body mass index (BMI) | | | |
| 0-4 | 4.79 | 0.62-37.22 | 0.134 | Normal | 1.00 | | |
| 5-8 | 4.09 | 0.62-32.32 | 0.182 | Underweight | 0.44 | 0.09-2.06 | 0.296 |
| ≤ 9 | 1.00 | | | Overweight | 0.86 | 0.45-1.63 | 0.639 |
| Living situation | | | | Waistline | | | |
| Alone | 1.00 | | | Normal | 1.00 | | |
| With spouse | 0.73 | 0.19-2.82 | 0.651 | Risk for metabolic complication | 2.20 | 1.16-4.16 | 0.015* |
| With child | 0.99 | 0.24-4.11 | 0.992 | Total cholesterol | | | |
| With relative | 0.14 | 0.01-1.50 | 0.104 | Normal | 1.00 | | |
| Father's history of diabetes | | | | High | 0.80 | 0.42-1.51 | 0.489 |
| No | 1.00 | | | Triglycerides | | | |
| Yes | 1.75 | 0.51-5.95 | 0.372 | Normal | 1.00 | | |
| Unknown | 0.83 | 0.43-1.58 | 0.563 | High | 1.67 | 1.09-3.07 | 0.049* |
| Mother's history of diabetes | | | | HDL cholesterol | | | |
| No | 1.00 | | | Low | 1.36 | 0.73-2.53 | 0.329 |
| Yes | 0.81 | 0.17-3.89 | 0.794 | Normal | 1.00 | | |
| Unknown | 0.75 | 0.39-1.44 | 0.382 | LDL cholesterol | | | |
| Smoking | | | | Normal | 1.00 | | |
| No | 1.00 | | | High | 0.57 | 0.31-1.07 | 0.079 |
| Yes | 0.82 | 0.42-1.61 | 0.562 | Waist-to-hip ratio | | | |
| Alcohol use | | | | Normal | 1.00 | | |
| No | 1.00 | | | Risk | 0.77 | 0.42-1.44 | 0.418 |
| Yes | 1.08 | 0.55-2.13 | 0.828 | | | | |

*Significant level at $\alpha=0.05$

economic status, and they lack better choices for daily dietary habits. In the final model, even obesity or waistline measurement was found to be associated with T2DM. Several studies have reported that socioeconomic status is associated with T2DM in different populations and in different countries [23-26]. In our study, it was found that waistline measurements ≥ 90 cm in males and ≥ 80 cm in females were associated with T2DM development among the Lisu people aged 30 years and older. This finding is supported by many studies from different settings. A study in China clearly demonstrated the association between waistline measurement and T2DM

development in Jinan city [27]. Two systematic reviews [28, 29] were clearly reported on the association and mechanism of obesity, particularly with high waistline measurements in both sexes, and T2DM development.

There are some limitations to this study. First, the measurements of the amount of oil, salt, and monosodium glutamate used in cooking were limited to participant self-report. We developed tools to demonstrate the use of these materials for cooking, and there were some improvements in the validity and reliability of the measurements. The level of participants' understanding of the Thai language during

the completion of the questionnaire might interfere with the accuracy of their responses to a question, particularly among those older than 50 years of age. At this point, we have helped villagers who were fluent Thai. Finally, according to the question regarding the use of oil, salt, and monosodium glutamate in participants' cooking, most of their lunches were made by other people. Thus, with a lifestyle in which individuals eat lunch outside of the home and family environment, they cannot control for oil, salt, and monosodium glutamate use in food.

Conclusion

The Lisu hill tribe people in Thailand are living in poor economic circumstances and have low levels of education. They also engage in risk behaviors such as smoking, alcohol use, and other substance abuse. Moreover, the Lisu people in Thailand regularly cook with high amounts of salt and oil. More than half of the Lisu people do not exercise regularly, and obesity and metabolic problems, particularly waistline measurements, exceed the standard in both males and females. The prevalence of T2DM among the Lisu people is greater than that among the general Thai population, and a large percentage of the Lisu people do not know their T2DM status. An effective screening test is needed to intervene in this population to clarify the actual magnitude of the problem. Furthermore, an effective public health program to reduce the use of oil in cooking and to encourage the initiation of appropriate and regular exercise should be implemented in Lisu villages.

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References

- [1] World Health Organization (WHO). Non communicable diseases, 2018. Available from: <https://www.who.int/gho/ncd/en/>. Assessed 23 Nov 2019
- [2] World Health Organization (WHO). WHO global meeting to accelerate progress on SDG target 3.4 on NCDs and mental health. Available from: <https://www.who.int/news-room/events/detail/2019/12/09/default-calendar/ncds2019>. Assessed 23 Nov 2019
- [3] World Health organization (WHO). Noncommunicable diseases: Key facts. Available from: <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>. Assessed 23 Nov 2019
- [4] Thai Health Promotion Foundation. Noncommunicable diseases in Thailand, 2018. Available from: <https://www.thaihealth.or.th/microsite/categories/5/ncds/2/173/176-กลุ่มโรค+NCDs.html>. Assessed 23 Nov 2019
- [5] Department of Disease Control, Ministry of Public Health, Thailand. Situation on NCDs prevention and control in Thailand, 2018. Available from: <http://www.thaincd.com/document/file/download/paper-manual/NCDUNIATF61.pdf>. Assessed 23 Nov 2019
- [6] Department of Disease Control, Ministry of Public Health, Thailand. Situation on NCDs prevention and control in Thailand, 2018. Available from: <http://www.thaincd.com/document/file/download/paper-manual/NCDUNIATF61.pdf>. Assessed 23 Nov 2019
- [7] Centers for Disease Control and Prevention. Smoking and diabetes. Available from: https://www.cdc.gov/tobacco/data_statistics/sgr/50th-anniversary/pdfs/fs_smoking_diabetes_508.pdf. Assessed 23 Nov 2019
- [8] American Diabetes Association. Standards for medical care in diabetes 2019. Available from: <https://clinical.diabetesjournals.org/content/early/2018/12/16/cd18-0105.full.pdf>. Assessed 23 Nov 2019
- [9] Colberg SR, Sigal RJ, Yardley JE, Ridell MC, Dunstan DW, Dempsey PC, et al. Physical activity/exercise and diabetes: a position statement of the American Diabetes Association. *Diabetes Care*. 2016; 39: 2065-79. Assessed 23 Nov 2019
- [10] Unwin DJ, Tobin SD, Murray SW, Delon C, Brady A. Substantial and sustained improvements in blood pressure, weight and lipid profiles from a carbohydrate restricted diet: an observational study on insulin resistant patients in primary care. *International Journal of Environmental Research and Public Health*. 2019; 16 (2680). DOI: 10.3390/ijerph16152680. Assessed 23 Nov 2019
- [11] Aekplakorn W, Chariyalertsak S, Kessomboon P, Assanangkornchai S, Taneepanichskul S, Putwatana P. Prevalence of diabetes and relationship with socioeconomic status in the Thai population: National Health Examination Survey, 2004-2014. *Journal of Diabetes Research*. 2018; DOI: 1654530. Assessed 23 Nov 2019
- [12] Department of Disease Control, Ministry of Public Health, Thailand. Situation on NCDs prevention and control in Thailand, 2018. Available from: <http://www.thaincd.com/document/file/download/paper-manual/NCDUNIATF61.pdf>. Assessed 23 Nov 2019

- [13] Srivanichakorn S. Morbidity and mortality situation of non-communicable diseases (diabetes type 2 and cardiovascular diseases) in Thailand during 2010-2014. *Disease Control Journal*. 2017; 43(4): 379-90. Assessed 23 Nov 2019
- [14] Diabetes Association of Thailand under The Patronage of Her Royal Highness princess Maha Chakri Siridhorn. *Clinical practice guideline for diabetes 2017*. Available from: <https://www.dmthai.org/attachments/article/443/guideline-diabetes-care-2017.pdf>. Assessed 23 Nov 2019
- [15] Apidechkul T. Prevalence and factors associated with type 2 diabetes mellitus and hypertension among the hill tribe elderly populations in northern Thailand. *BMC Public Health*. 2018; 18: 694. <https://doi.org/10.1186/s12889-018-5607-2>. Assessed 23 Nov 2019
- [16] Apidechkul T. A 20-year retrospective cohort study of TB infection among the Hill tribe HIV/AIDS populations, Thailand. *BMC Infectious Disease* 2016; 16:72. Assessed 23 Nov 2019
- [17] Apidechkul T. Epidemiology of Hill tribe HIV population, Thailand. *Journal of the Medical Association of Thailand* 2016; 99(6): 702-10. Assessed 23 Nov 2019
- [18] Tamornpark R, Apidechkul T, Upala P, Inta C. Factors associated with type 2 diabetes mellitus among the elderly hill tribe population in Thailand. *Southeast Asian Journal of Tropical Medicine and Public Health*. 2017; 48(5): 1072-82. Assessed 23 Nov 2019
- [19] Department of Mental Health, Ministry of Public Health. *Stress-5*. Available from: <https://www.dmh.go.th/test/qttest5/>.
- [20] The hill tribe welfare and development center, Chiang Rai province . Hill tribe population. The hill tribe welfare and development center. Chiang Rai: Ministry of Interior; 2016; 13–21.
- [21] World Health Organization (WHO). *Diabetes 2018*. Available from: <https://www.who.int/news-room/fact-sheets/detail/diabetes>.
- [22] Department of Disease Control. *Situation of T2DM in Thailand, 2018*. Available from: <http://thaincd.com/document/file/download/parameter-manual/Annual-report-2015.pdf>
- [23] Hsu CC, Lee CH, Wahlqvist ML, Huang HL, Chang HY, Chen L, et al. Poverty increases type 2 diabetes incidence and inequality of care despite universal health coverage. *Diabetes Care*. 2012; 35: 2286-92.
- [24] Haghghatpanah M, Nejad ASM, Haghghatpanah M, Thuga G, Mallayasamy S. Factors that correlate with poor glycemic control in type 2 diabetes mellitus patients with complication. *Osong Public Health and Research Perspective*. 2018; 9(4): 167-74.
- [25] Sami W, Ansari T, Butt NS, Hamid MR. Effect of diet on type 2 diabetes mellitus: a review. *Int J Health Sci (Qassim)*. 11(2): 65-71.
- [26] Nam GE, Han B, Joo CL, Kang SY, Lim J, Kim YH, et al. Poor control of blood glucose, life style, and cardiometabolic parameters in younger adult patients with type 2 diabetes mellitus. *Journal of Clinical Medicine*. 2019; 8: 1405. DOI: 10.3390/jcm8091405.
- [27] Wang S, Ma W, Yuan Z, Wang Z, Wang S, Yi X, et al. Association between obesity indices and type 2 diabetes mellitus among middle-aged and elderly people in Jinan, China, a cross sectional study. *BMJ Open*. 2016; 6(11): e012742.
- [28] Al-Goblan AS, Al-Alfi MA, Khan MZ. Mechanism linking diabetes mellitus and obesity. *Diabetes Metab Syndr Obes*. 2014; 7: 587-91.
- [29] Saboor AS, Reddy N, Smith E, Barber TM. Obesity and type 2 diabetes mellitus. *Internal Medicine: Open Access*. 2014; S6. DOI: 10.417/2165-8048.

Needle Stick Injuries among Nurses in China: Meta-analysis

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ABSTRACT

Background: Needle stick injury is a common occupational injury in all clinician who are working in health care setting. It leads to increase the risk of getting blood-borne diseases infections. Nurses are the main victims of needle stick injuries among health workers, and needle stick injuries expose higher risks among them in developing countries, especially in populous countries such as China. More than half of Chinese nurses face the risk of needle stick injuries in their busy nursing work. **Objective:** This study aims to assess the prevalence of needle stick injuries among nurses in China in the past decade by meta-analysis. **Methods:** We reviewed all relevant literatures in the PubMed, Science Direct, PMC and CNKI databases and conduct meta-analysis to find the associated factors for needle injuries among the nurses. By removing duplicate articles, filtering articles by title and abstract, and filtering the article based on inclusion criteria, the number of articles that were eventually included in the study was 16 articles. **Results:** The results showed that the prevalence of needle stick injuries among nurses in China was 57.3% (95%CI= 0.46-0.69). The prevalence of needle stick injuries among nurses in China had declined in the past decade. **Conclusion:** Needle stick injuries in China could be reduced the risk by improving for the nurses particularly strengthening occupational safety training for nurses, increasing protective equipment for needle stick injuries, and optimizing the working environment of hospitals.

Keywords: *Needlestick injuries, China, Nurse, Occupational exposure*

Introduction

Based on China's huge population and the "Healthy China 2020" initiative, China has now established a relatively complete health care system. However, the establishment of China's health care system has experienced a long history. It is mainly composed of four stages.

The first stage (1949-1983), due to lack of health resources, China established a Rural Cooperative Medical System (RCMS) in rural areas consisting of traditional Chinese traditional medicine practitioners in rural areas. The system provides farmers with basic medical and health care services. Government officials and workers living in cities enjoy a free labor medical security system paid by the government and businesses. The system's health care services are provided by professional doctors and nurses. The doctors are mainly general practitioners, and the education level of nurses is only secondary school education [1].

The second stage (1984-2002), due to the economic reforms in China, the fully established RCMS system collapsed and farmers did not receive free medical insurance. At this stage, farmers could go to

rural private clinics and urban public hospitals for medical treatment, but they need to pay for them by individuals. In the city, in order to reduce the medical and economic burden of the government and enterprises, the Urban Employee Basic Medical Insurance (UEBMI) system has been established. The government and enterprises pay part of the expenses for individuals, and individuals can pay for medical expenses themselves. At this stage, doctors began to change from general practitioners to specialists, medical assistants began to specialize, and nursing also established an undergraduate education system [1-3].

The third stage (2003-2008), the government established the New Rural Cooperative Medical Scheme (NRCMS) system to fully protect farmers' health care services and the Urban Residents Basic Medical Insurance (URBMI) to offer the health care serves for unemployed, elderly, students, women and children in the city. At this stage, the doctor's degree is generally above the bachelor's degree, the urban doctors reach the master's degree or above, and the nurses and other health care practitioners have generally established a relatively

complete medical education system for undergraduate-master's-doctoral [4, 5].

The fourth stage (2009-present), China has gradually established a relatively complete Chinese health care system consisting of professional public health services, primary public health and clinical care, curative health care and rural health care systems. Professional public health services are mainly composed of Centers of Disease Control and Prevention (CDC) at all levels and women's and children's health institutions. Primary public health and clinical care is mainly composed of community health service centers and rural government clinics, which provide basic medical and health care services for urban residents and farmers. Curative health care is mainly composed of secondary and tertiary medium and large hospitals, which provide professional medical services for critically ill patients. Rural health care systems consist of rural private clinics, which are partially funded by the government to protect farmers in poor and remote areas without rural government health facilities [1, 6].

Today, a more comprehensive health care system has made more and more Chinese urban residents have more choices in health care. Most urban residents distinguish between clinical treatment and health care, modern medicine has become the first choice for clinical treatment, and traditional Chinese medicine plays an important role in preventing disease and body health [7]. This has slowed the development of Chinese medicine hospitals in recent years, and the number of outpatients and hospitalizations in modern medicine hospitals has increased significantly. At the same time, it also exacerbates the work pressure of nurses and other health workers in modern medical hospitals [8].

As of 2015, the total number of registered nurses in China was 3.24 million, and the number of registered nurses per thousand population reached 2.36 [9]. They are distributed at all levels of health care institutions, nursing education institutions and public health agencies. In these institutions, they play the important roles of caregivers for patients, planner of the nursing program, manager of the nursing works, educator of nursing knowledge, coordinator of clinical works, advocate of patient benefit and the researcher in nursing science [10]. American Association of Critical-Care Nurses (AACN) defines the core competence of nurses as critical thinking, assessment, communication, and technical skills [11]. At present, the highest level of expectation for clinical nurses in Chinese patients is communication skill and technical skill, because good communication between nurses and patients and superb nursing technology have become the important part of the hospital experience hospital service in recent years [12]. However, as the patient's expectations for the nurse grow, the burden of work among nurses increases.

Nurses face many contradictions and problems in clinical work, but they have not yet been effectively solved. The most important work burden comes from the

following four aspects. The first aspect is medical violence and occupational injuries. In the past year, nearly 41.2% of nurses experienced violence by patients or their families. In addition, about 79.0% of nurses have suffered sharp and needle stick injuries at work. In the second aspect, nurses are unable to obtain sufficient recognition and respect from patients and society. 83.3% of nurses experienced an intense relationship between nurses and patients. In addition, more than 90.0% of Chinese nurses believe that the public has a narrow understanding of the work content of nurses, and the public does not have enough respect for the nurses. In the third aspect, nurses bear a heavier financial burden. 76.5% of nurses earn less than \$700 a month. In terms of nursing training, 67.7% of the nurses' units do not provide support for nurse training. In the fourth aspect, the nurse suffers from a heavier clinical workload and psychological burden. Nearly 10.0% of nurses work more than 60 hours a week. In addition, 86.0% of nurses need psychological counseling and mental decompression due to poor nurse-patient relationship and high work intensity [13].

Due to the work burden of nurses, how to deal with the increasingly tight relationship between nurses and patients and improve social recognition? How to ease the stress and psychological burden of nurses? How to improve the quality of nursing, reduce the sharp and needle stick injuries to ensure the occupational safety of nurses? These are the challenges facing current and future Chinese nurses. Among them, the most important challenge in the clinical work of nurses is how to reduce sharp and needle stick injuries.

Needle stick injury (NSI) is a common occupational injury that caused by clinical needles such as hypodermic needles, blood collection needles, intravenous (IV) cannula or needles used to connect part of IV delivery systems, it brings health workers the opportunity to be infected with blood-borne diseases [14-16]. After a needle stick injury, the infected blood or body fluid enters the human body through the wound, which may cause health workers to have a high risk of contracting Hepatitis B, Hepatitis C and HIV/AIDS [17].

Nurses are the most vulnerable group of all health workers to get needles stick injuries, because they provide the most common clinical needles and sharps in clinical service to patients [18]. Needle stick injuries have a great impact on them, which exacerbates their psychological burdens such as anxiety and depression [19, 20]. In addition, the average cost of \$747 for nurses suffering from needle stick injuries also increases the financial burden on governments and medical institutions [21].

Needle stick injuries among nurses have a high prevalence in developing countries, especially in some populous countries. In India, the prevalence of needle stick injuries in nurses in clinical work is as high as 75.8% [22]. In Pakistan and Iran, they also reached 44.0% and 41.2% respectively [23, 24]. The prevalence

of needle stick injuries in these countries is much higher than that of developed countries such as the UK (25.0%) and Italy (13.9%) [25, 26]. But in China, the prevalence of nurse needle stick injuries has reached an astonishing 64.9%, this data is much higher than the average of the worldwide prevalence of needle stick injuries [27].

At the present, due to the large time span of reports on needle stick injuries and the large difference in sample size and the prevalence of needle stick injuries among nurses in China, this has brought certain difficulties to clinical reference. This study intends to combine the previous studies by meta-analysis to analyze the overall prevalence of needle stick injuries among nurses in China and the prevalence of needle stick injuries with years.

Methods

The meta-study in this study was to review the prevalence of needle stick injuries among nurses in China and the prevalence of needle stick injuries with years. The inclusion criteria for data collection are mainly the following four items; 1) The selection of the article comes from the databases of PubMed, Science Direct, PMC and CNKI from January 2010 to September 2019; 2) Published in English and Chinese languages; 3) English articles are peer-reviewed articles, and Chinese articles are from Chinese core journals included in PKU; 4) The following keywords appear in the title or abstract: needle stick injury, occupational exposure, prevention, sharp injury, nurse, and; 5) Research design for cross-sectional study.

In the process of data processing, the researchers combined the data on the prevalence of needle stick injuries among nurses in China and the prevalence of needle stick injuries with years in all the literature. Before the data was merged, the investigator tested the heterogeneity of the included data. This study used the chi-square test to test the heterogeneity of the data, p -value = 0.100 and heterogeneity of data included in I^2 analysis while 25.0% was low grade heterogeneity, 25.0%-50.0% was medium grade heterogeneity, >50% was high grade heterogeneity. When p -value >0.100 and I^2 are satisfied, there was no heterogeneity between studies. The data was analyzed by Stata 15.1. The result showed the prevalence of needle stick injury from the forest plot, and the prevalence of needle stick injuries in different years from the line graph.

Results

General situation of inclusion of research results: according to the Chinese and English database search results, a total of 998 Chinese literature and 136 English articles were included. Then, exclude articles of 1,008 that did not match by reading the title and abstract of the literature. Then through reviewing the remaining literature, a total of 110 articles that did not meet the inclusion criteria. Finally, the total number of articles included in the standard were 16 and the total number of nurses were 3,167 (Figure 1).

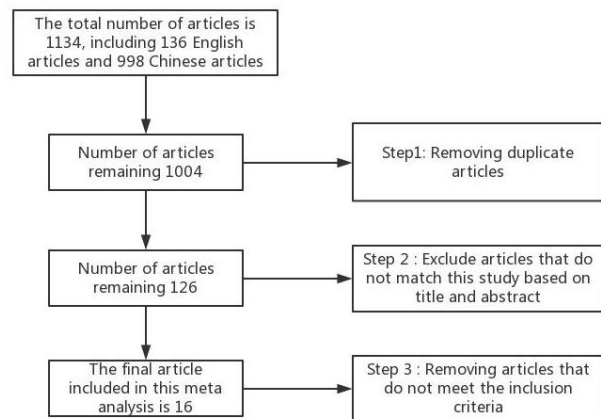


Figure 1 Process of selecting articles for review.

The study showed that a total of 1,939 nurses had at least one needle stick injury in the clinical work. Heterogeneity test showed greater heterogeneity between studies, $I^2 = 98.2\%$, p -value <0.010. Therefore, this study used a random effects model to merge data. The meta-analysis shows that the prevalence of needle stick injuries among nurses was 57.3% (95%CI=0.46 - 0.69) (Figure 2). The prevalence of needle stick injuries in different years shows that the decline in the prevalence of needle stick injuries among Chinese nurses in recent years (Figure 3).

The investigators used the egger test during the merger of prevalence of needle stick injuries and did not detect statistically significant publication bias, p -value >0.050.

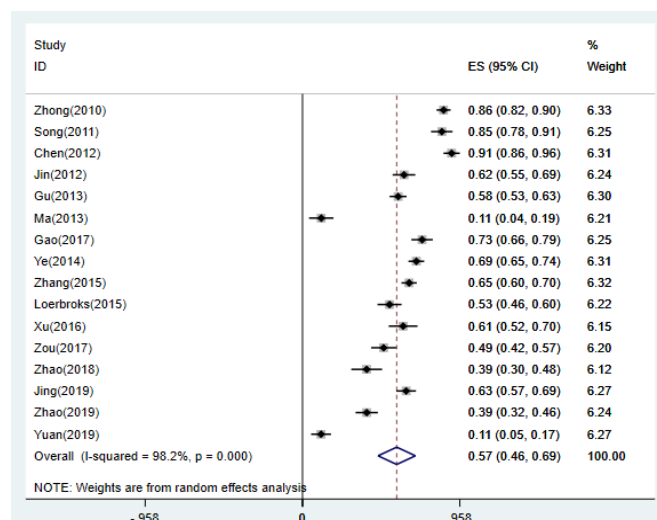


Figure 2 The meta analysis of prevalence of needle stick injuries among nurses in China

Discussion

This meta-analysis shows that there is a large difference in the prevalence of needle stick injuries between the various literature. The prevalence of needle stick injuries investigated by Chen in 2012 [28] was as

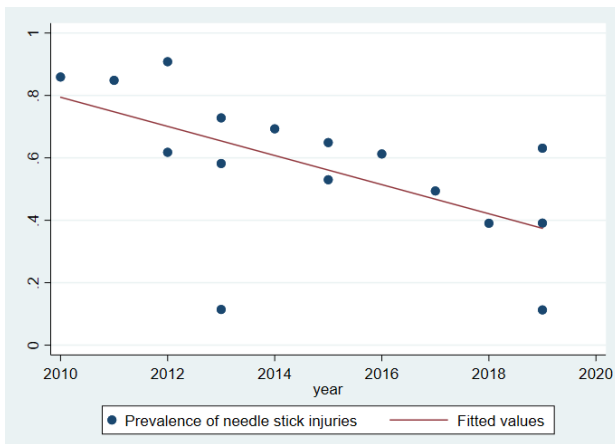


Figure 3 The prevalence of needle stick injuries among nurses in China in different years

high as 91.0%, while the lowest prevalence of needle stick injuries appeared in the literature from Ma (11.0%) and Zhao (11.0%) [34,41], but the result of this meta-analysis shows that the prevalence of needle stick injuries among nurses in China is 57.3%. It's not optimistic that the result is significantly higher than that of China's neighboring Korea (36.4%), Japan (4.8%) and Thailand (27.0%) [44-46]. However, it's relatively low compared to other populous countries in developing countries such as India (75.8%) and Indonesia (71.9%) [22, 47].

The prevalence of needle stick injuries depends mainly on hospital conditions and standards, overcrowded and noisy environments, education levels, knowledge, attitudes and skills of caregivers. In addition, cultural background and differences in the ability to access social resources are also the main causes of needle stick injuries in different regions [48]. Through time stratification analysis, the researchers found that the prevalence of needle stick injuries among nurses in China has gradually declined in the past decade. This has a great relationship with the nursing education institutions and hospitals in China in recent years to strengthen the occupational safety education for nurses and strengthen the safety supervision measures [49]. The number of needle stick injuries in Chinese nurses has gradually declined in the past decade, but this trend is slow, and there is still a big gap between the control level of needle stick injuries in developed countries. Therefore, how to continuously strengthen nurses' occupational safety education and formulate strategies to prevent needle stick injuries is still a problem that Chinese health departments, nursing education institutions and hospitals need to face for a long time.

The current research has certain limitations in two aspects. The first aspect is based on a large number of reports that Chinese nurses reported lower rates after needle stick injuries, which led to greater differences in the prevalence of statistical needle stick injuries in various literature [50, 51]. The second aspect is due to

the lack of information provided by some literature, the large differences between the study areas, the different follow-up times of each study, the small sample size, and the different hospital grades included in the study, it led to a large heterogeneity in this meta-analysis. This heterogeneity limits the scope of interpretation of the research results, but the combined effect value has a certain reference value in discussing the prevalence of needle stick injuries among nurses in China.

Conclusion and suggestion

Needle stick injuries have a high prevalence among nurses in China, but the prevalence of needle stick injuries has declined in the past decade. Nursing education institutions and hospitals can reduce nurses' needle stick injuries by strengthening occupational safety training for nurses, increasing protective equipment for needle stick injuries, and optimizing the working environment of hospitals.

The researcher suggest that future research can accurately assess the epidemiological situation of needle stick injuries among nurses in China, and that meta-analysis can be used to assess the differences in the prevalence of needle stick injuries among Chinese nurses and other national nurses. The researchers also suggest that future research can investigate the differences in nurses and other health workers in needle stick injuries.

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References

- [1] Sun Y, Gregersen H, Yuan W. Chinese health care system and clinical epidemiology. *Clin Epidemiol.* 2017; 9: 167-78.
- [2] Blumenthal D, Hsiao W. Lessons from the East--China's rapidly evolving health care system. *N Engl J Med.* 2015; 372: 1281-5.
- [3] Blumenthal D, Hsiao W. Privatization and Its Discontents — The Evolving Chinese Health Care System. *N Engl J Med.* 2005; 353: 1165-70.
- [4] Dong H, Duan S, Bogg L, et al. The impact of expanded health system reform on governmental contributions and individual copayments in the new Chinese rural cooperative medical system. *Heal Plan Manag.* 2016; 31(1): 36-48.
- [5] Zhou Z, Zhu L, Zhou Z, et al. The effects of China's urban basic medical insurance schemes on the equity of health service utilisation: Evidence from Shaanxi Province. *Int J Equity Health.* 2014; 13(1): 1-11.

- [6] Li L, Fu H. China's health care system reform: Progress and prospects. *Heal Plan Manag.* 2017; 32(3): 240-53.
- [7] Xu J, Yang Y. Traditional Chinese medicine in the Chinese health care system. *Health Policy (New York)*. 2009; 90(2-3): 133-9.
- [8] Jin L. From mainstream to marginal? Trends in the use of Chinese medicine in China from 1991 to 2004. *Soc Sci Med.* 2010; 71(6): 1063-7.
- [9] Xu Y, Wu Y, Zhang Y, et al. Investigation of nursing human resources in Chinese hospitals. *Chinese J Nurs.* 2016; 51(7): 819-22.
- [10] Sun X, Xiang W, Ye Z. An attempt to diversify the role of nurses. *Chinese J Hosp Adm.* 2003; 19(9): 573-5.
- [11] Institute of Medicine (US) Committee on the Robert Wood Johnson Foundation Initiative on the Future of Nursing at the I of M. *The Future of Nursing: Leading Change, Advancing Health.* 1st ed. Shalala DE, editor. Washington DC: National Academies Press (US); 2011; 21-47
- [12] Lan M, Meng Y, Wang S, et al. The patients' expectations on nurses' professional competence. *Chinese J Nurs.* 2014; 49(7): 878-80.
- [13] China Social Welfare Foundation. White Paper on the Survey of the Status of Chinese Nurses [Internet]. *Xinhuanet.* 2017 [cited 2019 Oct 14]. p. 1-2. Available from: http://www.xinhuanet.com//gongyi/2017-05/11/c_129601688.htm
- [14] Matsumoto H, Sunakawa M, Suda H, et al. Analysis of factors related to needle-stick and sharps injuries at a dental specialty university hospital and possible prevention methods. *J Oral Sci.* 2019; 61(1):164-70.
- [15] Senthil A, Anandh B, Jayachandran P, et al. Perception and prevalence of work-related health hazards among health care workers in public health facilities in Southern India. *Int J Occup Environ Health.* 2015; 21(1): 74-81.
- [16] Muralidhar S, Singh PK, Jain RK, et al. Needle stick injuries among health care workers in a tertiary care hospital of India. *Indian J Med Res.* 2010; March (131): 405-10.
- [17] Leong X, Yee F, Leong Y, et al. Incidence and analysis of sharps injuries and splash exposures in a tertiary hospital in Southeast Asia: a ten-year review. *Singapore Med J.* 2019:1-16.
- [18] Jończyk A, Szczypta A, Talaga-Ćwiertnia K. Injures as exposure events in providing medical services by nursing staff. *Przegl Epidemiol.* 2018; 72(3): 371-81.
- [19] Ishimaru T, Wada K, Huong HTX, et al. Nurses' attitudes towards co-workers infected with HIV or hepatitis B or C in Vietnam. *Southeast Asian J Trop Med Public Health.* 2017; 48(2): 376-85.
- [20] Wang C, Huang L, Li J, et al. Relationship between psychosocial working conditions, stress perception, and needle-stick injury among healthcare workers in Shanghai. *BMC Public Health.* 2019; 19(1): 1-11.
- [21] Cooke CE, Stephens JM. Clinical, economic, and humanistic burden of needlestick injuries in healthcare workers. *Med Devices.* 2017; 1(10): 225-35.
- [22] Bagdey P, Humne A, Wankhede S, et al. Needle Stick Injuries Among Staff Nurses in a Tertiary Care Hospital of Central India. *Asian Pacific J Heal Sci.* 2014; 1(3): 149-54.
- [23] Hassnain S, Hassan Z, Amjad S, et al. Needle stick injuries among nurses of two tertiary care hospitals of Lahore: A KAP study. *J Pak Med Assoc.* 2017; 67(12): 1874-8.
- [24] Ghasemi M, Khabazkhoob M, Hashemi H, et al. The incidence of needle stick and sharp injuries and their associations with visual function among hospital nurses. *J Curr Ophthalmol.* 2017; 29(3): 214-20.
- [25] Saia M, Hofmann F, Sharman J, et al. Needlestick Injuries: Incidence and Cost in the United States, United Kingdom, Germany, France, Italy, and Spain. *Biomed Int.* 2010; 1(2): 41-49.
- [26] Veronesi L, Giudice LD, Agodi A., et al. A multicentre study on epidemiology and prevention of needle stick injuries among students of nursing schools. *Annali di igiene : medicina preventiva e di comunita,* 2018; 30(5): 99-110.
- [27] Xujun Z, Yue G, Mengjing C, et al. Needlestick and sharps injuries among nurses at a teaching hospital in China. *Work Heal Saf.* 2015; 63(5): 219-25.
- [28] Chen H. Current status of needle stick injuries in nurses of grass-root hospital and countermeasures. *Chinese J Nosocomiology.* 2012; 22(9): 1841-3.
- [29] Gao X, Hu B, Suo Y, et al. A large-scale survey on sharp injuries among hospital-based healthcare workers in China. *Sci Rep.* 2017; 7(42620): 1-7.
- [30] Gu Y, Chen C, Cheng K, et al. Analysis of needlestick and sharps injuries among medical staff in upper first-class hospital. *Chinese J Ind Hyg Occup Dis.* 2013; 31(1): 41-4.
- [31] Jin F, Wang G. Investigation on occupational exposure status of nursing staff. *Chinese J Disinfect.* 2012; 29(11): 1040-1.
- [32] Jing W, Chen X, Xu M, et al. Investigation on the "Four High" injury of acute instrument in clinical nurses and protective measures. *Int J Nurs.* 2019; 38(13): 1950-3.
- [33] Loerbroks A, Shang L, Angerer P, et al. Psychosocial work characteristics and needle

- stick and sharps injuries among nurses in China: a prospective study. *Int Arch Occup Environ Health*. 2015; 88(7): 925-32.
- [34] Ma J, Hou Q, Liang X. Causes of needle stick injuries among nurses and intervention measures. *Chinese J Nosocomiology*. 2013; 23(23): 5776-7.
- [35] Song P, Zhou J, Wang Y. Monitoring and analysis of needle stick injuries events in clinical nurses. *Chinese J Nosocomiology*. 2011; 21(14): 3005-7.
- [36] Xu Y, Wu Y, Zhang Y, et al. Investigation of nursing work status in Chinese hospitals. *Chinese J Nurs*. 2016; 51(8): 947-50.
- [37] Ye H, Fan H. Investigation on medical personnel's occupational exposure to blood-borne pathogens. *Chinese J Disinfect*. 2014; 31(5): 488-9.
- [38] Yuan W, Sun L, Wang Z. Analysis of needlestick injuries and depression among the female medical staff in a city district in 2018. *Chinese J Ind Hyg Occup Dis*. 2019; 37(6): 443-5.
- [39] Zhang X, Gu Y, Cui M, et al. Needlestick and sharps injuries among nurses at a teaching hospital in China. *Work Heal Saf*. 2015; 63(5): 217-9.
- [40] Zhao F, Zhang M, Xuan J, et al. A Large-Scale Cross-Sectional Survey on Needle-Stick Injuries Related to Injections of Antidiabetics in China: Incidence and Infection Rates. *Value Heal*. 2018;21(1): S72.
- [41] Zhao F, Zhang M, Xuan J, et al. Burden of insulin injection-related needlestick injuries in mainland China—prevalence, incidence, and healthcare costs. *Int J Nurs Stud*. 2019; 97: 78-83.
- [42] Zhong W, Cai S, Zhong H. Investigation and analysis of psychological state after needle stick injury among nurses. *Chinese J Pract Nurs*. 2010; 26(24): 79-80.
- [43] Zou Z, Yang Y, Wang Y, et al. Needle-stick injuries among health care workers and protective strategies in a hospital. *Chinese J Infect Control*. 2017; 16(6): 548-50.
- [44] Jeong IS, Jeong JS, Sohn JS, et al. Prospective and Retrospective Incidence and Post-exposure Reporting of Needlestick Injuries. *Korean J Nosocomial Infect Control*. 2015; 20(1): 29-36.
- [45] Yoshikawa T, Wada K, Lee JJ, et al. Incidence Rate of Needlestick and Sharps Injuries in 67 Japanese Hospitals: A National Surveillance Study. *PLOS ONE*. 2013;8(10): e77524.
- [46] Setthamas M, Sawaengdee K, Theerawit T, et al. Incidence and risk factors of needle stick and sharp injuries among registered nurses in Thailand. *J Public Heal Dev*. 2018; 16(1): 17-28.
- [47] Bhaskaran Unnikrishnan RH. Occupational Exposure to Needle Stick Injuries among Health Care Personnel in a Tertiary Care Hospital: A Cross Sectional Study. *J Community Med Health Educ*. 2014;s2(01):004.
- [48] Ghanei Gheshlagh R, Aslani M, Shabani F, et al. Prevalence of needlestick and sharps injuries in the healthcare workers of Iranian hospitals: an updated meta-analysis. *Environ Health Prev Med*. 2018;23(1):44.
- [49] Zhang Y, Wang L. Protection Education towards Needle Stick Injuries among Nursing Students in China:A Meta-Analysis. *Chinese J Evidence-Based Med*. 2013; 13(6): 754-9.
- [50] Ma D, Zhou X, Wang F. Analysis of the low reporting ratio in the investigation of the occupation exposure in nurse midwives. *Chinese J Nurs*. 2006; 41(4): 328-9.
- [51] Cao S, Zhao Q, Zhang G. Survey on the occupational blood exposure among nursing staff in Chongqing. *Mod Prev Med*. 2009; 36(16): 3017-9.