Research Note（Non-Peer Reviewed Paper）（研究ノート）

Awareness, treatment, and control of hypertension and type 2 diabetes among male industry workers in Jaipur, India

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ABSTRACT

Background: Understanding levels of prevalence, awareness, treatment, and control of hypertension (HTN) and type 2 diabetes (T2D) is important for effective prevention of non-communicable diseases. However, these data are still insufficient, particularly among industry workers in India. **Objectives:** This study investigated HTN and T2D awareness, treatment, and control in urban industry workers in Jaipur, India. **Methods:** A cross-sectional survey using a questionnaire and health checkups was conducted in March 2018. Two hundred and fifty-nine (259) male factory and office workers participated in the survey. The questionnaire data included the participants' sociodemographic information, awareness, treatment, and control behaviors. The health checkup data included the participants' blood pressure, blood glucose, height, body weight, and other clinical outcomes. **Results:** The health checkup found that 36.3% and 13.7% were newly diagnosed as having HTN or T2D, respectively. Among participants who were "newly diagnosed" or "already diagnosed before" as having HTN" (n=106), the percentages of those who were already aware of having HTN (awareness), were taking any HTN drugs (treatment), and were controlled for HTN (control) were only 20.8%, 18.9% and 4.7%, respectively. Among participants who were "newly diagnosed" or "already diagnosed before" as having T2D (n=52), the percentages of those who were aware of having T2D (awareness), were taking any T2D drugs (treatment), and were controlled for T2D (control) were 44.2%, 28.8% and 13.5%, respectively. **Conclusion:** Levels of awareness, treatment, and control of HTN and T2D among rural industry workers in Jaipur are lower than those in previous studies in India. To improve these levels, regular health checkups targeting industry workers are needed in India.

Keywords: Awareness, treatment, control, hypertension, type 2 diabetes, health checkup, industry workers, India

Introduction

In India, non-communicable diseases (NCDs) such as hypertension (HTN), type 2 diabetes (T2D), and other cardiovascular diseases (CVD) account for more than 60% of all deaths [1]. HTN caused 1.6 million deaths and 33.9 million disability-adjusted life years, which is the most important cause of disease burden in recent India [2]. In addition, India has an estimated 77 million people with diabetes, which makes it the second-most affected in the world, after China [3]. The number is projected to increase to 134 million by 2045 [3]. Many studies have been conducted to estimate the HTN and T2D prevalence, awareness, treatment, and control [4-8] and they found that the levels of awareness, treatment, and control of HTN and T2D are very low in India. According to the most recent systematic reviews, 29.8% of Indians have HTN [4,5]. Among the HTN patients in rural India, only 25% were previously aware of having HTN, 25% were treated, and only 11% had their HTN under control [4,5]. However, these percentages vary widely by different regional areas in India due to diversity in sociocultural and economic conditions, risk factors, and the quality of healthcare services provided [4,5]. Although plausible studies on HTN and T2D prevalence, awareness, treatment, and control were previously conducted in India [4-8], very few have focused on the relationship among awareness, treatment, and control of HTN and T2D [4]. Increasing the awareness, treatment, and control of HTN and T2D will reduce the morbidity and mortality of CVD [9-11]. Determining characteristics of those who are aware, treated, and controlled for HTN and T2D will be useful in developing and implementing more targeted and cost-effective NCD prevention and control programs in India [4]. Industrial workplace is an appropriate setting for health promotion and disease prevention for working-age adults in an urban community [12-16]. Such interventions have the potential to reach a significant proportion of adults who are employed, particularly when industries are willing to take an active role in workplace health initia-

tives to promote their employees' health conditions [14-16]. The aim of this study is to investigate the relationships among those who are aware, treated, and controlled for HTN and T2D in industry workers in Jaipur, India.

Methods

Data Source and Data Collection Procedures (Figure 1)

Data were collected from 376 factory or office workers who agreed to participate in Portable Health Clinic (PHC) health checkup services in March 2018 at the Saras Jaipur Dairy (SJD or Jaipur Zila Dugdh Utpadak Sahakari Sangh, Ltd. Jaipur). Of 376 participants, 261 (69.4%) were male factory or office workers. SJD is one of the largest government milk product companies located in Jaipur District, Rajasthan State. According to the 2018 company profile, SJD has more than 500 office employees. SJD was chosen because of scares of a regular health checkup system for their employees and the high demand on PHC services. Participants' eligibility criteria were: those aged 15 years or older, who provided written consent forms, and voluntarily willing to participate in. Two individuals younger than 15 years were excluded from the analysis. The total sample size for analysis was 259. Prior to the implementation of PHC services, our field research coordinators had several initial preparation meetings with SJD managers to schedule and arrange the health checkups and surveys. Randomly selected participants were identified and booked by local research coordinators for four days PHC services in the large facility room in the factory compound. The field research team consisted of field research coordinators, field supervisors, healthcare workers, survey interviewers, IT data managers, and registration staff from the Biyani Group of Colleges, who were locally recruited and trained. The PHC services and survey questionnaires were provided in Hindi to all participants during the PHC health checkups and questionnaire surveys. The interviewers explained the purpose of the survey and its confidentiality, in accordance with the prin-

ciples of the Declaration of Helsinki. At each survey, participants' basic socio-demographic, behavioral, attitudinal, and health-related information were collected using standardized questionnaires. In addition, the following clinical data were measured or tested without any charges: 1) height, 2) weight, 3) hip circumference, 4) waist circumference, 5) body temperature, 6) systolic blood pressure, 7) diastolic blood pressure, 8) blood glucose, 9) blood hemoglobin, 10) urinary glucose, 11) urinary proteins, 12) pulse rate, and 13) blood cholesterol. More detailed methodologies, including color-coded logic, privacy, and security in collecting patients' personal health data, have been described elsewhere [17-20].

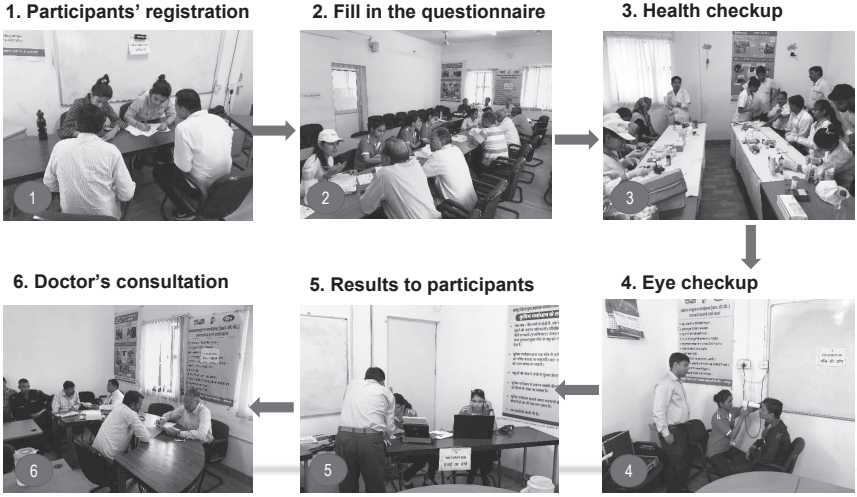

Figure 1: Process of PHC health checkups and questionnaire surveys for SJD factory and office workers in India

Measurements

HTN was defined as having a systolic blood pressure of greater than 140 mmHg or a diastolic blood pressure of greater than 90 mmHg. T2D was defined as having a blood glucose level greater than 126 mg/dL for fasting participants who reported that they did not eat or drink anytime except water in the morning, and 200 mg/dL for non-fasting participants. These definitions were based on the WHO criteria. Based on these definitions, HTN and T2D were classified dichotomously as either "yes" or "no."

Blood pressure and blood glucose were measured using the OMRON HEM 7130 and the OMRON HGM-112 Glucometer (OMRON Corporation, Kyoto, Japan), respectively. Awareness of HTN and T2D was defined by participants' self-report about whether they had ever been diagnosed as having HTN or T2D in the past. Treatment of HTN and T2D was defined as the self-reported current use of any medicines or drugs for HTN or T2D. HTN control was defined as having a blood pressure of less than 140/90 mmHg after having been previously diagnosed with HTN or currently using any antihypertensive drugs. Control of T2D was defined as having blood glucose level of less than 126 mg/dL for fasting or 200 mg/dL for non-fasting participants after having been previously diagnosed as having T2D or current using any medicines or drugs for T2D. Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2), and categorized into the following four sub-groups: BMI less than 23 was "healthy", BMI between 23 and 25 was "slightly overweight", BMI between 25 and 30 was "overweight", and BMI more than 30 was "obese". The BMI cut-off value between the "healthy" and the "slightly overweight" groups was 23 instead of the international standard of 25, due to vast majority of previous studies on BMI in South Asia suggesting that BMI 23 is better cut-off value than 25 because of the increased risk of "life-style diseases" including HTN and diabetes [21-23].

Data Analysis

A total of 261 male individuals participated in both the PHC health checkup services and the questionnaires during the study period. Among these individuals, those younger than 15 years (two cases) were excluded from the analysis. Thus, the total sample size for analysis was 259.

Pearson's chi-square test was performed to describe the inter-relationships among those who were newly found to have HTN or T2D, those who were currently using HTN or T2D drugs, and those who were previously diagnosed as having HTN or T2D. All statistical analyses were performed using SPSS version 21 (IBM Corp., Armonk, NY, USA). A P-value of less than 0.05 was considered significant.

Results

Table 1 shows participant sociodemographic characteristics and their health status, including their awareness and treatment status. More than half of the participants (52.5%) were 40 years of age or older, with a mean age of 43.4 years. More than 15% of participants (15.8%) were illiterate. The percentages of those who were overweight (BMI = 25-30) and obese (BMI = 30+) were 39.8% and 7.7%, respectively. The percentages of participants who reported having ever been diagnosed as having HTN (awareness) and currently using antihypertensive drugs (treatment) were only 8.5% and 9.7%, respectively, although more than one-third of all participants (36.3%) were newly diagnosed as HTN. Similarly, the percentages of participants who reported having ever been diagnosed as T2D (awareness) and currently using T2D drugs (treatment) were only 8.9% and 7.3%, respectively, although more than 10% of all participants (13.7%) were newly diagnosed with T2D. The percentages of those who had HTN or T2D, including those who were previously diagnosed with HTN or T2D, were 40.9% and 20.3%, respectively.

Table 1: Characteristics and health status among male factory employees who participated in the portable health checkup in Jaipur, India, in 2018

Items	Total N=259	Total %
Age (years)		Mean = 43.4 Median = 42.0 Range = 18-85
Age groups	**N=259**	
15-29 years	63	24.3
30-39 years	60	23.2
40-49 years	28	10.8
50-59 years	63	24.3
≥60 years	45	17.4
Literacy	**N=259**	
Illiterate	41	15.8
Literate	218	84.2
BMI (kg/m^2)		Mean = 24.8 Median = 24.8 Range = 15.7 - 41.3
BMI	**N=259**	
Less than 23 (Healthy)	77	29.7
23-25 (Slightly overweight)	59	22.8
25-30 (Overweight)	103	39.8
30 or more (Obese)	20	7.7
Already aware of my hypertension status (awareness)	**N=259**	
No	237	91.5
Yes	22	8.5
Currently using any medicines or drugs for hypertension (treatment)	**N=259**	
No	234	90.3
Yes	25	9.7
Systolic blood pressure (mmHg)		Mean = 134.2 Median = 132.0 Range = 96.0 - 201.0
Diastolic blood pressure (mmHg)		Mean = 80.5 Median = 81.0 Range = 56.0 - 113.0
Hypertension (excluding self-reported hypertension)		
No	165	63.7
Yes	94	36.3
Hypertension (including self-reported hypertension)	**N=259**	
No	153	59.1
Yes	106	40.9
Already aware of my type 2 diabetes status (awareness)	**N=259**	
No	236	91.1
Yes	23	8.9
Currently using any medicines or drugs for type 2 diabetes (treatment)	**N=259**	
No	240	92.7
Yes	19	7.3
Type 2 diabetes (excluding self-reported type 2 diabetes)	N=256	
No	221	86.3
Yes	35	13.7
Type 2 diabetes (including self-reported type 2 diabetes)	N=256	
No	204	79.7
Yes	52	20.3

Table 2a presents the unadjusted associations of HTN with age, literacy, BMI, awareness and treatment factors. Age group was significantly associated with HTN ($P < 0.001$), such that older age groups had a higher percentage of having HTN than younger age groups. The percentage of participants with HTN was significantly higher among those with higher BMI than those in the lower BMI groups ($P < 0.001$). Those who reported cur-

rently using antihypertensive drugs had a significantly higher percentage of having HTN than those who did not use antihypertensive drugs (P = 0.010).

Table 2a: Unadjusted association of independent variables with hypertension

	Hypertension (N=259)				
	No (n=165)		Yes (n=94)		
Items	**N**	**%**	**n**	**%**	**P for diff.**
Age groups					0.000
15–29 years	54	85.7	9	14.3	
30–39 years	44	73.3	16	26.7	
40–49 years	16	57.1	12	42.9	
50–59 years	30	47.6	33	52.4	
≥60 years	21	46.7	24	53.3	
Literacy					0.070
Illiterate	21	51.2	20	48.8	
Literate	144	66.1	74	33.9	
BMI category*					0.000
Less than 23 (Healthy)	64	83.1	13	16.9	
23-25 (Slightly overweight)	37	72.7	22	37.3	
25-30 (Overweight)	54	52.4	49	47.6	
30 or more (Obese)	10	50.0	10	50.0	
Already aware of my hypertension status (awareness)					0.350
No	153	64.6	84	35.4	
Yes	12	54.5	10	45.5	
Currently using any medicines or drugs for hypertension (treatment)					0.010
No	155	66.2	79	33.8	
Yes	10	40.0	15	60.0	

Table 2b presents the unadjusted associations of T2D with age, literacy, BMI, awareness and treatment factors. Age group was a significantly associated with T2D (P < 0.001), such that older age groups had higher percentage of having T2D than younger age groups. Those who reported currently using any medicines or drugs for T2D had a significantly higher percentage of having T2D, compared with those who did not use those drugs (P < 0.001).

Table 2b: Unadjusted association of independent variables with type 2 diabetes

	Type 2 diabetes (N=256)				
	No (n=221)		Yes (n=35)		
Items	N	%	n	%	P for diff.
Age groups					0.000
15–29 years	61	96.8	2	3.2	
30–39 years	56	93.3	4	6.7	
40–49 years	26	92.9	2	7.1	
50–59 years	48	78.7	13	21.3	
≥60 years	30	68.2	14	31.8	
Literacy					0.489
Illiterate	34	82.9	7	17.1	
Literate	187	87.0	28	13.0	
BMI category*					0.081
Less than 23 (Healthy)	72	93.5	5	6.5	
23-25 (Slightly overweight)	51	86.4	8	13.6	
25-30 (Over-weight)	81	80.2	20	19.8	
30 or more (Obese)	17	89.5	2	10.5	
Already aware of my type 2 diabetes status (awareness)					0.069
No	204	87.6	29	12.4	
Yes	17	73.9	6	26.1	
Currently using any medicines or drugs for type 2 diabetes (treatment)					0.000
No	210	88.6	27	11.4	
Yes	11	57.9	8	42.1	

Figure 2 shows the relationship of study participants who were newly diagnosed with HTN (n = 94), who were currently using antihypertensive drugs (n = 25), and who were previously diagnosed as having HTN (n = 22). Among participants who were newly diagnosed with HTN and/or who were previously diagnosed with HTN (n = 106), 20.8% were aware of their HTN status. The percentages of those who were taking antihypertensive drugs (treated) and those who were found to have no hypertension (controlled) were only 18.9% and 4.7%, respectively.

Figure 3 shows the relationship of study participants who were newly diagnosed with T2D (n = 35), who were currently using any drugs for T2D (n = 19), and who were previously diagnosed with T2D (n = 23). Among participants who were newly diagnosed with T2D and/or who were previously diagnosed with T2D (n = 52), 44.2% were aware of their T2D status. The percentages of those who were taking any drugs for T2D (treated) and those whose T2D was well-regulated (controlled) were only 28.8% and 13.5%, respectively.

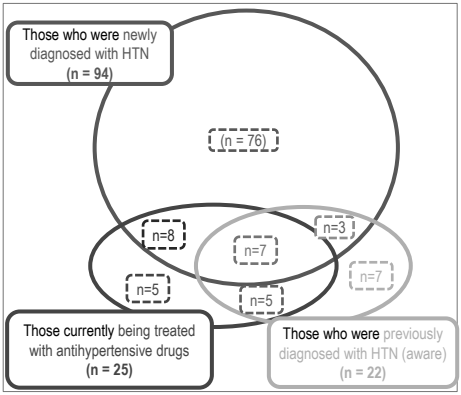

Figure 2: Number and percentage of participants who were aware of, receiving treatment for, and controlled for HTN

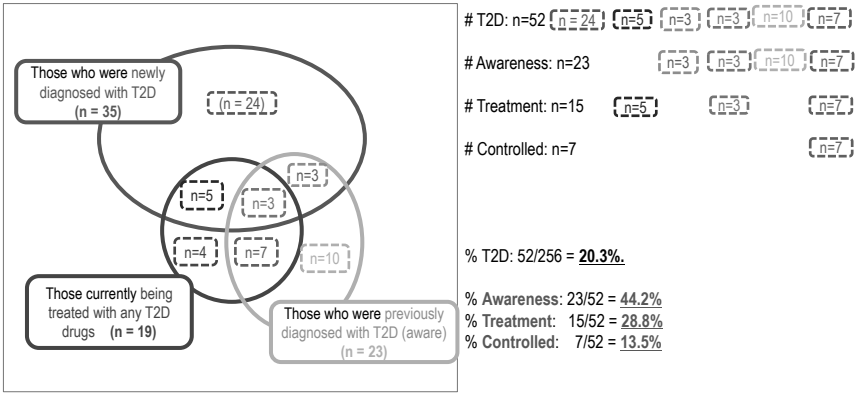

Figure 3: Number and percentage of participants who were aware of, receiving treatment for, and controlled for T2D

Conclusions:

The percentages of participants who were newly diagnosed with HTN in the health checkup and those who self-reported being already diagnosed with HTN (n = 106) were 40.9%, which was much higher than that reported in previous studies in India (29.8%). The percentages of those who were

already aware of having HTN (awareness), were taking any HTN drugs (treatment), and were controlled for HTN (control) were only 20.8%, 18.9%, and 4.7%, respectively. These levels of awareness, treatment, and control of HTN are lower than those in previous studies conducted in rural India (25%, 25%, and 11%, respectively). The percentages of participants who were newly diagnosed with T2D in the health checkup and those who self-reported having already been diagnosed with T2D" (n=52) were 20.3%. Of these, the percentages of those who were aware of having T2D (awareness), were taking any T2D drugs (treatment), and had controlled for T2D (control) were 44.2%, 28.8%, and 13.5%, respectively. To improve these levels of awareness, treatment, and control of HTN and T2D, regular health checkups targeting industry workers are needed in India.

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END MATERIALS:

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Disclosure statement

The authors report no conflicts of interest.

Ethics and consent

Data collection from each participant was performed in accordance with the Declaration of Helsinki. The study was approved by the ethics committee of the Kyushu University Institutional Review Board (# 24-048). Verbal informed consent was obtained from all participants who received a detailed explanation of the study purposes by the field research assistants.

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