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Original Research

A Mixed Methods Evaluation of a Pilot Resilience Training Course on Stress Management

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ABSTRACT

Background: Chronic stress adversely affects biologic, cognitive and emotional functioning, is associated with worsened morbidity and mortality outcomes, and is predictive of performance and productivity. Interventions for resilience to stress can be effective but are typically time intensive. With contemporary life demands, effective, brief interventions may be advantageous.

Methods: This single arm, mixed methods study evaluated the effectiveness of a 1-day resilience to stress training course. Thirty community participants were surveyed at baseline and 1-month. Qualitative interviews were conducted between 30-68 days post-intervention according to a grounded theory approach. Quantitative measures included Perceived Stress Scale (PSS), Public Health Surveillance Wellbeing (PHS-WB), Rand Medical Outcome Survey (MOS) SF-36, Health, and Productivity Questionnaire (HPQ), Work Productivity and Activity Impairment (WPAI) and Brief Cope Scale (BCS). Participants had a mean age of 53-years (SD=9) and were largely female (57%), caucasian (79%), married (83%), and employed (80%). Generalized estimating equations and paired sample *t*-tests were used to analyze quantitative data.

Results: Participants self-reported improvement at 1-month on the PSS (moderate or high 100% *vs.* 50%, $p<0.001$), PHS-WB (29.8 *vs.* 31.5, $p=.04$), SF-36 subscales role limitation due to physical health (44.1 *vs.* 69.0, $p=.002$), vitality (55.2 *vs.* 63.6, $p=.008$), emotional wellbeing (70.9 *vs.* 78.0, $p=0.001$), and social functioning (76.0 *vs.* 87.9, $p=0.003$). Qualitative analysis suggested participants used the course as an opportunity to build a framework for action. Critical ideas triggered a recalibration of perspectives and reference points (i.e., mindsets) opening the way to updating routinized decisions and harnessing new ways of behaving in service of resilience. Embedding changes in behavior were swift for some or a gradual process of pragmatic adaption for others.

Conclusions: Our pilot findings suggest that brief one-day interventions may facilitate personal reform and may enhance resilience and psychological wellbeing. Longer follows-ups to determine sustainability are also required.

Keywords
Resilience; Stress; Wellbeing.

INTRODUCTION

The impact of stress has critical implications for both individuals and organizations.[1-2] Stress for individual health has been associated with heart disease, diabetes, decreased immune functioning, as well as mental health disorders such as depression and anxiety.[3] At the organizational level, stress has been associated with increased rates of medical errors and employee burnout, retention and turnover.[4-5] The most recent American Psychological Association (APA) survey on stress found that although overall stress was stable from 2016 to 2017, individuals were more likely to report experiencing the effect of stress.[6] In 2015, the survey found that 24% of adults reported extreme levels of stress compared to 18% in 2014. In this same survey, 34% of the adult report that their stress increased over the past year, while only 16% report decreased stress in the past year.[7] These statistics suggest that stress is a critical challenge.

Although multiple approaches have been developed

to intervene on stress, various levels of impact have been observed.[8-10] Individuals typically start by learning to identify types of stressors and associated cues and triggers which helps improve awareness and may help to plan for and or prepare for expected situations and future stress.[11] Mental exercises such as meditation and mindfulness can also be beneficial. Magnetic Resonance Imaging (MRI) scans show that after an eight-week course of mindfulness practice, the brain's "*fight or flight*" center appears to shrink.[12] Other benefits have included reduced symptoms of anxiety and depression,[12] improvements of emotional regulation,[12] learning, and memory[13] and decrease the amygdala response.[12] A 2012 study by Keller et al found that individuals who experience high-levels of stress and perceive that stress affects their health are at greater risk for poor health and mortality outcomes.[14] Cognitive framing is thus an important technique used to change how individuals understand and experience stress. "*Eustress*",[15] for example, is used to describe and emphasize the positive benefits of stress. Overall, an abundance of research has been dedicated to understanding the effects of minimization or removal of stress on health and behavior. However, the relationships between sustained stress, the redefinition of stress, and strategic recovery within workplace settings are still not fully understood. A 2011 study used the randomized controlled trial to assess the effect of a Stress Management and Resiliency Training (SMART) program on 25 women diagnosed with breast cancer. The study found out the brief training enhanced Resilience and Quality of Life (QoL) and decreased stress and anxiety at 12-weeks among treatment arm but not the control arm. This type of research led to the current study to evaluate a resilience training program on community participants.[16]

The objective of the study was to determine the impact of a resilience to stress approach, where resilience is the ability to reframe or to bounce back from stressful experiences. The Johnson & Johnson Human Performance Institute (HPI) Resilience training program takes this approach through recalibrating mindset and changing resilience supportive behavior. Short-term follow-up was employed to determine initial viability of the intervention. The quantitative component sought to understand changes in specific behaviors and in measures of participants' health and wellbeing, while the qualitative component sought to understand how participants may have recalibrated their mindsets to change their behaviors.

METHODS

Participants

Research participants were 30 community members located in Central Florida, USA. Individuals registered as part of the Lake Nona Life Project Community health study[17] were recruited *via* email. This study was reviewed and approved by the Advarra (formerly Chesapeake) Internal Review Board (IRB). Each participant provided written consent. Inclusion criteria included: 1) Adults (18 years or older), 2) speak, read, and understand English fluently, 3) willing to complete baseline assessments at least 10-days prior to the training course, 4) willing to attend a full day training program at the Lake Nona Institute during the designated training date, 5) willing to provide email and phone number as a contact method, 6) able to comprehend and follow the requirements of the study, 7) have a valid e-mail address. 8) able to provide informed consent (IC), 9) willing and able to comply with all study procedures for the duration of the study. There were no limitations or exclusion criteria beyond inclusion criteria. Participant means age was 52.8-years (SD=9.0). Demographic characteristics are displayed in Table 1.

Table 1. *Demographic Characteristics of the Study Sample*

Demographic Variable	N	Percent
Gender		
Male	13	43.3
Female	17	56.7
Age		
35-44	5	16.7
45-54	13	43.3
55-64	9	30.0
65-74	3	10.0
Marital Status		
Married	25	83.3
Divorced	3	10.0
Domestic Partnership	1	3.3
Single	1	3.3
People Living in Household		
Child(ren) under 18	13	43.3
Adult Dependents	5	16.7
Adult Dependents and Child(ren) under 18	2	6.7
Not currently applicable	10	33.3
Ethnicity		
Caucasian	23	79.3
African American	1	3.4
Latino	4	13.8
Other	1	3.4
Job Position		
Employed	24	80.0
Other	6	20.0

Design

This study employed a single arm, interventional, mixed methods (qualitative & quantitative), pre-post design. A control group was not included in order to balance the program's stage of development and scope of the project. Instead, qualitative interviews were intended to help explain or refute potential quantitative outcomes. Therefore, no extraneous variables were measured *via* survey besides demographic characteristics and outcome measures. Participants completed baseline surveys between 21 to 3-days prior to the intervention and again 30-days afterward. Telephone qualitative semi-structured interviews were conducted on a rolling basis between 3-68-days post-intervention.

Intervention

The resilience course is a 1-day training program that employs the use of adult learning principles and experiential learning design

to create an immersive face-to-face experience for participants. The rationale for creating a 1-day intervention is consistent with broader efforts to support brief behavioral interventions (e.g., minimize participant burden, reduce attrition, and potentially enhance engagement). Further, there is a widespread need for programs that have not only evidence for effectiveness, but also can be systematically delivered on a large scale to populations suffering from stress and burnout. General employee and health provider populations, in particular, have received much attention in this regard. This study examines the initial level of evidence for such a program. The primary objectives of the course are to:

1. Understand the definition of resilience and its relationship to performance and wellbeing.
2. Recognize the difference between different types of stress.
3. Learn how to strategically recover to manage stress and improve resilience.

The course is led by a certified facilitator where participants are guided through the course content through a variety of individual and group activities, self-reflection, introspection, and concept presentations. Included with the course is a resilience assessment that participants use as a tool to help them understand their current level of resilience, oscillation patterns of high and low stress, resilience behaviors, and mental framework for understanding stress called stress mindset. This enables participants to identify their areas of strength and opportunity. By recognizing the gaps between current resilience and desired resilience levels, and connecting with a sense of purpose or meaningful direction in life, participants could develop a more comprehensive action plan. This action plan is designed by each participant and defines specific action steps (rituals), accountability, and setback management tactics that they use to better manage stress and improve resilience. Lastly, participants received access to the HPI mobile app as a digital sustainability tool to help them track their progress in their 90-day journey. The app is designed to provide timely tips and strategies to help manage stress by using recovery exercise strategically, mindfulness, and promoting a deeper connection to having a meaningful sense of purpose and direction in life.

MATERIALS AND MEASURES

Survey measures included the Perceived Stress Scale (PSS),[18] public health surveillance wellbeing (PHS-WB),[19] Rand Medical Outcome Survey (MOS) SF-36 (SF-36),[20] health and productivity questionnaire (HPQ),[21] Work Productivity and Activity Impairment (WPAI),[22] and Brief Cope Scale (BCS).[23] PSS included 5 items, where a total score ranged 0-40 was calculated and three stratifications were made: low stress (score 0-13), moderate stress (score 14-26), high stress (27-40). PHS-WB included 10 items and a total score ranged 0-40 was calculated as the higher score indicates better wellbeing. Items from 5 domains of SF-36 were included in the survey: Role limitations due to physical health, energy, emotional wellbeing, social functioning, and general health. Domain scores ranged 0-100 were calculated as the higher score indicates better health/wellbeing. BCS includes 28 items, and the domain scores ranged 2-8 were calculated for 14 domains: self distraction, active coping, denial, substance use, use of emotional support, use of instrumental support, behavioral disengagement, venting, positive reframing, planning, humor, acceptance, religion, and self blame. To measure job performance, 3 items from HPQ were used to calculate absolute presenteeism and relative presenteeism, with scores, ranged 0-100, and 0-10 respectively and a higher score indicating better performance. One modified item from WPAI was used to measure presenteeism due to low energy: "*During the past seven days, how much did your low (or less than optimal) energy levels affect your productivity while you were working?*" (0=Low energy had no effect on my work; 10=Low energy completely prevented me from working). For qualitative, a telephone-based 30-minute semi-structured interview was used to obtain data, and analysis methods were used based on grounded theory.[24] A grounded theory seeks to explain the main concern of participants and how that concern is resolved or processed: the focus is on patterns of behavior.

Analysis

Descriptive data were computed on frequencies and percentages of each level of the demographic variable and PSS stratification. Means and Standard Deviations (SDs) were computed for continuous outcome variables at baseline and follow-up. For statistical analysis, Generalized Estimating Equations (GEE) were used to test if the probability of falling low, moderate or high category are different at baseline *vs.*, follow-up on PSS stratification since this is a categorical variable. Paired sample tests were used for other study outcomes since they are all continuous variables, to test if the mean change from baseline to follow-up are the difference from zero. Ninety five percent of confidence intervals on the change were also computed. Analysis was conducted using SPSS V24 (Chicago, IL, USA). A *p*-value less than 00.05 was considered statistically significant since the study sample size is small (n=30).

For the qualitative analysis, after open coding using the constant comparison method,[24] a review of the initial patterns emerging from the first 12 interviews was conducted. A recent study of a course using the same educational principles had emerged both the main concern and a key concept ('core category'). During the review, we sought and established 'emergent fit' with these concepts.[25]

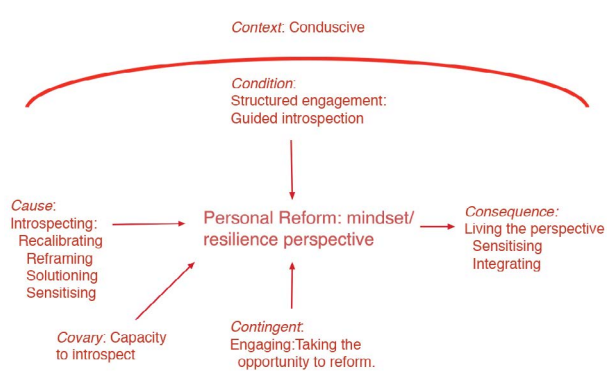
Once the core category is identified, future data collected is specific and intended to saturate the core category and related categories. The act of collecting specific data is 'theoretical sampling', whilst the act of analyzing specific data is 'selective coding'.[26] The interview guide was therefore refined to facilitate theoretical sampling and the remaining 18 participants interviewed and the data analyzed. Throughout analysis, memos are written about concepts and the relationships between them. Table 2 shows the development of the concepts theoretical and personal frameworks for action emerging from initial ideas about course design, designed opportunity for change and personal opportunity for change. The ideas captured in memos were separated, compared and sorted to reveal the overall shape of the theory (Figure 1: Theory of Personal reform: Living the perspective).

The main concern of the participants in this study is to

Table 2. *Memos Tracking Development of the Concept 'Theoretical Framework for Action'*

Memos	Course Design
23 September – 12 October, 2017	Disconnect is a misfit between an individual's Personal Opportunity for Change (PO4C) and the Designed Opportunity for Change (DO4C).
	Course design
	Focus on something you wouldn't normally focus on that needs addressing. Create goals, the achievement of which, will lead to successfully addressing that which needs to be addressed. Select the tools from this toolbox which you have created together.
	Course
	The course helps participants build a framework for action. People are aware of some of these ideas but the course brings a coherency to the knowledge and gives a method to make the knowledge actionable. But the person needs to build the framework?
	Not sure about the relationship between framework and methods to process stress.
Memos	**Course Design**
13 October – 13 December, 2017	For those who found value, the value was in the framework?
	Framework for action
	… is more important than a personal opportunity for change in this instance of the course. Need to look at role of reports.
	Method
	Stress management = a methodology…a framework for stress management.
	What is your stress management framework going to comprise?
	Framework for reform
	Comprises a set of methods
Memos	**Framework**
14 December 2017 – 6 January 2018	as a conceptual artefact: the methods to use and the conceptual tools.
	Framework
	Conceptual framework…mindset... set of perspectives. Plan for action
Memos	**Conceptual Framework V Framework for Action**
7 – 29 January 2018	A conceptual framework: more than a long list of tools without form
	Current conceptualization
	Embedded in the design of the course is a theoretical framework for action designed to help people develop resilience.
	The framework for action includes a method for minimizing and processing stress events using conceptual and behavioral tools and techniques.
	The aim of the course is to help an individual develop a 'resilience perspective' incorporating a personalized framework for action and a personal toolkit.

Figure 1. *Shape of Theory*



take the opportunity of the course to better their lives, specifically to improve their resilience, or at least to address the consequences of stress in their lives. The theory explains the degree to which the theoretical framework for action embedded in the course design becomes incorporated into a person's mindset and the impact of the application of that integration, such as it is.

RESULTS

Survey Data

All 30 participants completed both the baseline and follow-up surveys. Please see scores in Table 3. PSS stratification was changed significantly ($p<0.001$). Most participants moved from moderate or high stress at baseline to low or moderate stress at 1-month follow-up. PSS total score did not decrease significantly. The PHS-WB total score and physical health subscale improved significantly ($p<0.05$). For BCS, "*Self-distraction*" ($p=0.022$), "*Planning*" ($p=0.001$) and "*Humor*" ($p=0.035$) subscale changed significantly. Four out of 5 subscales in SF-36 were significantly improved as well. Participants reported less role limitations due to physical health, more energy, better emotional and social functioning at 1-month after the training ($p<0.01$). Participants also reported better general health score, but not significantly. Finally, there was no significant change on the three presenteeism scores from HPQ and WPAI.

Table 3. *Comparisons of Baseline and Follow-up Survey Total and Subscales Scores*

		Baseline				Follow-up				Difference		*p*
		Mean	SD	N	%	Mean	SD	N	%	Mean	95% C.I.	0.098
PSS	Total Score	16.07	6.78			14.43	5.75			-1.63	(-3.59, 0.32)	<0.001
	Low Stress			0	0%			15	50.0%			
	Moderate Stress			15	50.0%			14	46.7%			
	High Stress			15	50.0%			1	3.3%			
PHS-WB	Total Score	29.88	5.66			31.50	5.21			1.62	(0.08, 3.15)	0.040
	Mental Health	15.53	3.12			16.17	2.93			0.63	(-0.38, 1.65)	0.211
	Social Health	5.93	1.41			6.20	1.35			0.27	(-0.16, 0.69)	0.211
	Physical Health	8.42	2.08			9.13	1.75			0.72	(0.03, 1.40)	0.040
BCS	Self Distraction	4.63	1.87			3.73	1.48			-0.90	(-1.66, -0.14)	0.022
	Active Coping	5.73	1.89			6.07	1.84			0.33	(-0.36, 1.03)	0.335
	Denial	2.40	0.72			2.20	0.55			-0.20	(-0.47, 0.07)	0.136
	Substance Use	2.50	0.73			2.37	0.67			-0.13	(-0.37, 0.10)	0.255
	Use of Emotional Support	4.70	1.73			4.40	1.90			-0.30	(-0.87, 0.27)	0.293
	Use of Instrumental Support	4.40	1.43			4.67	1.65			0.27	(-0.53, 1.06)	0.499
	Behavioral Disengagement	2.63	1.03			2.27	0.69			-0.37	(-0.81, 0.08)	0.102
	Venting	4.77	1.30			4.07	1.57			-0.70	(-1.48, 0.08)	0.076
	Positive Reframing	5.45	2.08			5.70	1.90			0.25	(-0.49, 0.99)	0.494
	Planning	6.13	1.87			4.77	1.25			-1.37	(-2.13, -0.60)	00.001
	Humor	4.33	1.58			4.97	1.67			0.63	(00.05, 1.22)	0.035
	Acceptance	5.80	1.79			5.40	1.54			-0.40	(-1.29, 0.49)	0.363
	Religion	4.90	2.32			4.60	1.38			-0.30	(-1.17, 0.57)	0.487
	Self Blame	4.00	1.36			4.30	1.51			0.30	(-0.32, 0.92)	0.332
SF-36	Role Limitations due to Physical Health	44.05	41.63			69.04	35.06			24.99	(10.22, 39.77)	0.002
	Vitality/Energy	55.18	20.02			63.57	14.33			8.39	(2.42, 14.36)	0.008
	Emotional Wellbeing	70.86	17.98			78.00	12.15			7.14	(3.15, 11.13)	00.001
	Social Functioning	75.98	21.34			87.86	13.26			11.88	(4.52, 19.23)	00.003
	General Health	74.29	17.99			78.75	13.58			4.46	(-0.57, 9.51)	0.080
HPQ	Absolute Presenteeism	71.43	19.00			73.57	16.60			2.14	(-7.26, 11.54)	0.644
	Relative Presenteeism	1.14	0.53			1.08	0.22			-0.06	(-0.26, 0.15)	0.571
WPAI	Presenteeism due to Low Energy	3.32	2.20			2.64	2.39			-0.68	(-1.66, 0.30)	0.166

Qualitative Data

Participants experience the course as a process of guided introspection. Success is the degree to which participants were able to develop their resilience perspective using a *recalibration* process of reframing, *solutioning* and *sensitizing*, and the extent to which they are able to apply this perspective to process stress events (*living the perspective*). Success is contingent upon *taking the opportunity* of the course and *introspecting* to *recalibrate perspectives* and co-varies with an individual's *capacity to introspect* (Figure 1). Key behaviors in the continual processing of future stress events are: (i) sensitizing; recognizing that stress is being experienced, its source and selecting an appropriate method to process the stress and (ii) integrating; taking the time to introspect to identify the causes of stress and to practice methods of reducing stress.

Three types of participants emerged from the analysis. 'Seekers' have an established resilience perspective, seek to work at the frontiers of resilience and seek an edge to their knowledge. They are beyond the course. 'Seed planters' remain stuck in a status quo either because they have made silent decisions to prioritize a different perspective or because a different perspective dominates introspection and compromises recalibration. For this group, the seeds of ideas planted during the course may grow into new perspectives. 'Reformers' introspect, recalibrate their mindsets to some degree and apply their revised perspectives to better process their stress by sensitizing and integrating.

DISCUSSION

The purpose of this pilot study was to test the impact of a novel, brief intervention designed to enhance individual level resilience to stress. The novelties of the intervention include the 1-day group format and the combination of techniques employed. Quantitative results show improvements across various measures of stress and functioning which were observed up to a 30-day period following the course. They included stress perception, wellbeing and quality of life across multiple domains, and enhancement in some specific

coping mechanism uses. Qualitative results helped to explain the phenomena participants experienced from a process perspective. The model derived from interviews suggests that participants needed to have an adequate level of openness to the intervention (e.g., taking the opportunity) and the capacity to introspect about their lives and life direction. Recalibration of their mindset and beliefs about stress, as well as their capacity to reform were precursors to integrating the course material into their lives.

Among the principles taught in the course, there are some notables. First, oscillation, the principle used to organize life activities as they relate to stress and integrates this concept of eustress. By not avoiding or removing stress, the focus can be placed on how a sequence of stress paired with strategic recovery, or "*oscillation*", can be beneficial to performance and overall wellbeing.[27] Oscillation, also conceptualized as the strategic recovery has shown positive outcomes of recovery in various shapes or durations. For example, Bergoulgnan et al found evidence that "*microbursts of activity during the day improve energy level, mood, and fatigue level while maintaining usual levels of cognitive function*." The microbursts of physical activity were conceptualized to be strategic recovery breaks throughout a sedentary workday condition.[28]

Secondly is the purpose in life, another factor that has been shown to positively impact recovery and performance. A study led by Schaefer et al[29] found that "*purpose in life predicts both health and longevity suggesting that the ability to find meaning from life's experiences, especially when confronting life's challenges, may be a mechanism underlying resilience*." Having a purpose in life may motivate reframing stressful situations to deal with them more productively, thereby facilitating recovery from stress and trauma. In turn, enhanced ability to recover from negative events may allow a person to achieve or maintain a feeling of greater purpose in life over time.[30] Other studies have indicated that a greater sense of meaning and purpose in life have been shown to positively impact people's emotional recovery from negative situations, sensitivity to pain, and ability to heal from illness more effectively and quickly.[31]

In regard to stress mindset, research has also shown different stress mindsets impact health perceptions, Here, individuals who embraced a "*stress-is-enhancing*" mindset reported having better health than those who endorse a "*stress-is-debilitating*" mindset: specifically, respondents reported fewer symptoms of depression and anxiety while also reporting higher levels of energy. Additionally, both workplace performance and overall satisfaction with life were positively correlated with a "*stress-is-enhancing*" mindset.[32]

Results from this study suggest consistency with findings in the research on separate intervention topics, and further suggest the integration of these topics in a brief, group format may provide benefit to individuals experiencing stress in life in the short-term. Primary limitations of this study are characteristics of typical pilot research in that no control group was used and the follow-up was a brief 30-days. In addition, the stress-mindset measure was a planned screener and primary outcome for the study. However, due to technical errors this survey could not be included. Last, the generalization of the program effectiveness needs to be cautious given the representativeness of the study sample. Future research on this intervention will include a control condition, have a longer follow, and may be applied in specific settings where stress is prevalent, such as health care delivery.

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CONFLICTS OF INTEREST

Grounded Solutions Ltd. received fees for research consultancy from Johnson & Johnson Health and Wellbeing Solutions. Remaining authors were employees of Johnson & Johnson during the time of this study.

REFERENCES

1. Schneiderman N, Ironson G, Siegel SD. Stress and health: Psychological, behavioral, and biological determinants. *Annual Review of Clinical Psychology*. 2005; 1: 607-628. doi: 10.1146/annurev.clinpsy.1.102803.144141

2. Workplace Stress. The American Institute of Stress Website: https://www.stress.org/workplace-stress/. Accessed July 19, 2018.

3. Five Things You Should Know About Stress. National Institute of Mental Health. Website: https://www.nimh.nih.gov/health/publications/stress/index.shtml. Accessed July 19, 2018.

4. Waterman AD, Garbutt J, Hazel E, et al. The emotional impact of medical errors on practicing physicians in the United States and Canada. *Jt Comm J Qual Patient Saf*. 2007; 33(8): 1-10.

5. Mosadeghrad AM. Occupational stress and turnover intention: Implications for nursing management. *Int J Health Policy Manag*. 2013; 1(2): 169-176. doi: 10.15171%2Fijhpm.2013.30

6. Stress in America: The State of our Nation. Stress in America™ Survey. American Psychological Association. 2017.

7. Stress in America: The Impact of Discrimination. American Psychological Association. 2016.

8. Lamontagne AD, Keegel T, Louie AM, Ostry A, Landsbergis PA. A systematic review of the job-stress intervention evaluation literature, 1990-2005. *Int J Occup Environ Health*. 2007; 13(3): 268-80. doi: 10.1179/oeh.2007.13.3.268

9. Goyal M, Singh S, Sibinga EM, et al. Meditation programs for psychological stress and wellbeing: A systematic review and meta-

analysis. *JAMA Intern Med.* 2014; 174(3): 357-368. doi: 10.1001/jamainternmed.2013.13018

10. Fjorback LO, Arendt M, Ørnbøl E, Fink P, Walach H. Mindfulness-based stress reduction and mindfulness-based cognitive therapy: A systematic review of randomized controlled trials. *Acta Psychiatr Scand.* 2011; 124(2): 102-119. doi: 10.1111/j.1600-0447.2011.01704.x

11. Elder JP, Ayala GX, Harris S. Theories and intervention approaches to health-behavior change in primary care. *Am J Prev Med.* 1999; 17(4): 275-284.

12. Holzel BK, Carmody J, Vangel M, et al. Mindfulness practice leads to increases in regional brain gray matter density. *Psychiatry Res.* 2011; 191(1): 36-43. doi: 10.1016%2Fj.pscychresns.2010.08.006

13. Mrazek MD, Franklin MS, Phillips DT, Baird B, Schooler JW. Mindfulness training improves working memory capacity and GRE performance while reducing mind wandering. *Psychol Sci.* 2013; 24(5): 776-781. doi: 10.1177/0956797612459659

14. Keller A, Litzelman K, Wisk LE, et al. Does the perception that stress affects health matter? The association with health and mortality. *Health Psychol.* 2012; 31(5): 677-684. doi: 10.1037/a0026743

15. Kupriyanov R, Zhdanov R. The eustress concept: problems and outlooks. *World Journal of Medical Sciences*. 2014; 11(2): 179-185.

16. Loprinzi C, Prasad K, Schroeder D, Sood A. Stress management and resilience training (SMART) program to decrease stress and enhance resilience among breast cancer survivors: A pilot randomized clinical trial. *Clinical Breast Cancer.* 2011; 11(6): 364-368. doi: 10.1016/j.clbc.2011.06.008

17. Lake Nona Life Project Community Health Study. Website: http://www.liveworkparticipate.com/. Accessed July 19, 2018.

18. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav.* 1983; 24(4): 385-396.

19. Bann CM, Kobau R, Lewis MA, Zack MM, Thompson WW. Development and psychometric evaluation of the public health surveillance wellbeing scale. *Qual Life Res.* 2012; 21(6): 1031-1043. doi: 10.1007/s11136-011-0002-9

20. Ware Jr JE, Sherbourne CD. The MOS 36-item short-form health survey (SF-36): I. Conceptual framework and item selection. *Med Care.*1992; 473-483.

21. Kessler RC, Barber C, Beck AL, et al. The world health organization health and work performance questionnaire (HPQ). *J Occup Environ Med.* 2003; 45(2): 156-174.

22. Reilly MC, Zbrozek AS, Dukes EM. The validity and reproducibility of a Work Productivity and Activity Impairment instrument. *Pharmacoeconomics.* 1993; 4(5): 353-365. doi: 10.2165/00019053-199304050-00006

23. Carver CS. You want to measure coping but your protocol's too long: Consider the brief COPE. *Int J Behav Med.* 1997; 4(1): 92-100. doi: 10.1207/s15327558ijbm0401_6

24. Glaser B. *Theoretical Sensitivity*. Mill Valley, CA, USA: Sociology Press. 1978.

25. Glaser B. *Doing Grounded Theory: Issues and Discussions*. Mill Valley, CA, USA: Sociology Press. 1998.

26. Glaser B, Strauss A. *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Chicago, USA: Aldine Publishing. 1967

27. Loehr J. *Toughness Training for Life*. New York, USA: Plume by Penguin Group.1993.

28. Bergouignan A, Legget KT, De Jong N, et al. Effect of frequent interruptions of prolonged sitting on self-perceived levels of energy, mood, food cravings and cognitive function. *Int J Behav Nutr Phys Act.* 2016; 13(1): 113. doi: 10.1186/s12966-016-0437-z

29. Schaefer SM, Morozink Boylan J, Van Reekum CM, et al. Purpose in life predicts better emotional recovery from negative stimuli. *PLoS One.* 2013; 8(11): e80329. doi: 10.1371/journal.pone.0080329. eCollection 2013

30. Kim ES, Strecher VJ, Ryff CD. Purpose in life and use of preventive health care services. *Proc Natl Acad Sci U S A.* 2014; 111(46): 16331-16336. doi: 10.1073/pnas.1414826111

31. Hill PL, Turiano NA. Purpose in life as a predictor of mortality across adulthood. *Psychol Sci.* 2014; 25(7): 1482-1486. doi: 10.1177/0956797614531799

32. Crum A, Salovey P, Achor S. Rethinking stress: The role of mindsets in determining the stress response. *J Pers Soc Psychol.* 2013; 104(4): 716-733. doi: 10.1037/a0031201

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Case Study

The Principles of Good Health Care in the U.S. in the 2020s

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ABSTRACT

Purpose: Purpose of this investigation is to define the principles of good health in the U.S. in the 21st century. The interdisciplinary, civilizational approach.
Methodology: Methodology is applied to establish roots of this health care at the national level.
Findings are: "the well-being Americans" is the constitutional opportunity of American, good health of Americans is a constituent of their well-being, primary health care should be perceived as the controlled right of a citizen. Human and societal wisdom requires mentally healthy people. Human and societal wisdom requires well-educated citizens. The state of health care of the Americans is in a state which is not appropriate for the richest and influential country in the world. The quality of health care is at the level of 54 percent. The vision of American society has been defined as well as its goals and strategies for the next 12-years, till 2030.
Practical implications: If the integration of well-being, health care, and information infrastructure-oriented components into one comprehensive solution is not provided,and if each one is treated in isolation, the improvements in health care won't be lasting and positive.
Social implications suggest: These political will and leadership at all levels of the nation must reach agreement; otherwise the society will be declining in its physical and mental health.

Keywords
Constitutional well-being; Health care; Health care principles; Health care rights; Health care vision; Health care goals; Health care strategy; Health care implications.

INTRODUCTION

The policy for improving American health care can be analyzed from the *legal* and *moral* point of views. From the former view three comprehensive national plans have been implemented in the United States so far:

- The Medicaid (begun in 1965) is a health care program that assists low-income families or individuals in paying for doctor visits, hospital stays, long-term medical, custodial care costs and more. It is a joint program, funded primarily by the federal government and run at the state level, where coverage may vary.It provides free health insurance to 74 million low-income and disabled people (23% of Americans) as of 2017.[1]
- The Medicare (begun in 1966) is a national health insurance program in the United States, under the Social Security Administration for people who are 65 or older. Certain younger people with disabilities. People with End-Stage Renal Disease (permanent kidney failure requiring dialysis or a transplant, sometimes called ESRD). About 59 million people applied for this program in 2017.[2]
- The Affordable Care Act (ACA) ("Obamacare" 2009)-requires that all Americans have health insurance that meets minimum essential coverage standards, such as through an employer, veteran's benefits, or another source.

The first two plans serve to about 133 million people (40% of the population) and provide good health insurance, comparable with the famous Scandinavian plans. However, what about the remaining 60% of the population? Those lucky who work may have plans co-paid by the employers. Unfortunately, not all employers finance such plans. What about part-time workers, who in the majority cases do not have any health care plans, since are too young for the Medicare or not so poor yet to get the Medicaid

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plan? What about those who are homeless or cannot afford any health care insurance plan? They in the case of weakness go to the emergency rooms of hospitals and get a limited help, causing the massive rise of the hospitalization cost for those who are insured.

The response for those people with limited abilities to have the right health care–President Barack Obama implemented the ACA plan in 2009. After almost ten years of applying this plan, many weak points of this plan have been recognized, like the following[3]:

1. It is difficult to understand how much Obamacare taxes your pay if you do not buy insurance. In 2016, it increased to 2.5 percent of adjusted gross income.
2. Experts disagree on whether the ACA reduced the deficit. The original projection was $143 billion in savings. Others forecast it would add $1.76 trillion to the debt. That would be bad because Congress passed the ACA to reduce the cost of Medicare and Medicaid. Federal payments for these benefits eat up the entire budget. That leaves less for programs in the discretionary budget. It is difficult to understand the true cost of Obamacare to the nation when even the experts disagree so much.
3. President Obama promised that, if you like your plan, you can keep it. However, health insurance companies canceled plans for 1 million people. That is because they did not comply with the ACA's 10 essential health benefits. That was their decision, not Obama's. However, many people lost insurance as a result.
4. The ACA changes how Medicare reimburses hospitals. It is switching from a fee-for-service to value-based payment. It will stop paying for every test, exam, and procedure. Instead, it will base payments on how well the patient does. It should cut costs in the long run. However, it creates a painful transition for hospital systems in the short term.
5. It requires doctors' offices to computerize all medical records. The government first introduced this mandate in 2009 as part of the Economic Stimulus Act. It is making life miserable for doctors' offices. As of October 1, 2013, doctors must choose from 140,000 codes when entering data about a diagnosis. It is up from 18,000 codes. Hospital records need to comply with the new Medicare value-based payment system.
6. It made health care available to millions more—however, that increased health care costs over the short term. Many people received preventive care for the first time in decades. Tests and treatments for cancer, cholesterol, and diabetes raised costs for insurance companies.
7. Families lost some tax deductions for uninsured medical costs. The ACA raised the deductible level from 7.5 percent of adjusted gross income to 10 percent. Trump's tax plan restored the deductible level for 2017 and 2018.
8. Higher income families paid additional Medicare taxes. It affected 1 million individuals and 4 million couples who made more than $200,000 and $250,000 respectively. It affected both income taxes and capital gains taxes.
9. Between 3 million and 5 million people lost their company-sponsored health care plans. Many businesses found it was more cost-effective to pay the penalty than provide health insurance benefits. Many small businesses found out their workers could get a better plan through the exchanges.
10. Health care providers and health insurance companies paid additional taxes to help fund Obamacare's benefits. They may pass these costs on to consumers as higher premiums. Indoor tanning services were assessed a 10 percent excise tax. Drug companies will pay an extra $84.8 billion in fees over the next 10 years. That will pay for closing the "doughnut hole" in Medicare Part D. Medical device manufacturers and importers were assessed a 2.3 percent excise tax in 2013. Congress suspended the medical device tax for 2016-2018. Insurance companies will pay a 40 percent excise tax on "Cadillac" health plans in 2022. These plans are for people in high-risk pools, such as older workers or those with dangerous jobs.
11. Buying health insurance is still complicated. For example, the exchanges offer four types of insurance policy levels: Bronze, Silver, Gold, and Platinum. So now you've got to figure out which level you want. You must also compare the copays, deductibles, and co-insurance levels between the different providers. On the other hand, the exchanges gave consumers more control over the shopping process. Before the ACA, one had to rely on a broker and hope for the best.

These weak points of Obama care triggereda roasting criticism by President Donald Trump, who wants to have a less costly plan, based on the competition of insurance companies. Also, according to the President, such a plan should provide minimal coverage of desires and situations, like should not pay for pre-existing diseases. The latter requirement caused the lost election to the House of Congress in 2018. Since the promised "best" plan was not yet implemented even not elaborated beyond the general PR-oriented slogans.

Jost TS[4] argues that even though many Americans lack access to health care, we spent over $1.9 trillion on health care in 2004-more (this cost was $3.5 trillion in 2017, or $10,739 per person, and accounted for 17.9% of gross domestic product (GDP)[5] than we spent on food, housing, transportation, or anything else-and the amount that we spend on health care is increasing every year at rates far in excess of inflation generally.

Wolman D, et al[6] stated that the uninsured get less health care than the insured, and they get it later when it is often less effective or too late.

Anderson G[7] just openly states that perhaps the most important factor explaining higher costs in the United States is that we just pay higher prices for health care than other countries do.

Pauly MV, et al[8] argues that consumer-driven health care attempts to direct competition to the point at which health care goods and services are purchased. It is firmly rooted in a belief that too good insurance drives health care cost. Another word, is good health too costly for the Americans?

It seems that the weakness of a new "affordable" health insurance plan is in the fact that before defining such plan one must agree on the moral principles of the health care in the most powerful country in the world. Otherwise, one can argue that "The only good American is a sick American?" It is a paraphrasing of the ill-famed saying in the 19th century.

TOWARD THE PRINCIPLES OF THE HEALTH CARE IN THE UNITED STATES IN THE 21ST CENTURY

In order to pursue the universal reform of health care in the U.S. one must define the principles and aims of this reform. The principles of 2020s Reform of Health Care in the U.S. (known so far as The Patient Protection and Affordable Care Act, often shortened to the Affordable Care Act or nicknamed Obamacare) should include the following:

1. The fundamental laws of the U.S. should be the foundation for the concept of health care.
2. The Declaration of Independence of the U.S. (1776) states, that "We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of happiness.
3. The United States Constitution (1787) is also the base for the concept of health care. In the Constitution's preamble is stated: *"We the People of the United States, in order to form a more perfect union, establish justice, insure domestic tranquility, provide for the common defense, promote the general welfare, and secure the blessings of liberty to ourselves and our posterity, do ordain and establish this Constitution for the United States of America."*
4. The concept of "*Happiness*" and "*Welfare*" in the 18th century was slightly different than today. We can assume that both terms currently mean "Well-Being of Americans". This value is the constitutional opportunity of an American. Well-being is a very time and process-oriented value that cannot be guaranteed forever. Once accomplished, it can be lost to many internal and external factors. On the other hand, the American constitution supports this value by providing tools that help in pursuing this opportunity.
5. Good health of Americans is a constituent of their well-being. In other words, good well-being is usually a determinant of good health. Without good well-being, Americans may not have good health.
6. Good health care is the constitutional opportunity of Americans. Today health care is costly. If it is free, it certainly will not satisfy the high expectations of Americans. Do they often perceive death as an option? The choice is between the right and the privilege of having health care. It depends on the state's economic situation and societal and political support. In this respect today, Americans are divided almost equally between the right and privilege. Due to the following:

   a. Almost 16.3% percent of the population not having health insurance (49.9 million) in 2012[9] and high inequality (for 2010, 40.8 % are below perfect distribution, according to the GINI index, comparable to Morocco's and in contrast to Norway's 25.8% in 2000.[10]
   b. It took place in times when 10 percent is unemployed, and another 5 percent is out of statistics.
   c. To have a privilege of health care, it may lead to the lack of social *tranquility* which is expected by the U.S. Constitution. Therefore, basichealth care should be perceived as the controlled right. It means that basic medical help is secured but its use will be controlled. If it is abused by unwise lifestyles, it can be suspended.

7. The intense effort to improve the American Health System is the number 1 in the political agenda of President Barak Obama's administration (2009-16) and president Donald Trump's administration (2017-2020). The fund of $30 billion supported the provision of the Health Information Technology for Economic and Clinical Health (HITECH) Act under the American Recovery and Reinvestment Act of 2009 (signed in February 2009) and of the Patient Protection and ACA. It led to significant changes in the adoption of electronic health records by eligible providers (EP) and eligible hospitals (EH). However, the digital national registration system was malfunctioning for several months, due to poor design and lack of testing before going to the public.
8. When President Trump was elected (2017-2020), he promised to repeal the Affordable Care Act on his first day in White House; he issued an executive order envisioned to turn back ACA execution. He has kept a constant tide of declarations criticizing the law, often saying that it has already been smashed or limited. ACA supporters proclaim that the president's activities reflect his words; that he is intentionally "harming" enforcement of the ACA. Truly, a first-of-its-kind lawsuit was recently filed claiming that President Trump is violating his constitutional duty to "take care that the laws be faithfully executed."
9. However, its first year of complete Act implementation, which began on October 1, 2009, led to the profound political crisis, resulted in shutting down the federal government due to the budget dispute at the Congress. This crisis is mostly caused by the lack of agreed principles of the American Health Care System and limited to the insurance issues.
10. Some positive changes have been implemented in 2009-2016 as the result of the mentioned Acts in p. 4, namely in quality reporting, population health monitoring, electronic health record (EHR) certification for meaningful use and adoption and the start of significant healthcare practice and payment reforms.[11,12] The Obama Care Act triggered many positive changes in the improvements of the American Health Care System; among such improvements, one can notice;

   a. Vendor investment in the healthcare sector has grown significantly since 2009-2010.
   b. The Federal Advisory Committees (FACA) for HIT Policy and HIT Standards has been created inguiding the development of standards and working to improve interoperability and reduce cost, improve quality reporting

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and increase transparency.
c. However, many individual physicians implementing EMR reduced their productivity and lowered health quality by limiting good bedside manners (looking in patients' eyes) by replacing them with a look at the screen of a computer.

The principles of the American Health Care System should also include the following:

1. The well-being of Americans means equal access to sustainable economic vitality with minimized inequality, based upon a sustainable environment, which delivers healthy food, fresh water and air, and culture-oriented activities.
2. The well-being of Americans is achievable through human and societal wisdom, meaning prudent choices made in economic, cultural, and technology-oriented processes at all levels of American society.

a. In particular, political wisdom is essential, since it leads the whole regions and nation.
b. Human and societal wisdom requires mentally healthy people.
c. Human and societal wisdom requires well-educated citizens.

3. Good health is possible if the Americans' lifestyles are wise and good. It means that the citizens have the responsibility to conduct a healthy lifestyle.
4. The United States as a verywell developed nation and world superpower should secure health care for the poor citizens, who according to the headline were 39.7 million in 2017. It works out to 12.3 percent of the population or 1 in 8 Americans. Why are so many poor people in a country that are so rich?[13]
5. How does one justify our distribution of 90% for treatment to other nations who appropriate 90% for prevention? The major socioeconomic determinant for health or well-being in the USA is poverty.[14]

THE STATE AND AIMS OF THE HEALTH CARE REFORM IN 2020

The U.S. State in 2018:

• **The state of the Americans** is below its peak in 1960 (so-called fabulous years). In the 20th century, America towered over its rivals. At the end of the Second World War, America's dreams were collectively ambitious but individually modest. Nowadays, the collective ambitions of America have shrunk but the individual aspirations of its citizens–their dreams of prosperity, freedom, and happiness[15] are undiminished.[16] The question for the future is whether the relative decline of America (due to unregulated globalization) means that the dreams of individual Americans will need to be downsized as well.

• **The state of the well-being of the Americans** is low. The service economy is too weak to support the American Way as used to be. The offshore out sourcing of manufacturing is the permanent cause of high unemployment. The Americans borrow too much money and capital and soon may be internationally bankrupt. The 2008-2013 financial crises indicate that the Managerial Revolution (executives intercept dividends under a form of huge bonuses) is at the peak. Wall Street turned the American financial system into a casino. Bad economy limits taxes at all levels, and as a result, schools are closing (ex. 44 in Detroit in 2009) and colleges are in financial crises. The national IQ of 98 is far behind too many countries. Regarding social-civilizational wisdom, the U.S. is not the first, as its level of Academia could indicate. Mass culture lowered academic standards of social taste and behavior, which is reflected in this statement: "no logic, be nice and have fun".

• **The state of health care of the Americans** is in a state, which is not appropriate for the richest and powerful, and influential country in the world. The quality of health care is at the level of 54 percent.[17] The cost of health care per capita is twice bigger than in some developed countries. While, life expectancy is lower than Japan and Sweden, in countries which are less affluent than the U.S.? Even in the U.S., the same difference is among northern (New England) and southern states (Louisiana and Texas) as between the U.S. and leading countries.[18]

• **The vision of American Society** Americans achieved the highest standard of living among large nations in the second part of the 20th century and should strive to maintain it throughout the 21st century. It can be achieved if:

o Manufacturing will return to the U.S and business will secure jobs for the Americans as its best well-being customers.
o Schools and colleges should shift from education based on the knowledge to wisdom inquiry and rise national IQ from 98 to 105. It will lead to the shift from the fun to a wise, good, and healthy society.
o Mental health should be meaningfully improved. Such society should practice wise lifestyles and pursue happiness as it is aimed in the Declaration of Independence, 237-years-ago.
o The Americans will keep playingthe roleas a stabilizing force in the world affairs, as it was provided in the last almost 100 years (since 1914). Because in the 21st century, there is no other state in the world which could play this role instead of the U.S. The Americans are perhaps the only nation which is interested in almost all countries' state of affairs which means that Americans' well-being in general defines well-being of other countries.

Creed: Wise Americans are healthy.

Goals: Goals are defined in the scope of Well-Being (Table 1), Health Care (Table 2) and Information Infrastructure (Table 3). These goals are defined first at the big picture of the national level, and when it is necessary they are also defined at the small-picture of levels below the national one.

Table 1. *The Main Goals of Well-Being of the Americans in the 2020th*

Areas	Goals	2020-2025	2025-2030	Outcome
Enhance education	WBG1. The shift for knowledge to wisdom inquiry	10 % of schools and colleges	60% of schools and colleges	Wiser graduates, future professionals, managers, leaders, and politicians
	WBG2. Enhance national IQ	From 98 to 101	From 101 to105	More able citizens
Establish sustainable economy	WBG3. Minimize statistical and structured unemployment	From 10%+5% To 8%+4%	From 8%+4% To 6%+3%	Middle class restored
	WBG4. Regulate food business 's products and consolidation	Increase the number of food making companies by 200% Reduce the volume of unhealthy food by 30%	Increase the number of food making companies by 500% Reduce the volume of unhealthy food by 80%	More local versus global food production and services
	WBG5. Reduce Inequality	From 0.40 to 0.35 (of GINI index)	From 0.35 to 0.25 (of GINI index)	The larger middle class developed
Green-up environment	WBG6. Increase fresh water availability	Expanding the scope of sources by 5%	Expanding the scope of sources by 5%	Healthier consumption
	WBG7. Increase availability potential of timber, fiber, and fuel	By 5%	By 5%	Maintaining sufficiency of civilization
	WBG8. Increase the availability of fresh air by reducing C2O emission	By 20%	By 30%	Slowed warming of the climate and healthier air
	WBG9. Increase recycling	By 20%	By 30%	Better use of unrenewable resources and better management of waste
Increase social awareness	WBG10. Implement curriculum (or electives) of environmental study and civilization study	In 25% of schools and colleges	In 95% of schools and colleges	More aware graduate
	WBG11. Increase the number of green organizations (campuses, enterprises, institutions)	By 25%	By 50%	More social awareness in promoting green workplaces
	WBG12.Establish prestigious awards systems for best practices in the sustainability of civilization	Several	Several	More inspirational ruling and society
	WBG13. Reduce super-consumerism	Expand the education curricula in the area of secular spirituality (virtues and values)	Intensify the education curricula in the area of secular spirituality (virtues and values)	More wiser and ethical business and consumers

Table 2. *The Goals of Improving Health Care of the Americans in the 21st Century*

Areas	Goals	2020-2025	2025-2030	Outcome
Population	HCG1.Stabilize the growth of the American population	Reduce the annual growth rate of the population from 0.89 to 0.75	Reduce the annual growth rate of the population from 0.75 to 0.50	Better use of strategic resources Stabilize population in 2050 below 400 million.
Mental health	HCG2. Reduce the number of mentally ill to the level of leading countries	To the level of the Czech Republic	To the level of Japan	Better decision-makers within the society
Prevention---life styles	HCG3. Popularize healthy diets	Reduce the obesity of the population from 60% to 50%	Reduce the obesity of the population from 50% to 25%	Reduce the rate of mortality and the cost of health care for diabetic and heart-born patients
	HCG4. Implement Wellness Programs	Increase the number of participants by 20%	Increase the number of participants by 30%	Healthier people
Quality	HCG5. Increase the quality of health care	From 54% to 65%	From 65% to 75%	Healthier patients and lower curing cost
Green-up environment	WBG6. Increase fresh water availability	Expanding the scope of sources by 5%	Expanding the scope of sources by 5%	Healthier consumption
	HCG6. Increase life expectancy	From 78 to 80	From 80 to 82	The pleasure of living and the sign of well-being and health
Cost	HCG7. Reduce the cost/capita	From $8,000 to $5,500 (in 2010 dollar)	From $5,500 to $4,000 (in $2020 dollar)	The containment of cost growth
Insurance	HCG8. Improve insurance system	Develop the national system of **controlling rights** to basic health care at the level of the individual patient (NBHCS)	Improve the NBHCS according to issues of practice	Less abuse **basic rights** for health care by those who do not care about their lives styles
	HCG9. Improve the 2010 Health Care Law	Remove errors and misuse solutions	Implement the universal health care insurance law	Insurance system more suiting the right of basic health care
	HCG10. Improve malpractice insurance system	Remove solutions which abuse the health care system	Implement the universal mal practice malpractice insurance	

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Table 3. *The Goals of Improving Health Information Infrastructure of the Americans in the 21st Century*

Areas	Goals	2020-2025	2025-2030	Outcome
EMR-Electronic Medical Records	HIG1. Increase the use of EMR	From 7% to 25% of medical practice	From 25% to 85% of medical practice	Higher throughput of the entire health care system for the sake of patients and administration
HIE-Health Information Exchange	HIG2. Make it operational in all 50 states	At the level of basic services of a region	At the level of knowledge management systems (Data warehousing and Data Mining)	The right regional information environment for providing better and less expensive health care
NHIE-National Health Information Exchange	HIG3. Make it operational	At the level of basic services	At the level of regional knowledge management systems (Data Warehousing and Data Mining)	The right national information environment for providing better and less expensive health care
Global- Health Information Exchange	HIG4. Make it operational at the level of standardization	At the level of basic services	At the level of regional knowledge management systems (Data Warehousing and Data Mining)	The right global information environment for providing better and less expensive health care

Strategies:

1. The implementation of 10 well-being-oriented goals of Americans for the next 20 years requires top-down leadership at the federal, state and local governments' levels and bottom-up engagement at the level of schools, colleges, civic organizations, and citizens. Special coordination offices should be created and supported by updated well-being indexes and information systems for reporting and analysis.
2. The implementation of 10 healthcare-oriented goals of Americans for the next 20 years requires top-down leadership at the federal, state and local governments' levels and bottom-up engagement at the level of local health care providers. Special coordination offices should be created and supported by updated health care indexes and information systems for reporting and analysis. The critical issue of improving the quality of health care can be solved in the following approaches (by each one or their combination):

a. Comprehensive public reporting on quality (using The Quality Assessment and Analysis Systems) and pay for quality-driven performance.
b. Secured market-oriented *competition* among providers should be guaranteed. The Quality Assessment and Analysis Systems at local, regional, and national levels should be available for the public and serve in supporting their judgment and choices of the most suited providers.
c. The number of physicians from 2.3 (2000) to 4.0 per 1,000 people should be implemented.
d. Physicians should be reimbursed by pay rate per day.

3. The implementation of four information infrastructure-oriented goals of Americans for the next 20 years requires top-down leadership at the federal, state and local governments' levels and bottom-up engagement at the level of local health care providers. Special coordination offices office of national coordinator (ONC) for Health IT, office of legal counsel (OLC), and other office of should be created and supported by updated indexes and information systems for reporting and analysis.

a. The critical issue of the successful Health Information Infrastructure is in implementing EMR at the physicians' level. The significant improvements in the health care delivery cannot occur without physicians making the transition from paper medical records to EMR.[19]
b. The most significant barriers that prevent most American physicians from adopting EMRs are in their cost ($15,000 to 50,000 per physician) and their probable loss in productivity (due to slower data entry in comparison to quick notes on paper). According to a critical doctors' opinion, this system raises costs, without increasing revenues. On the other hand, those physicians who implemented EMRs never gone back to paper charts.[19]

i. Part of the federal economic stimulus package that passed in February 2009 included a provision for physicians who accepted Medicare patients to earn $44,000 over five years if they prove they are "meaningful users" of a certified EMR system. The rule also includes a 1 percent penalty on Medicare reimbursements for physicians who do not adopt records by 2015.
ii. Being electronic and connected to the Internet allows physicians to access records on an iPhone or Blackberry. The mobile system does not contain all functions available in the office, but physicians can view patient summary information in real time for active problems, allergies, current medications and immunizations, social history, and values from the most recent lab tests.

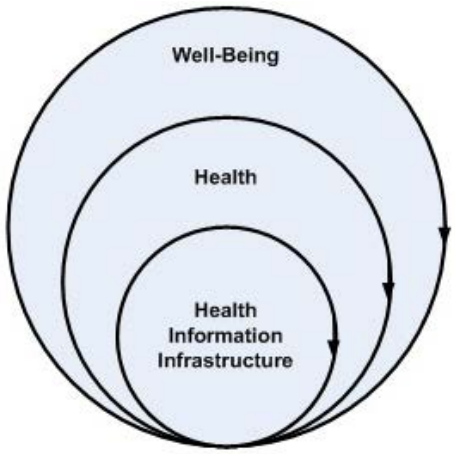
c. Perhaps the user-unfriendliness of some EMR software packages is the reason that physicians do not want to use this solution. It is a room for nation-wide standardization and acceptance rules for EMR software. Then the best solutions (certified) would be more successfully applied.

CONCLUSION

The implementation of this comprehensive concept of goals and strategies leading to better well-being and healthy Americans requires:

1. The integration of well-being, health care, and information infrastructure-oriented components into one comprehensive solution should be implemented. If each one of these elements is treated in isolation, the improvements will not be lasting and positive (Figure 1).

Figure 1. *The Relationships Among Americans' Good Lives*



2. Political will and leadership at all levels of the nation.
3. Professional leadership at all significant professional associations (ex. AMA).
4. Academic leadership at selected schools and colleges, at the preparatory phase of the program.
5. Business leadership of this program-oriented health care providers.
6. Media's support in developing and implementing this program.
7. Other necessary initiatives.

At the time of publishing this paper (2019), the author is rather pessimistic about the possibility of successful implementation of this program. The American national political and societal climate is negative for large-scale and innovative initiatives. The *status quo* is the most popular policy among established political and professional leaders. It is because the 19th century attitude was supposedly very successful in developing of Americanism (an efficient way to wealth and "happiness"). Unfortunately, after the passing of almost two centuries, today we enter a new epoch of new societal issues and required solutions, which require bold conceptualization and tough choices, through the 21st century.

Perhaps, the American Medical Association (AMA) and medical schools should take the lead in promoting professional and political ways of wise and good health care in the U.S.

REFERENCES

1. America's Health Insurance Plans (HIAA). 232.

2. Annual Report of the Medicare Trustees (for the year 2017), 2018.

3. What is wrong with Obamacare. Web site. https://www.thebalance.com/what-is-wrong-with-obamacare-3306076, accessed 01.03. 2019

4. Jost TS. Our broken health care system and how to fix it: An essay on health law and policy. 41 Wake Forest L. Rev. 2006; 537.

5. CMS.gov. Centers for medicare & medicaid services. NHE Fact Sheet. Web site. https://www.cms.gov/research-statistics-data-and-systems/statistics-trends-and-reports/nationalhealthexpenddata/nhe-fact-sheet.html. Accessed January, 4, 2019.

6. Wolman DM, Miller W. The consequences of no insurance for -individuals, families, communities, and the nation. 32 J.L. MED. & ETHICS. 2004; 397-399.

7. Anderson GF, Reinhardt UE, Hussey PS, Petrosyan V. It's the prices, stupid: Why the united states is so different from other countries. *Health Aff (Millwood)*. 2003; 22(3): 89-105. doi: 10.1377/hlthaff.22.3.89

8. Pauly MV, Goodman JC, Feder GJ, et al.Tax credits for health insurance and medical savings accounts. *Health Aff (Millwood)*. 1995; 14(1): 125-139. doi: 10.1377/hlthaff.14.1.125

9. By the numbers: Health insurance. CNN Politics. Web site. https://edition.cnn.com/2012/06/27/politics/btn-health-care/index.html. Retrieved September 15, 2013.

10. Eric S. World development indicators 2007. Washington, DC: World Bank. 67-68.

11. Johnson RW. Health information technology in the united states: Better information systems for better care. Retrieved September 25, 2017.

12. Health and human services August 5, 2013 Press Release, Data exchange growing through EHR adoption, new study finds. Web site. https://www.naylornetwork.com/cmsatoday/articles/index.asp?aid=229954&issueID=30156. Retrieved September 25, 2017.

13. Pressman S. The range of poverty in America. U.S. News. web site. https://www.usnews.com/news/healthiest-communities/articles/2018-09-12/poverty-in-america-new-census-data-paint-an-unpleasant-picture. September 12, 2018.

14. Slavkin H. In e-letter to this Autor. November 24, 2018.

15. Painer K. Smile: USA ranks 17th among world's happiest countries. USA Today. Web site: https://www.usatoday.com/story/news/world/2013/09/09/happy-countries/2785845/ 2013.

16. Brands HW. *American Dreams: The United States Since 1945*. New York, USA: Penguin Press. 2010.

17. Targowski A. The Proceedings of the 210 Conference on Sustaining the Business of Health care in America. Paper presented at: Well-being, wisdom, and health care; September 25, 2010; Michigan, Kalamazoo.

18. Davidson KA. The most efficient health care systems in the world. The Huntington Post. Web site. https://www.huffingtonpost.in/entry/most-efficient-healthcare_n_3825477?ec_carp=5187240215106077235. Published August 29, 2013. Updated December 12, 2017.

19. Lee TH, Mongan JJ. *Chaos and Organization in Health Care*. Cambridge, MA, USA: The MIT Press. 2009.

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Original Research

Risk Behaviors for Proactive Health Promotion

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ABSTRACT

Background
Effective, high quality health promotion policy and practice depends on the availability of sound evidence generated from both quantitative and qualitative methods. This study aimed to identify the reasons leading to inappropriate practices and risk behaviors among target populations, and to determine the knowledge and attitude of communities regarding healthy diet, physical activity and body weight.

Methods
A qualitative study conducted by Non-Communicable Disease Directorate, in association with the Public Health Institute, Federal Ministry of Health, Khartoum, Sudan, and covering three states. After grouping the Sudan 18 States into four geographical zones, the State with poorest indicators from each zone was selected. The participants in each State were selected purposefully based on their knowledge and expertise in the area, and stratified according to the residence to urban and rural. A total of 12 focus group discussions, each of 8-10 persons, were conducted using focus group discussion guide. Ethical clearance was obtained from the National Research Ethical Committee and written informed consent was obtained from all participants.

Results
The consumption of vegetables was on a daily basis; but for fruit, consumption was less and depended on accessibility and price. Consumption of whole grain flour was more than refined flour among the respondents and consumption of vegetable oil was more than margarine/butter. Despite the fact that respondents were identified white meat as better to the health, they were found to consume red meat more. There was also high consumption of both white sugar and salt. Although the respondents aware of the benefit of physical exercise, but only a few of them were engaged in regular physical activities. In addition, the respondents aware of the effect of obesity on the health and it is closely linked with diseases, some women believed that obesity is a marker of beauty. Most of the respondents showed their willingness to change towards healthy lifestyles.

Conclusions
This study had shown a high degree of awareness among the respondents about healthy diet, harmful effects of obesity and the benefits of physical activity on the health, although some of them consumed more red meat, white sugar, salt, less fruit, and few of them only engaged in physical activity. The respondents were willing to change their diet and exercise habits if the need arise and if asked to do that by medical doctors.

Keywords
Non-Communicable Disease (NCDs); Risk behaviors; Unhealthy diet; Physical inactivity; Obesity; Lifestyles change.

INTRODUCTION

Non-Communicable Diseases (NCDs) are by far the leading cause of death worldwide and one of the major health challenges of the 21st century. In September 2011, at the United Nations General Assembly in New York, USA a political declaration was made to strengthen global and national responses to prevent and control NCDs.[1] In 2016, they were responsible for 71% (41

million) of the 57 million deaths, which occurred globally.[2]

The major NCDs responsible for these deaths included cardiovascular diseases (17.9 million deaths, accounting for 44% of all NCDs deaths and 31% of all global deaths); cancers (9 million deaths, 22% of all NCDs deaths and 16% of all global deaths); chronic respiratory diseases (3.8 million deaths, 9% of all NCDs deaths and 7% of all global deaths); and diabetes (1.6 million deaths, 4% of all NCDs deaths and 3% of all global deaths). An even higher proportion (75%) of premature adult deaths (occurring in those aged 30-69 years) was caused by NCDs, which meant that NCDs are not a problem for older populations. The global probability of dying from one of the four main NCDs in 2016 was 18%, with a slightly higher risk for males (22%) than for females (15%).[2]

In addition, they are the main cause of death in all World Health Organization (WHO) regions (with the exception of Africa) and most individual countries.[3] Although in some countries of the Eastern Mediterranean Region (EMR) the demographic transition has not yet happened, NCDs are responsible for over fifty percent of all deaths. In the Arab World, NCDs were a cause of 55% of all disability-adjusted life years (DALYs), from 41% in 1990.[4,5]

In Sudan, NCDs cause 50% of all deaths (150,000 deaths per year). Twenty six percent of the populations have a risk of premature death from targeted NCDs.[6]

As part of the declaration, WHO was given a leadership role, and subsequently established the WHO Global Action Plan for the Prevention and Control of NCDs 2013-2020 (Global NCD Action Plan) adopted by the World Health Assembly in 2013.[1,7,8]

The Global NCD Action Plan included a global monitoring framework and nine voluntary global targets to be attained by 2025.[7] These targets are aligned to those for NCDs included in the 2030 Agenda for Sustainable Development adopted at the United Nations Summit on Sustainable Development in September 2015 and the WHO 13th General Programme of Work 2019-2023 (GPW 13) adopted by the World Health Assembly in May 2018.[9-12]

The available data from Sudan were from the few studies conducted; these are the annual health statistic records of the Federal Ministry of Health.[13] Sudan Household Health Survey,[14] and the WHO STEPwise was study done in Khartoum State,[15] these studies reveal a rising prevalence and an overwhelming impact of NCDs on the Sudan health system.

Effective, high-quality health promotion policy and practice depend on the availability of information from research and evaluation. In Sudan, currently the health promotion department in the process of developing the five-year strategic plan and it is becoming increasingly apparent that evidence is needed for effective health promotion interventions. Many studies have been conducted by the different health programs to determine the level of knowledge, practices and behaviors of target populations towards major health issues including NCDs. This is in addition to research on determinants of health problems. However, for designating effective health interventions to promote the health of the population, more deep information is needed through qualitative methods to elicit the reasons behind the risk behaviors. As nutrition and physical activity play an important role in the prevention and control of chronic diseases such as hypertension, diabetes and ischemic heart diseases, therefore, there should first be in-depth study and analysis of the current situation regarding unhealthy diet and physical inactivity.

The main purpose of this study is to identify the reasons leading to inappropriate practices and risk behaviors among target populations, and to determine the knowledge and attitude of communities regarding healthy diet, physical activity and body weight in order to design effective interventions that promote the health of the targeted population.

MATERIALS AND METHODS

Study Design and Settings

Federal Ministry of Health, Khartoum, Sudan (Non-Communicable Disease Directorate, and Public Health Institute), conducted a qualitative study, covering three states. The eighteen States of Sudan were grouped into zonal groups. The Sstates in each zone were ranked according to the group of health indicators describing the health problems targeted by the study. The State with poorest indicators from each zonal group was selected.

The selected states were: Northern, Red Sea and Blue Nile States. They are situated in northern; eastern; and southern part of Sudan respectively.

Study Population and Sampling

According to the specific health topic, study participants were selected purposefully by the aid and permission of the local authorities/leaders. Study populations were stratified by area of residence (rural/urban) and by gender and age. A total of 12 focus group discussions (FGDs) were conducted to identify the knowledge, attitude and practices regarding healthy diet and physical activity. Each group had from eight to ten participants, with age group >18 years for both males and females. Two focus group discussions were held with men, one in an urban area and the other in a rural area; the same was carried out with women, giving four focus group discussions in each State.

Demographic Characteristics of the Study Participants

The table below demonstrates the socio-demographic characteristics of the participants.

Table 1. *Demographic Characteristics of the Study Participants*

Characteristics	Male		Female	
	No	%	No	%
Age group				
18-29	9	16.3	12	21.8
30-39	17	31	15	27.2
40-49	20	36.3	22	40
50-59	6	11	5	9
60 and above	3	5.4	1	2
Marital status				
Single	16	29.1	12	21.8
Married	31	56.5	37	67.3
Divorced	5	9	4	7.3
Widowed	3	5.4	2	3.6
Education				
Illiterate	7	12.7	15	27.3
Basic	12	21.8	24	43.6
Secondary	27	49.1	14	25.5
University	7	12.8	2	3.6
Post graduate	2	3.6	0	0
Income				
Low	32	58.2	34	61.8
Middle	15	27.3	17	31
High	8	14.5	4	7.2

Technique of Data Collection

All FGD members were informed of the ground rules before starting the discussions. Participants were advised to:

(a) Respect the privacy of the others;
(b) Only one allowed to speak at a time to ensure that the opinions of others could be heard;
(c) Allow everyone an equal time to participate in the discussions;
(d) Encourage participants to share in the discussion.

The guiding and probing points were developed based on the outcome of the review of the available literature, and they covered all the areas in order to achieve the proposed objectives; The frequency of eating fruit and green salad/vegetables (raw or cooked); the frequency of drinking fruit juices; number of servings of vegetables usually eaten/day; type of meat consumed mostly; type of meat that is better for the health and mention the reasons; type of flour (whole grain or refined) you usually consume in the bread and other types of local food that flour is used in; type of oil used for cooking and the frequency of usage of butter for cooking, and the effect of butter/animal fat on health; opinions on vegetable oil and butter; the amount and the way the white sugar used (in the tea and other drinks); amount of salt in average added to the food per day (in tea-spoons); the frequency of engaging in physical activities/day or /week, and whether it is intentional for exercise or as part of the daily activities. The benefits of physical exercise to health. The effect of obesity on health, and the preferred channels of information about health issues.

A very simple local and understandable language was used for a structured conversation to obtain in-depth information concerning each participant. The discussions in each group took between 90-120 minutes. With each group, the researcher began by introducing him/herself and explaining carefully and clearly the objectives of the discussion. He/she checked that the participants felt comfortable with what was going to be discussed, and asked them to introduce themselves and ensured that they were willing to participate.

The data collectors coordinated and guided conversations by ensuring that all opinions were reported and that the participants restricted their comments to the desired information.

All varieties of topics were discussed with FGD participants to achieve the objectives of the study.

Data Analysis

The reports of discussions were transcribed verbatim. The results were analyzed manually. The analytical approach involved grouping together similar responses using different colors for the different FGDs for easy comparison of themes across groups. Similar concepts were grouped together to form common themes, and each occurrence was labeled as it occurs. The frequencies of similar words or phrases were noted to assist with identifying important themes.

Ethical clearance for the study was obtained from the National Research Ethical Committee, and written informed consent was obtained from all participants of the study.

RESULTS

Diet

Vegetables and fruit consumption: The pattern of vegetables consumption was similar in the three states, for almost all the respondents are consumed vegetables daily, cooked or in the form of fresh salad. The types of vegetables consumed usually differ according to the season.

For those not consuming vegetables on a daily basis, the reason was unavailability of daily local markets for vegetables.

Regarding fruit consumption, the pattern was also similar in the three states. The consumption varies from daily to rarely. The reason for the low consumption was the high price of fruits compared to vegetables.

Preferred and consumed type of meat: The most consumed types of meat were sheep and beef meet in Northern and Blue Nile States, and goats meet in the Red Sea State, camel meat was commonly used in the Northern and the Red Sea States.

Although respondents in all States identified white meat –fish specifically–as the best type of meat for the health, fish was the least consumed meat even in the Red Sea State.

The type of consumed flour: In the Blue Nile and Red Sea States, households consume whole grain local corn flour in the form of porridge (locally known as Kisra), while in the Northern State; households mainly consume bread made of whole grain wheat flour. Bread made of refined wheat flour was the least consumed type and mainly consumed in the Northern State.

Preferred and consumed type of oil: In all states, vegetable oil is used for cooking and as a salad dressing. Butter or margarine are not used for cooking but are added in small amounts to the dish after it is ready. However, women and men, especially in the Red Sea and Blue Nile States think that butter/margarine is better for the health more than vegetable oil because it is made from milk and it tastes better.

Consumption of white sugar: The majority of respondents from all states add sugar to tea or coffee, the amount added ranged from one teaspoon up to six spoons. Only a few respondents do not add sugar to their drinks. Some of the women add sugar to the pot of tea before serving it to the family members, while some put the sugar in a separate pot and serve the tea without sugar. The majority of the respondents from the Northern State stated that they would never consider drinking tea or coffee without sugar or other types of sweeteners (dates).

Respondent in the Red Sea and Blue Nile States said they would consider having their drinks without sugar if it is not available, or in case of ill health, diabetes or old age.

Consumption of salt: Regarding salt consumption, women in all States do not follow standard measurements; they add salt to the whole food pot in "suitable" amounts depending on their experience. Only when some family members have high blood pressure would they reduce the amount of salt added to the food.

The effect of butter/animal fat on health: In the opinion of all respondents from the Northern State, consumption of butter or margarine is harmful to the health. They think that it leads to high cholesterol level and blockage of arteries in addition to obesity. On the other hand, most of the respondents from the Red Sea and Blue Nile States think that butter and margarine consumption is useful to the body. They think that it improves health, strengthens the body and facilitates childbirth.
"*Our ancestors had good health because they used to drink margarine*".

Physical Activity and Exercise

The majority of the respondents from all States did not engage in regular physical activities with the purpose of exercising. However, they considered walking to achieve different work or social tasks as an exercise, they also considered the activities they perform at the house or work place as exercise. Those who engaged in physical activities with the purpose of exercise were entirely males and mostly from the Red Sea State.

The benefits of physical exercise to the health: In the opinion of the respondents from all states, exercise is useful to the body because "*it improves blood circulation*", "*makes the person more active*", "*prevents and reduce obesity*" and "*builds the body muscles*".

Obesity

It seems that respondents to some extent aware of the effect of obesity on health. Participants mentioned that obese people were less active and easily became tired. As well, the majority of participants linked obesity with diseases of blood vessels, joints and limbs problems, hypertension, diabetes mellitus and to the general appearance of the person. Women (particularly in Red Sea State) believed that obesity is a marker of beauty.

Possible Role

Communities in Sudan are willing to change diet and exercise habits. Yet this commitment seems conditional: "*We are willing to change diet and exercise habits if the need arise*" and "*We are obliged to comply with doctors decisions*".

The knowledge and skills obtained from the study communities were from different sources. Participants order communication channel as follows: Radio, Television, face-to-face communication, newspapers and pamphlets. They also obtained their knowledge from health care providers and internet and mobile messages. School were listed as a source of knowledge.

DISCUSSION

Sudan does not have a surveillance system for NCDs and NCD risk factors but has only a few scattered studies. This is due to difficulties in the health information system and lack of research resulting from the shortage of human and financial resources.[16]

In contributing to an understanding of health risk behaviors in Sudan, the present study examined the distribution of selected health risk behaviors among the communities of the targeted states.

Dietary Pattern

WHO recommended at least 400 g (i.e. five portions) of fruit and vegetables per day excluding starchy roots.[17]

In this study, the respondents maintained a daily intake of vegetables either fresh or cooked. However, it was difficult to quantify the amount consumed per person, because eating directly from a common dish, is the traditional practice of many people in Sudan.

Consumption of fruits was not as frequent as that of vegetables and it depended on the seasonally available types of fruit and its price. In these communities due to the lack of facilities

of transport and storage, people depend on locally produced vegetables and fruits.

Researches showed that greater perceived access was associated with higher increases in fruit and vegetable consumption, and the price was a contributing factor in individual food choices.[18]

Compared with Sudan STEPwise survey done in 2016, the healthy diet recommendation of consuming 5 portions of vegetables and fruits combined, was not met by 94.7% of the population. Fruits are consumed on average on 1.9 days per week and vegetables on 4.0 days per week. Darfur, Khartoum, Northern and Central regions had a mean number of days of consumption of fruit greater than the national average of 1.9 days.[19]

In November 2014, WHO organized, jointly with the Food and Agriculture Organization of the United Nations (FAO), the Second International Conference on Nutrition, adopted Declaration on Nutrition,[20] and the Framework for Action,[21] which promote diversified, safe and healthy diets at all stages of life.

Regarding the red meat, results from two large prospective cohorts of US men and women, found that a higher intake of red meat was associated with a significantly elevated risk of total cardiovascular disease (CVD), and cancer mortality and this association was observed for unprocessed and processed red meat, with a relatively greater risk for processed red meat. Substitution of fish, poultry, nuts, legumes, low-fat dairy products, and whole grains for red meat was associated with a significantly lower risk of mortality. Red meat is a major food source of protein and fat, and its potential associations with risks of diabetes mellitus,[22] CVD,[23] Cancer,[24] and mortality,[25] have attracted much attention.

In addition, CVD mortality, previously reported that red meat intake was associated with an increased risk of coronary heart disease.[23,26]

In this study, although most of the respondents reported that white meat (fish) is better for the health compared to red meat, the consumption pattern was in favour of red meat. This could possibly be due to availability of the red meat, although white meat has fewer prices than the red one.

Amount and type of oil used: To avoid unhealthy weight gain, total fat should not exceed 30% of total energy intake.[17,27,28] Intake of saturated fats should be less than 10% of total energy intake, and intake of trans fats less than 1% of total energy intake, with a shift in fat consumption away from saturated fats and trans fats to unsaturated fats,[28] and towards the goal of eliminating industrially-produced trans fats.[29,30]

In this study, despite most of the participants reporting to use vegetable oil, some respondents perceived margarine/ butter to be better to the health than vegetable oil, because it is of animal origin.

Sudan STEPwise survey done in 2016 found that 99.5% of the participants used vegetable oil for cooking and preparation of meals. No household uses margarine or butter for meal preparation.[19]

Whole grains (e.g. unprocessed maize, millet, oats, wheat and brown rice), are part of the healthy diet recommended by WHO, and they are helping to protect against NCDs, such as diabetes, heart disease, stroke and cancer.

Furthermore, refined grain products contain more starch but substantially lower amounts of dietary fiber, essential fatty acids, and phytochemicals.

An important finding in this study, the consumptions of whole grain flour was found to be high, and the refined wheat flour was found to be rarely used.

For the effect of salt, in May 2018, the Health Assembly approved the 13th General Programme of Work (GPW13), which will guide the work of WHO in 2019-2023. Reduction of salt/ sodium intake and elimination of industrially-produced trans fats from the food supply are identified as part of WHO's priority actions to achieve the aims of ensuring healthy lives and promote well-being for all at all ages.[11]

Salt, sodium: Reducing salt intake to the recommended level of less than 5 g per day could prevent 1.7 million deaths each year.[31]

Most people consume too much sodium through salt (corresponding to consuming an average of 9-12 g of salt per day) and not enough potassium (less than 3.5 g). High sodium intake and insufficient potassium intake contribute to high blood pressure, which in turn increases the risk of heart disease and stroke.[32,33]

In this study, women in all states do not follow standard measurements for the consumption of the salt; they added it to the whole food pot in "suitable" amounts depending on their experience. Only when some family members have high blood pressure, they reduce the amount of salt added to the food.

Compared with Sudan STEPwise survey 2016 for salt consumption, although (87%) of participants thought that consuming too much salt could cause serious health problems and (91.8%) were aware that it was important to reduce salt intake, nevertheless (32.4%) added salt or salty sauce to their food before eating. Measured salt in urine was 8.2 gram of sodium in Khartoum sate.[19]

Regarding the usage of sugars, there is a recommendation that, less than 10% of total energy intake from free sugars,[17,34] which is equivalent to 50 g (or about 12 level teaspoons) for a person of healthy body weight consuming about 2000 calories per day, but ideally is less than 5% of total energy intake for additional health benefits.[34]

Excess calories from foods and drinks high in free sugars also contribute to unhealthy weight gain, which can lead

to overweight and obesity. Recent evidence also shows that free sugars influence blood pressure and serum lipids, and suggests that a reduction in free sugars intake reduces risk factors for cardiovascular diseases.[35]

Free sugars are all sugars added to foods or drinks by the manufacturer, cook or consumer, as well as sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates.

In this study, the majority of respondents from all states add sugar to tea or coffee, the amount added ranged from one teaspoon up to six spoons. Some of the women add sugar to the pot of tea before serving it to the family members.

The majority of the respondents from the Northern State stated that they would never consider drinking tea or coffee without sugar or other types of sweeteners (dates).

The results of Sudan STEPwise survey 2016 found that the average number of days in which respondents consumed soft drinks and/or manufactured juices is 1.2 days per week. On average all participants and among all age groups, consume 6.3 teaspoons of sugar daily.[19]

Physical Activity (PA)

WHO defined physical activity (PA); as any bodily movement produced by skeletal muscles that require energy expenditure. WHO recommends doing at least 150 minutes of moderate-intensity physical activity per week or equivalent.

Studies revealed that lack of PA during childhood and youth may lead to cardiovascular disturbances and progression of atherosclerosis that could contribute to the development of CVD in adulthood. Indeed, organizations and governments have identified a population-wide promotion of a healthy lifestyle including PA in young people as a key priority for primordial prevention of CVD.[36]

In this study, the respondents were aware of the benefits of exercise on health. Although only a few of the participants claimed to be engaged in physical activity with the purpose of the exercise, the majority of them were not engaged in regular exercise and considered their daily chores at home or the workplace as an exercise.

In addition, physical inactivity is also driving the increasing magnitude of NCDs. People who are insufficiently physically active have an increased risk of all-cause mortality, compared with those who engage in at least 30 minutes of moderate-intensity physical activity most days of the week. Added to these, physical activity lowers the risk of stroke, hypertension and depression.[37]

Participation in 150 minutes of moderate physical activity each week (or equivalent) is estimated to reduce the risk of ischaemic heart disease by approximately 30%, the risk of diabetes by 27%, and the risk of breast and colon cancer by 21-25%.[38]

The 2016 Sudan STEPwise survey revealed that overall 14.1% of Sudanese (11.4% men and 17.3%) do not engage in the recommended amount of physical activity. There was a great variation of insufficient PA among the regions (Kordofan 8.1% and Northern 20.8%). Inactivity was higher among urban (18%) than rural (11.6%) respondents.[19]

Overweight and Obesity

Other serious risk factors, is overweight and obesity; In 2016, more than 1.9 billion people aged 18 and older were overweight (a person whose BMI is greater than or equal to 25), with more than 650 million considered obese (one with a BMI≥30).

Obesity is not solely an issue for adults: in 2016, 340 million children and adolescents aged 5-19 years, and around 40 million children under the age of 5 years, were considered overweight or obese.[39]

Gaining excess weight in childhood and adolescence is associated with an increased likelihood of obesity, type 2 diabetes, and premature death in adult life.[40]

Moreover, obesity is linked to an increased risk of hypertension, many NCDs (such as diabetes, coronary heart disease, stroke, and cancers), and conditions including obstructive sleep apnoea and osteoarthritis.[40] Between 1975 and 2016, the worldwide prevalence of obesity nearly tripled and continues to rise in low- and middle-income countries, although it was once considered a problem of high-income countries.[39]

In this study, the respondents had shown a high degree of awareness about the harmful effects of obesity on the health, and the majority of them link obesity with diseases of blood vessels, joints and limbs problems, hypertension, diabetes mellitus. In contrast, women (particularly in Red Sea State) saw obesity as a marker of beauty.

Sudan STEPwise survey 2016 results revealed that 28.3% of Sudanese adults are either overweight or obese with the percentage being greatly higher in women (35.6%) than men (22.6%).[19]

There is convincing evidence that nutrition and physical activity play an important role in the prevention of chronic diseases such as hypertension, diabetes and ischemic heart diseases.[41]

The respondents to this study claimed they would adopt a healthy diet and lifestyle if they developed a health condition that requires this change, which indicated that a health promotion program, is strongly recommended.

In this study, although most of the respondents reported that white meat (fish) is better for health compared to red meat, the consumption pattern was in favor of red meat. This could possibly be due to the availability of red meat, although white meat has fewer prices than the red one.

Study's strengths: Prevention and control of NCDs is one of the policy foundations of Sudan's National Strategic Plan for the health sector (2003-2027), so the results of this study, which elicited the reasons behind the risk behaviors among the targeted group, will be used for designating effective health interventions to promote healthy lifestyles among the population. In addition, we can contribute much to the achievement of Sustainable Development Goals, especially in the area of health system strengthening.

Study's weaknesses: In Sudan, there are many tribes with different cultures and behaviors, in order to develop a strong health promotion program for lifestyle changes, the study should cover all the zones of Sudan, but our main obstacles are the resources (both finance and human) In addition, this study did not cover people below 18 years, although health promotion interventions is extremely needed among this group, so more researches are needed to fill these gaps.

CONCLUSION

This study had shown a high degree of awareness among the respondents about healthy diet, harmful effects of obesity and the benefits of physical activity on the health, although some of them consumed more red meat, white sugar, salt, less fruit, and few of them only engaged in physical activity.

The respondents were willing to change their diet and exercise habits if the need arise and if asked to do that by medical doctors.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

REFERENCES

1. United Nations General Assembly Resolution. Follow-up to the Political Declaration of the High-level Meeting of the General Assembly on the Prevention and Control of Non-Communicable Diseases. New York: United Nations; 2012. https://digitallibrary.un.org/record/720106/files/A_RES_66_2-EN.pdf. Accessed August 16, 2018.

2. Global Health Estimates 2016: Deaths by Cause, Age, Sex, by Country and by Region, 2000-2016. Geneva, Switzerland: World Health Organization; 2018.

3. World Health Organization (WHO). Global Status Report on Noncommunicable Diseases 2014. https://www.who.int/nmh/publications/ncd-status-report-2014/en/. Accessed August 16, 2018.

4. Mokdad AH, Jaber S, Aziz MI, et al. The state of health in the Arab world, 1990-2010: An analysis of the burden of diseases, injuries, and risk factors. *Lancet*. 2014; 383(9914): 309-320. doi: 10.1016/S0140-6736(13)62189-3

5. Rahim HF, Sibai A, Khader Y, et al. Non-communicable diseases in the Arab world. *Lancet*. 2014; 383: 356-367 doi: 10.1016/S0140-6736(13)62383-1

6. World Health Organization (WHO). WHO NCD progress monitor 2017. https://www.who.int/nmh/publications/ncd-progress-monitor-2017/en/. Accessed August 16, 2018.

7. World Health Organization (WHO). Global action plan for the prevention and control of noncommunicable diseases 2013-2020. http://www.who.int/nmh/events/ncd_action_plan/en/. Accessed August 16, 2018.

8. Sixty-sixth World Health Assembly. Follow-up to the political declaration of the high-level meeting of the general assembly on the prevention and control of non-communicable diseases. May 27, 2013. http://apps.who.int/gb/ebwha/pdf_files/WHA66/A66_R10-en.pdf?ua=1. Accessed August 16, 2018.

9. Sustainable Development Goals. Transforming our World: The 2030 Agenda for Sustainable Development. https://sustainabledevelopment. un.org/post2015/transformingourworld. Accessed August 16, 2018.

10. United Nations General Assembly. Transforming our world: The 2030 agenda for sustainable development. http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E. Accessed August 16, 2018.

11. World Health Organization (WHO). Thirteenth General Programme of Work 2019-2023. http://www.who.int/about/what-wedo/gpw-thirteen-consultation/en/. Accessed August 16, 2018.

12. Seventy-first World Health Assembly. Thirteenth General Programme of Work, 2019-2023. http://apps.who.int/gb/ebwha/pdf_files/WHA71/A71_R1-en.pdf. Accessed August 16, 2018.

13. Annual Health Statistical Reports. Federal Ministry of Health. Web site. http://www.fmoh.gov.sd. 2014. Updated May 21, 2019. Accessed August 16, 2018.

14. Sudan Household Health Survey-2010. Federal Ministry of Health. Web site. http://www.fmoh.gov.sd. Updated May 21, 2019. Accessed August 16, 2018.

15. WHO STEP-wise Risk factor indicator survey, conducted in Sudan (Khartoum State in (2005 -2006)). Federal Ministry of Health. Web site. http://www.fmoh.gov.sd. Updated May 21, 2019. Accessed August 16, 2018.

16. Non-communicable disease national strategic plan 2010-2015. https://www.iccp-portal.org/system/files/plans/SDN_B3_Sudan%20NCD%20strategy.pdf.

17. WHO/FAO Expert Consultation. Diet, nutrition and the prevention of chronic diseases. World Health Organ Tech Rep Ser. 2003; 916: i-viii, 1-149. https://apps.who.int/iris/bitstream/handle/10665/42665/WHO_TRS_916.pdf?sequence=1. Accessed August 16, 2018.

18. Caldwell EM, Kobayashi MM, DuBow WM, Wytinck SM. Perceived access to fruits and vegetables associated with increased consumption. *Public Health Nutr.* 2009; 12(10): 1743-1750. doi: 10.1017/S1368980008004308

19. World Health Organization (WHO). Sudan STEPwise survey 2016. Fact Sheet by Region. Web site. https://www.who.int, emro. Accessed August 16, 2018.

20. Food and Agriculture Organization of the United Nations and World Health Organization (WHO). Rome declaration on nutrition. Paper presented at: Second International Conference; November 17, 2014; Rome, Italy. http://www.fao.org/3/a-i4465e.pdf. Accessed August 16, 2018.

21. Food and Agriculture Organization of the United Nations and World Health Organization (WHO). Framework for action. Pater presented at: Second International Conference; November 17, 2014; Rome, Italy. http://www.fao.org/3/a-i4465e.pdf. Accessed August 16, 2018.

22. Pan A, Sun Q, Bernstein AM, et al. Red meat consumption and risk of type 2 diabetes: 3 cohorts of US adults and an updated meta-analysis. *Am J Clin Nutr.* 2011; 94(4): 1088-1096. doi: 10.3945/ajcn.111.018978

23. Micha R, Wallace SK, Mozaffarian D. Red and processed meat consumption and risk of incident coronary heart disease, stroke, and diabetes mellitus: A systematic review and meta-analysis. *Circulation.* 2010; 121(21): 2271-2283. doi: 10.1161/CIRCULATIONAHA.109.924977

24. Zheng W, Lee SA. Well-done meat intake, heterocyclic amine exposure, and cancer risk. *Nutr Cancer.* 2009; 61(4): 437-446. doi: 10.1080/01635580802710741

25. Sinar R, Cross AJ, Graubard BI, Leitzmann MF, Schatzkin A. Meat intake and mortality: A prospective study of over half amillion people. *Arch Intern Med.* 2009; 169(6): 562-571. doi: 10.1001/archinternmed.2009.6

26. Bernstein AM, Sun Q, Hu FB, Stampfer MJ, Manson JE, Willett WC. Major dietary protein sources and risk of coronary heart disease in women. *Circulation.* 2010; 122(9): 876-883. doi: 10.1161/CIRCULATIONAHA.109.915165

27. Hooper L, Abdelhamid A, Bunn D, Brown T, Summerbell CD, Skeaff CM. Effects of total fat intake on body weight. *Cochrane Database Syst Rev.* 2015; (8): CD011834. doi: 10.1002/14651858.CD011834

28. World Health Organization (WHO). Fats and fatty acids in human nutrition: Report of an expert consultation. https://www.who.int/nutrition/publications/nutrientrequirements/fatsandfattyacids_humannutrition/en/. 2010. Accessed August 16, 2018.

29. World Health Organization (WHO). Guidelines: Saturated fatty acid and trans-fatty acid intake for adults and children. https://extranet.who.int/dataform/upload/surveys/666752/files/Draft%20WHO%20SFA-TFA%20guidelines_04052018%20Public%20Consultation(1).pdf. 2018.

30. World Health Organization (WHO). Eliminate industrially-produced trans-fatty acids. https://www.who.int/docs/default-source/documents/replace-transfats/replace-action-package.pdf. 2018.

31. Mozaffarian D, Fahimi S, Singh GM, et al. Global sodium consumption and death from cardiovascular causes. *N Engl J Med.* 2014; 371(7): 624-634. doi: 10.1056/NEJMoa1304127

32. World Health Organization (WHO). Sodium intake for adults and children. https://www.who.int/nutrition/publications/guidelines/sodium_intake/en/. 2012. Accessed August 16, 2018.

33. World Health Organization (WHO). Potassium intake for adults and children. https://www.who.int/nutrition/publications/guidelines/potassium_intake/en/. 2012. Accessed August 16, 2018.

34. World Health Organization (WHO). Sugars intake for adults and children. https://www.who.int/nutrition/publications/guidelines/sugars_intake/en/. 2015. Accessed August 16, 2018.

35. Te Morenga LA, Howatson A, Jones RM, Mann J. Dietary sugars and cardiometabolic risk: Systematic review and meta-analyses of randomized controlled trials of the effects on blood pressure and lipids. *Am J Clin Nutr.* 2014; 100(1): 65-79. doi: 10.3945/ajcn.113.081521

36. Kraus WE, Bittner V, Appel L, et al. The National Physical Activity Plan: A call to action from the American Heart Association: a science advisory from the American Heart Association. *Circulation.* 2015; 131: 1932-1940. doi: 10.1161/CIR.0000000000000203

37. World Health Organization (WHO). Global recommendations on physical activity for health. http://www.who.int/dietphysicalactivity/publications/9789241599979/en/. Accessed August 16, 2018.

38. World Health Organization (WHO). Global recommendations on physical activity for health. https://www.who.int/dietphysicalactivity/factsheet_recommendations/en/. 2010.

Accessed August 16, 2018.

39. NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: A pooled analysis of 2416 population-based measurement studies with 128.9 million participants. *Lancet*. 2017; 390(10113): 2627-2642. doi: 10.1016/S0140-6736(17)32129-3

40. World Health Organization (WHO). Report of the commission on ending childhood obesity. https://www.who.int/end-childhood-obesity/publications/echo-report/en/. Accessed August 20, 2018.

41. Fang J, Keenan NL, Ayala C, Dai S, Valderrama AL. Fruits and vegetables intake and physical activity among hypertensive adults in the United States: Behavioral risk factor surveillance system, 2003 and 2007. *Am J Hypertens*. 2010; 23(7): 762-766. doi: 10.1038/ajh.2010.46

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Original Research

Epidemiological Profile of Hypertension, and Its Determinants Amongst Adult Patients in Cameroon: A Hospital-Based Study

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ABSTRACT

Background: Hypertension (HTN) is the major risk factor of cardiovascular diseases. Despite the increasing trends suggesting that HTN is a growing public health problem in developing countries; studies on its prevalence, associated risk factors, and extent of blood pressure control have been mostly done in communities in these countries. In Cameroon, there exists few data on the prevalence of hypertension in hospital area.

Aim of the study: To determine the prevalence of hypertension and identifying the cardiometabolic risk factors associated with HTN of the patients attending to Deido District Hospital.

Methodology: Descriptive and cross sectional survey was carried out at the Deido District Hospital. For this, 805 cameroonians male and female aged 20 years above were recruited on their arrival at the hospital. After filling a questionnaire related to their lifestyle (cigarette, food consumption frequency, practice of physical activity), the following parameters were recorded: age, gender, weight, height and glycemia. HTN was defined according to 2017 American College of Cardiology and the American Heart Association (ACC/AHA) guidelines. Hyperglycemia was diagnosed with Intermediate distribution frame (IDF) criteria. Body mass index was calculated and physical activity was defined according to World Health Organization (WHO) recommendations.

Results: The prevalence of hypertension was 28.4%. Concerning subtypes of HTN, the prevalence of subdural hematoma (SDH) was 27.1%, that of ISH was 15.7% and that of intradialytic hypotension (IDH) was 17.8%. Women were more affected than men (63.8% *vs* 36.2%). The prevalence of hyperglycemia was 16.2%, obesity was 40.2% and overweight was 30.6%. Adults aged 40-59, 60-79 and 80 and above were 1.99, 4.21 and 4.71 times more exposed to HTN (OR=1.99; p=0.002), (OR=4.21; p=0.000) and (OR=4.71; p=0.014). Concerning marital status, individuals "Divorced", "widowed" and "married" individuals were more exposed (OR=5.40; p=0.006), (OR=2.17; p=0.000) and (OR=2.10; p=0.006). Monthly Wages influences the onset of HTN. Individuals having high (OR= 4.40; p=0.000), middle (OR=2.92; p=0.000) and minimum (OR=2.08; p=0.015) monthly wages were more exposed to HTN than none. Concerning educational level, it appears that those with University education were 3.32 times exposed to HTN following by those with secondary education (OR=2.98; p=0.004) and primary education (OR=2.49; p=0.010). In the case of physical activity, those who don't practice physical activity were 0.24 times exposed than others (OR=0.24; p=0.050).

Conclusion: Around one-third of the subjects were hypertensive. Age, sedentarity (physical inactivity), monthly wages, marital status and education level were cardiometabolic risk factors associated to hypertension.

Keywords
Hypertension; Cardiometabolic risk factors; Deido District Hospital.

INTRODUCTION

The Non communicable diseases (NCD) represent today a serious burden in the world and constitute one of the major development challenges for the development. These diseases are driven by forces that include rapid unplanned urbanization, globalization of unhealthy lifestyles and population ageing. Unhealthy diets and a lack of physical activity may show up in people as raised blood pressure, increased blood glucose, elevated blood lipids and obesity.[1] However, all the ages are affected by NCD and more than 90% of the premature deaths due to the NCD occur in the poor countries.

Hypertension (HTN) is a major risk factor of cardiovascular and cerebrovascular diseases and is associated with a high degree of morbidity and mortality.[2] Hypertension accounts for approximately 1 million deaths amongst the 1 billion adults living with HTN worldwide.[3] Sub-Saharan Africa (SSA) bears a great burden of HTN, which is the leading cause of heart failure,[4] and stroke[5] and accounts for over 80% of all cardiovascular disease-related deaths.[6]

It is considered that the ageing of the population and the fast urbanization largely contribute to increase prevalence of hypertension in the urban areas. Nearly 30% of the adults of the area never control their blood pressure. Among the diagnosed people, 35% do not receive essential treatment.[7] In Cameroon, prevalence of HTN is reported to vary from 31.1% in rural milieu,[8] 32.2% in semi-urban[9] to 47.5% in urban milieu[10] with a national average of 31.0%.6 Moreover, many studies of HTN have been mainly done in communities in southern and northern regions of the country. Few studies have been done in hospital milieu. Referenced hospital based assessment have been carried out in Northern region (Ngaoundere or Maroua) and some of the results of these studies were based on retrospective datas.[11-13]

The present study aimed at determining the prevalence of hypertension and identifying the cardiometabolic risk factors associated with HTN of patients attending to Deido District Hospital.

METHODOLOGY

Descriptive and cross sectional survey was carried out at the Deido District Hospital. Deido District Hospital is a public hospital with several specialties. For this, all cameroonians men and women aged 20 years above coming to the hospital for any health complaint or check-up were recruited on their arrival. The study proceeded between August 2015 and February 2016. At the end of this study, 805 patients have been recruited.

For this, participants gave a written informed consent prior to participation. Data were collected through predesigned questionnaire adapted from WHO STEP wise approach to surveillance (STEPS). An interviewer-administered face-to-face questionnaire was used to obtain participants demographic informations (tobacco, food consumption frequency, practice of physical activity), the following parameters were recorded: age, gender, weight, height, blood pressure, glycemia. Body mass index (BMI) was derived from weight and height measurements. Height was measured to the nearest 0.5 cm, weight to the nearest 0.5 kg, and the BMI was calculated (weight/height^2 (kg/m^2)).

Participants were classified as obese if they had a body mass index (BMI)≥30 kg/m^2, overweight for 25≤BMI≤29.9 kg/m^2 and normal weight for 18.5≤BMI≤ 24.9 kg/m^2 [47].

Measurement of blood pressure was done using Blood Pressure Monitor (OMRON HEM 7124) based on oscillometric measurement method with Fuzzylogic technique. Blood pressure records were made three times on the upper left arm. The first measurement was taken after a 5 min rest in a sitting position and was followed by two subsequent measurements in the middle and at the end of the interview. The average of the three measurements was used to assess the presence or absence of hypertension according to the 2017 American College of Cardiology/American Heart Association (ACC/AHA) guidelines (SBP≥130 mmHg, or DBP≥80 mmHg) as referred to Islam JY.[14] A participant was considered to have isolated systolic hypertension (ISH) for a SBP≥130 mmHg and DBP<80 mmHg; isolated diastolic hypertension (IDH) for a SBP<130 mmHg and DBP≥80 mmHg and the systo-diastolic hypertension (SDH) with a SBP≥130 mmHg and DBP≥80 mmHg.

Among 805 subjects, only 500 subjects have done their inform consent for blood intake to measure fasting blood glucose. To perform this, the fingertips of the patients were disinfected using ethanol (90%). With a sterile needle, a gently pressure was applied to the pricked finger and a drop of blood was collected for the determination of blood glucose concentration. For this purpose a glucometer (ONE TOUCH ULTRA 2) was used according to glucose oxidase method described by Trinder P.[15] Hyperglycemia was defined as fasting blood glucose>5.6 mmol/l for subjects without prior diagnosis of diabetes.[16]

Physical activity was defined according to World Health Organizaion (WHO) recommendations. Physical activity of each participant was defined on the basis of activities of work, transportation and leisure.

The smoking and alcohol intake constitute a cardiometabolic risk factor. Thus all those who consumed alcohol at least twice a week were considered drunker while all those who areed to consume tobacco regularly were considered smoker.

The age is a cardiometabolic risk factor independently of other factors.[17] In this study, age was represented in sections of 20-39 years, 40-59 years, 60-79 years, 80 years and more.

The gender constitutes a cardiometabolic risk factor[18]; in this study both genders were explored.

Monthly wage is defined by the decree N° 2014/2217/PM of 24 July 2014 to revalue the guaranteed minimum inter-

professional wage. This decree sets the minimum wage at 36,270 FCFA (73 US dollars). In our survey the minimum wage was set at 40,000 FCFA (80 US dollars), middle wage: 40,000 (80 US dollars)-100,000 FCFA (200 US dollars) and high wage: >100,000 FCFA (200 US dollars). Marital status and smoking have been also evaluated

Statistical Analysis

Data analysis was performed using the statistical package for IBM SPSS Statistics version 22.0. Main analysis included descriptive statistics. Incidence of hypertension and cardiometabolic risk factors was expressed as the proportion of hypertensive in all study participants. Qualitative variables were reported as frequencies or proportions, while quantitative variables were reported as mean±standard error mean (SEM). Quantitative variables were compared using the Student *t* test. Identification of cardiometabolic risk factors of our study population was done using binary logistic regressions (performed using STATA version 14.0) which evaluate the relative risk of HTN with statistical significance at $p<0.05$.

Ethical Approval

One month preceding the survey, the communities and their leaders were informed by the study investigators about the goals, the importance and the benefits of the study. Participation in the study was voluntary. All the study participants provided written informed before inclusion in the survey. The study protocol was approved by the Deido District Hospital (Registry number N°959/AV/MINSANTE/DRSPL/SSDD/HDD).

RESULTS

Characteristics of Population Study

In this study, 805 participants were aged 20-91 years, and BMI values range 15.63 to 63.29 kg/m^2; 554 individuals (68.8%) were females and 251 males (31.2%); with SBP range between 88 and 236 mmHg and DBP between 36 and 153 mmHg and glycemia between 39 and 595 mg/dl.

The proportion of women is higher than that of men. Moreover, the most represented age groups are those of 20-39 years and 40-59 years (Table 1).

Table 1. *Distribution of Gender and Age in General Populationy*

Gender Age	Men n (%)	Women n (%)	Total n (%)
20 – 39	98 (31.8)	211 (69.2)	309 (100.0)
40 – 59	87 (28.7)	217 (71.3)	304 (100.0)
60 – 79	62 (35.2)	114 (64.8)	176 (100.0)
80 and more	4 (25.0)	12 (75.0)	16 (100.0)
Total	251	554	805

Based on means obtained, all individuals are overweight but BMI of women (29.3±0.2 Kg/m^2) are significantly high ($p<0.01$) than men (27.0±0.3 Kg/m^2). The same result was observed with pulse (Table 2).

Table 2. *Hemodynamic and Anthropometric Parameters of Study Population*

Parameters	Total Population (N=805)	Male (N=251)	Female (N=554)
Age (years)	46.5±0.6	46.8±1.0	46.4±0.6
BMI (kg/m2)	28.6±0.2	27.0±0.3	29.3±0.2*
SBP (mmHg)	130.9±0.8	132.9±1.4	130.0±0.9
DBP (mmHg)	80.1±0.4	81.0±0.8	79.7±0.5
Heart rate (pulse/min)	79.0±0.6	75.7±0.7	80.5±0.8*

Results were significant for p<0.01

Prevalence of Arterial Hypertension and Hyperglycemia

The results of this study have shown that the prevalence of hypertension was 28.4%. The prevalence of systo–diastolic hypertension (SDH) was 27.1%, that of Isolated Systolic Hypertension (ISH) was 15.7% and that of Isolated Diastolic Hypertension (IDH) was 17.8%. The prevalence of hyperglycemia was 16.2% (Table 3).

Table 3. *Prevalence of Hypertension and Hyperglycemia*

		Frequency n (%)
Diagnosis criteria of HTN	2017 ACC/AHA	229 (28.4)
Subtypes of HTN	SDH	218 (27.1)
	ISH	126 (15.7)
	IDH	143 (17.8)
Diagnosis criteria of Hyperglycemia	Based on IDF criteria	500 (16.2)

Determinants of Hypertension

Several cardiometabolic risk factors are hypothesized to associate hypertension and including age, sex, family history, obesity, smoking, physical activity and socio-economic status.

- **Overweight and obesity** In our study, we observed a high prevalence of overweight and obesity in hypertensive patients. Prevalence of obesity was high in patients with systolic hypertension (Table 4). We also observed that prevalence of obesity is high among women and that of overweight is high among men (Table 5).

Table 4. *Prevalence of overweight and obesity*

	Total Population n (%) (N=805)	Hypertensive n (%) (N=229)	Normal n (%) (N=576)
Underweight	13 (1.6)	2 (0.9)	11 (1.9)
Normal weight	205 (25.5)	65 (28.4)	140 (24.3)
Obesity	316 (39.3)	92 (40.2)	224 (38.9)
Overweight	271 (33.7)	70 (30.6)	201 (34.9)
Total	805	229	576

Table 5. *Distribution of Hypertensive Patients Based on Overweight and Obesity Among Hypertensive Patients*

	Hypertension		Male		Female	
	N	%	N	%	N	%
Underweight (<18.5 kg/m2)	2	0.9	2	2.4	0	0.0
Normal weight (18.5-24.9 kg/m2)	65	28.4	30	35.8	35	24.1
Obesity (25-29.9 kg/m2)	92	40.2	17	20.2	75	51.7
Overweight (>30 kg/m2)	70	30.6	35	41.7	35	24.1
Total	229		84		145	

• **Age and gender** The results of the study showed that women are more hypertensive than men. In addition, 70.2% of hypertensive women are in the age category 40-59 (Table 6).

Table 6. *Distribution of Hypertensive Patients According to Age and Gender*

Gender / Age category	Men		Women		Total	
	N	%	N	%	N	%
20-39	28	46.7	32	53.3	60	100.0
40-59	28	29.8	66	70.2	94	100.0
60-79	26	37.7	43	62.3	69	100.0
80 and more	2	33.3	4	66.7	6	100.0
Total	84		145		229	

The distribution of hypertensive patients according to BMI, gender and age showed that in hypertensive men the prevalence of overweight and obesity were high in age category 40-59. In hypertensive women, the prevalence of obesity was high in age category 60-79 and overweight in age category 20-39 (Table 7).

Table 7. *Distribution of Hypertensive Patients Based on BMI, Age and Gender*

Gender	Males (N=84)					Females (N=145)				
BMI (kg/m2) Age category (years)	<18.5 Underweight n (%)	18.5-24.9 Normal n (%)	25-29.9 Overweight n (%)	>30 Obesity n (%)	Total n (%)	<18.5 Underweight n (%)	18.5-24.9 Normal n (%)	25-29.9 Overweight n (%)	>30 Obesity n (%)	Total n (%)
20-39	1 (3.6)	12 (42.9)	13 (46.4)	2 (7.1)	28 (100)	0 (0.0)	10 (31.2)	11 (34.4)	11 (34.4)	32 (100)
40-59	0 (0.0)	6 (21.4)	14 (50.0)	8 (28.6)	28 (100)	0 (0.0)	12 (18.2)	17 (25.8)	37 (56.0)	66 (100)
60-79	1 (3.8)	11 (42.3)	8 (30.8)	6 (23.1)	26 (100)	0 (0.0)	11 (25.6)	6 (13.9)	26 (60.5)	43 (100)
80 and more	0 (0.0)	1 (50.0)	0 (0.0)	1 (50.0)	2 (100)	0 (0.0)	2 (50.0)	1 (25.0)	1 (25.0)	4 (100)
Total	2	30	35	17	84	0	35	35	75	145

• **Others cardiometabolic risk factors** Concerning physical activity, more hypertensive patients (60.7%) don't practice physical activity, 31% practice light physical activity (Table 8).

Table 8. *Other Cardiometabolic Risk Factors and HTN*

		Total Population n (%) (N=805)	Hypertensive n (%) (N=229)	Normal n (%)(N=576)
Physical activity	None	589 (73.2)	139 (60.7)	450 (78.1)
	Light	178 (22.1)	71 (31.0)	107 (18.6)
	Intense	29 (3.6)	14 (6.1)	15 (2.6)
	More intense	9 (1.1)	5 (2.2)	4 (0.7)
Education level	Iliteracy	117 (14.5)	14 (6.1)	103 (17.9)
	Primary	306 (38.0)	84 (36.7)	222 (38.5)
	Secondary	313 (38.9)	100 (43.7)	213 (37.0)
	University	69 (8.6)	31 (13.5)	38 (6.6)
Wages	None	241 (29.9)	29 (12.7)	212 (36.8)
	Minimum	146 (18.1)	35 (15.3)	111 (19.3)
	Middle	213 (26.5)	73 (31.9)	140 (24.3)
	High	205 (25.5)	92 (40.2)	113 (19.6)
Cigarette Smoking	smokers	55 (6.8)	16 (29.1)	39 (70.9)
	Non smokers	750 (93.2)	213 (28.4)	537 (71.6)
Marital status	Single	406 (50.4)	79 (19.5)	327 (80.5)
	Married	288 (35.8)	103 (35.8)	185 (64.2)
	Divorced	17 (2.1)	11 (64.7)	6 (35.3)
	Widowed	94 (11.7)	36 (38.2)	58 (29.8)

Concerning socio-economic parameters (instruction, marital status and monthly wages), hypertension is high among patients of primary (36.7%) and secondary school (43.7%). Prevalence of HTN is high among patients having middle (31.9%) and high (40.2%) monthly wages. The results of marital status showed that prevalence of HTN is high among married (35.8%), divorced (64.7%) and widowed (38.2%). Prevalence HTN is 29.1% among smokers (Table 8).

Association between Some Cardiometabolic Risk Factors and Hypertension in the Study Population

After binary logistic analysis, age, physical inactivity/activity, monthly wages, education level and marital status are the factors associated with HTN.

With respect to age, it appears it appears that advanced in age increases the risk of HTN. Individuals aged of 40-59 were 5.40 times more exposed than individuals aged of 60-79 (OR=4.21; p=0.000) and those aged of 80 and more (OR=4.71; p=0.014). Concerning marital status, individuals "Divorced", "widowed" and "married" individuals were respectively 5.40 times, 2.10 times and 2.17 times exposed than "single". Monthly Wages influences the onset of HTN. Individuals having high (OR=4.40; p=0.000), middle (OR=2.92; p=0.000) and minimum (OR=2.08; p=0.015) monthly wages were more exposed to HTN than none. Concerning educational level, it appears that those with University edu-

cation were 3.32 times exposed to HTN following by those with secondary education (OR=2.98; p=0.004) and primary education (OR=2.49; p=0.010).

In the case of physical activity, those who don't practice physical activity were 0.24 times exposed than others (Table 9).

Table 9. *Odd Ratio of Elevated Blood Pressure According to Some Cardiometabolic Risk Factors*

CardioMetabolic Risk Factors		Odd ratio (CI 95%)	p value
Age category	20-39	1	
	40-59	1.99 (1.29-3.07)	0.002
	60-79	4.21 (2.43-7.31)	0.000
	80 and above	4.71 (1.36-16.27)	0.014
BMI	Normal/ underweight	1	
	Overweight	0.81 (0.54-1.20)	0.304
	Obesity	1.00 (0.68-1.48)	0.964
Gender	Male	1	
	Female	0.72 (0.52-1.00)	0.051
Physical activity	More intense	1	
	None	0.24 (0.06-0.99)	0.050
	Light	0.35 (0.08-1.46)	0.154
	Intense	0.38 (0.08-1.82)	0.227
Cigarette Smoking	Non smokers	1	
	Smokers	1.00 (0.55-1.84)	0.978
Monthly Wages	None	1	
	Minimum	2.08 (1.15-3.77)	0.015
	Middle	2.92 (1.68-5.07)	0.000
	High	4.40 (2.45-7.89)	0.000
Education level	Iliteracy	1	
	Primary	2.49 (1.24-5.00)	0.010
	Secondary	2.98 (1.40-6.34)	0.004
	University	3.32 (1.29-8.56)	0.013
Marital status	Single	1	
	Married	2.17 (1.47-3.20)	0.000
	Divorced	5.40 (1.61-18.12)	0.006
	Widowed	2.10 (1.16-3.80)	0.006
R2 Nagelkerke: 0.247			R2 Cox and Nell: 0.172

DISCUSSION

Prevalence of Hypertension and Hyperglycemia

Hypertension is now an epidemic with developing countries being heavily burdened. Over the last 20 years various studies have shown that people in economically developing countries are increasingly having high blood pressure levels with a high prevalence of hypertension.[19] Our study revealed that the prevalence of hypertension was 28.4%. Concerning subtypes of HTN, the prevalence of ISH was 15.65%, IDH was 17.76% and SDH was 27.08%. The studies carried out on the general population in Yaounde by Azantsa Kingue GB[20] showed a weak prevalence of systolic arterial hypertension (14.9%) and a high prevalence of diastolic arterial hypertension (32.8%). These findings are in line with previous work by OMS[7] in six companies of the Douala city that also showed a prevalence of hypertension equal to 24.6%. Our findings revealed that women had a higher prevalence of hypertension compared to men.

Type 2 diabetes is a heterogeneous disease resulting from the incapacity of the body to correctly react to the action of insulin. Insulin is either low or high (insulino-resistance or insulinopeny).[21] This incapacity depends on the environmental factors, the first of which is excessive consumption of saturated fats, rapid sugars, and sedentarity. Thus, to bring back the rate of blood glucose to the normal, the β cells of the pancreas secrete more insulin and end up becoming exhausted until producing some more. Peripheral resistance to insulin is thus a central factor in the pathogenesis of type 2 diabetes which is related to a failure to activate glycogen synthetase, and an increase in the availability of free fatty acids.[22]

In the study, prevalence of hyperglycemia was 16.2%.[23] have shown a prevalence of 6.1% of diabetes in general population of Cameroon (6.4% among men *versus* 5.7% among women) based on WHO STEP wise investigations. The high prevalence in the present study could be explained by urban environment where there is high risk of non communicable diseases.

During its evolution, diabetes can generate serious complications concerning heart, vessels, eyes, kidneys and nerves. These complications are microvascular and macrovascular[24]; they occur in long term with the evolution of the disease. These are the chronic complications whose prevalence increases with the rise in the diabetic life expectancy.

Cardiometabolic Risk Factors

Several risk factors are hypothesized to associate hypertension and type 2 diabetes including age, sex, family history, obesity, smoking, physical activity and socio-economic status.

The cardiometabolic risk factors are a group of clinical and metabolic situations which increase the risk to develop cardiovascular diseases or type 2 diabetes.[25] The majority of the chronic diseases is strongly interrelated and has a bond of causality with four common behavioral factors: a bad quality of food, physical inactivity, smoking and excessive consumption of alcohol.[7] These behaviors lead to four great metabolic and/or physiological changes: HTA, overweight or obesity, hyperglycemia and dyslipidemia. A classification based on the nature of the modifiable and non modifiable risk factors was proposed by WHO.

Obesity

Obesity represents a major risk of Hypertension. Distribution of BMI varied with gender, race/ethnicity, and age. In our study, we observed a high prevalence of overweight and obesity in hypertensive patients. Prevalence of obesity was high in patients with

HTN. This prevalence is also high in women than men and the prevalence of overweight is high among men. These results are in line with studies of WHO, CamBoD[26,27] which showed that the overweight is frequent among men and obesity is frequent among women.[28] Hypertension is approximately three times more frequent among obese people than normal weight people.[29,30] Showed that the increase in the body weight is a predictive element of a rise in the blood pressure. The loss of weight is clearly associated with a fall of the blood pressure. Hypertension is more often associated to abdominal obesity than femoral obesity.[31] The explained mechanism is the increase in the activity of the sympatric nervous system by an excessive food intake. It is necessary to note certain particular points: the simple excess of weight does not explain the relation between body weight and hypertension. The distribution of fats plays a role and there is a correlation between waist to hip ratio, dyslipidemia and blood pressure.[14] The abdominal obesity has a closer link with hypertension; indicating the possibility of a role of the sexual hormones, this overweight status depends on the distribution of adipose tissues.[32] In our study, the increase of BMI does not contribute to hypertension.

Age

It is shown in our study that the risk of hypertension becomes higher as the individual advanced in age. The studies of Bita Fouda AA[33] showed that the prevalence of hypertension was higher among individuals aged from 45 years and above. After age 50, ISH becomes the major form of hypertension.[34] Elevated SBP has been thought to be more important than elevated DBP as a risk factor for adverse cardiovascular and renal outcomes.[35] With increasing age, there is a gradual shift from DBP to SBP as predictors of cardiovascular risk.[36] The risk of hypertension increases with the age because of the hardening of the blood vessels, although the ageing of the latter can be slowed down by the adoption of a healthy way of life, including a balanced diet and a reduction of the salt consumption.[7] In our study, age significantly contributes to the onset of HTN.

Gender

Our study showed that women are most exposed to hypertension than men. This female prevalence appears in the studies of Azantsa Kingue GB.[20] This high prevalence of hypertension among women could be due to the menopausal state characterized by a stopping of the mechanism of the steroids hormones.[14] explained that the prevalence hypertension among women was due to obesity, the intake of hormonal contraceptives with high oestrogens contents, the abusive intake of growth regulators and non steroidic anti-inflammatory drugs. In addition to these factors, it would be necessary to add pregnancy and the nephropathy.[32] It is interesting to underline the significant and protective role of female hormones against arterial hypertension. In our study gender were not associated to the onset of HTN.

Physical Activity

Sedentarity is defined as a state in which the body movements are at least reduced. Thus, energy expenditure is near to energy expenditure at rest. It is characterized by behaviors such as looking at television set, working on computer and move by cars.[37] It concerns much more the populations of urban areas, especially those with a modest life; because an improvement of the incomes allows an improvement of the living conditions, and reduction of painful physical works. Thus, the mechanization of transport and work, the development of the technological means of communication and leisure among the many factors which come to be added to the ageing of the population of the developing countries, exposing them to greater risks of sedentarity.[38] In addition, the urban environment supports sedentarity by expansion of the sector of the services, many means of transport, the passive distractions like cinema or television. Only a part of educated population is doing sporting leisures.[39] Physical inactivity is presented as one of the principal factors of the progression of obesity.[40] It increases the vascular lipid peroxidation, the production of the superoxide radical which supports endothelial dysfunction and atherosclerosis, thus increasing the activity of the NADPH oxidase which is a major source of superoxide.[41] Several studies show that physical inactivity is a risk factor of cardiovascular diseases. These studies attest that physical activity is a factor of protection against obesity, cardiovascular diseases and type 2 diabetes.[42] In the study, more hypertensive patients don't practice physical activity but sedentarity (physical inactivity) were associated to the onset of hypertension.

Monthly Wage

The studies of Mushtaq M[43] showed that stress factors are positive correlated with hypertension. Among the stress factors, monthly wage contributes to hypertension.[44] The general trends were that the higher the monthly wage, the lower the prevalence of hypertension.[44]

In our study we observed that monthly wages was implied in the onset of HTN and as the monthly wages increases as the prevalence of HTN also increases. These results showed that the burden of hypertension has been seen to be unequally distributed among different social classes. It could be explained by the job of our population study.

Education Level

Education level is associated to the onset of HTN. The prevalence of hypertension is higher among patients having high education level compared to illiteracy patients. These results are different of these of Ntentie FR[8,45] who showed that the prevalence of hypertension is high among none educated patients. The difference between results could be due to the fact that these authors had been work in rural communities. Moreover, our study was conducted in hospital milieu and in urban areas (particularly in large metropolis) where the illiteracy rate is low. The high prevalence of HTN among individuals with high education level could be explained by the fact that being in urban areas and in a large metropolis, the majority of people met had a minimum of education level and was aware of the importance of going to the hospital in case of illness. Indeed, schooling would promote a better knowledge of the disease and the means to avoid it.[45]

Marital Status

Marital status is associated with health. Recent evidence suggests that losing a spouse has differential impacts on men's and women's cardiovascular health in older ages.[46] It has been shown that marital disruption is associated with the onset of cardiovascular disease in middle-aged women but not in men.[47] Based on longitudinal data from a British cohort, being "single" (never married, divorced, or widowed) was significantly related to higher mortality in single men compared with married men. Being never married put women at no greater risk for mortality, but being widowed, divorced, or separated increased their risk of death compared with married women.[48] Using cross-sectional data from six European countries,[49] found-at all ages and for both genders—there was a significant protective effect of marriage on mortality. In general, marriage is thought to be protective against mortality[50] and against adverse health outcomes,[51] including cardiovascular disease.[52] In our study marital status increase the risk of HTN by 1.3 times, the prevalence of HTN being high with divorced, married and widowed status. This result could be due to stress observed during divorce period, widowhood period and daily living of married people. In fact, stress leads to a chronic increase in the secretion of catecholamine and cortisol resulting in a state of insulin resistance, visceral obesity, high levels of triglycerides and low levels of HDL cholesterol associated with hypertension.[53]

Smoking

Cigarette smoking is a powerful cardiovascular risk factor and smoking cessation is the single most effective lifestyle measure for the prevention of a large number of cardiovascular diseases. Impairment of endothelial function, arterial stiffness, inflammation, lipid modification as well as an alteration of antithrombotic and prothrombotic factors are smoking-related major determinants of initiation, and acceleration of the atherothrombotic process, leading to cardiovascular events. Cigarette smoking acutely exerts an hypertensive effect, mainly through the stimulation of the sympathetic nervous system. Hypertensive smokers are more likely to develop severe forms of hypertension, including malignant and renovascular hypertension, an effect likely due to an accelerated atherosclerosis.[54] In our study, cigarette smoking was not associated to the onset of HTN.

This study was done in Deido District Hospital whose findings can be different in others hospital of Cameroon. Moreover, the risk factors like dyslipidemia and salt intake were no assessed in our study.

CONCLUSION

This study showed that the prevalence of hypertension in Deido District hospital was 28.4% and that hyperglycemia was 16.2%. In addition age, BMI, wages, instruction and physical activity were the main risk factors amongst population of this hospital. As with nutritional transition and double burden of malnutrition, the implementation of nutritional education programs adapted to Cameroon having a goal to fight against hypertension and other chronic diseases related to nutrition become urgent. The promotion of frequent physical activity like walking, more consumption of fruits and vegetables is recommended.

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AVAILABILITY OF DATA AND MATERIALS

The primary data and materials of this study are available in Deido district hospital. Official registration is required to access the database *via* secretariat of Director. The datasets analyzed during the study are available from the corresponding author.

AUTHORS' CONTRIBUTIONS

NBCF and MMP designed the study protocol and wrote the first manuscript draft. CB led the statistical analyses and contributed to the manuscript drafting. BM, NY and medical personal of hospital contributed to data collection. NBCF and MMP critically contributed to analysis, discussion and interpretation of the data and BME and NY contributed to data interpretation and the writing of the manuscript. All authors reviewed and approved the final manuscript draft.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was conducted according to the principles of the Declaration of Helsinki and approved by the Deido District Hospital (Registry number N°959/AV/MINSANTE/DRSPL/SSDD/HDD). Participation to the study was voluntary and written informed consent was obtained from each participant.

CONSENT FOR PUBLICATION

Not applicable

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

REFERENCES

1. World Health Orginization (WHO). Noncommunicable diseases. Web site. https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases. Visited April 21, 2019.

2. Lionakis N, Mendrinos D, Sanidas E, Favatas G, Georgopoulou M. Hypertension in the elderly. *World J Cardiol*. 2012; 4(5): 135-147. doi: 10.4330/wjc.v4.i5.135

3. World Health Organization (WHO). A Global Brief on Hypertension. Geneva, Switzerland, World Health Organization: 40. Web site. http://apps.who.int/iris/bitstream/10665/79059/1/WHO_DCO_WHD_2013.2_eng.pdf. Published April 2013.

4. Nyaga UF, Bigna JJ, Agbor VN, Essouma M, Ntusi NA, Noubiap JJ. Data on the epidemiology of heart failure in Sub-Saharan Africa. *Data Brief*. 2018; 17: 1218-1239. doi: 10.1016/j.dib.2018.01.100

5. Owolabi MO, Arulogun O, Melikam S, et al. The burden of stroke in Africa: A glance at the present and a glimpse into the future. *Cardiovasc J Afr*. 2015; 26 (2 H3Africa Suppl): S27-S38. doi: 10.5830/CVJA-2015-038

6. Kingue S, Ngoe CN, Menanga AP, et al. Prevalence and risk factors of hypertension in urban areas of Cameroon: A nationwide population-based cross-sectional study. *J Clin Hypert*. 2015; 17(10): 819-824. doi: 10.1111/jch.12604

7. OMS. Etat de mise en œuvre de la convention-cadre pour la lutte antitabac au Cameroun. https://untobaccocontrol.org/impldb/wp-content/uploads/reports/cameroon_2012_report.pdf. 2013.

8. Arrey WT, Dimala AC, Atashili J, Mbuagbaw JAJ, Monekosso GL. Hypertension, an emerging problem in rural Cameroon: Prevalence, risk factors and control. *Int J Hypertens*. 2016; 2016 (6): 1-6. doi: 10.1155/2016/5639146

9. Ntentie FR, Ngondi JL, Azantsa KGB, et al. Urbanization and metabolic syndrome in Cameroon: Alertness on less urbanised Areas. *Endocrinol Metab Syndr*. 2014; 3(2): 1-8. doi: 10.4172/2161-1017.1000137

10. Dzudie A, Kengne A, Muna WFT, et al. Prevalence, awareness, treatment and control of hypertension in a self selected sub-Saharan African Urban populations: A cross sectional study. *BMJ Open*. 2012; 2(4): pii: e001217. doi: 10.1136/bmjopen-2012-001217

11. Pancha MO, Adonis KK, Joachim C. Hypertension and classical risk factors in ambulatory patients: A hospital-based study in Adamawa region (Northern Cameroon). *Intern J Medicine and Medical Sciences*. 2011; 3(11): 331-336. doi: 10.5897/IJMMS

12. Pancha MO, Ngoufack OJ, Koona KA, Maha F, Samuel K. Place and evolutionary profile of cardiovascular diseases in Northern Cameroon: The case of regional hospital of ngaoundere. *Health Sciences and Disease*. 2015; 16(1): 1-7.

13. Tebeu PM, Foumane P, Mbu R, Fosso G, Biyaga PT, Fomulu JN. Risk factors for hypertensive disorders in pregnancy: A report from maroua regional hospital, Cameroon. *J Reprod Infertil*. 2011; 12(3): 227-234.

14. Islam JY, Zaman MM, Haq SA, Ahmed S, Al-Quadir Z. Epidemiology of hypertension among Bangladeshi adults using the 2017 ACC/AHA Hypertension Clinical Practice Guidelines and Joint National Committee 7 Guidelines. *J Hum Hypertens*. 2018; 32(10): 668-680. doi: 10.1038/s41371-018-0087-5

15. Trinder P. Determination of glucose in blood using glucose oxidase with an alternative acceptor. *Ann of clin Biochem*. 1959; 6: 24-27. doi: 10.1177/000456326900600108

16. International Diabetes Federation. The IDF consensus worldwide definition of the metabolic syndrome. Brussels, Belgium. https://www.pitt.edu/~super1/Metabolic/IDF1.pdf. 2006.

17. Agyemang C, Bruijnzeels M, Owusu-Dabo E. Factors associated with hypertension awareness, treatment, and control in Ghana, West Africa. *J Hum Hypertens*. 2006; 20: 67-71. doi: 10.1038/sj.jhh.1001923

18. Silander K, Alanne M, Kristiansson K, Saarela O, Ripatti S, Auro K. Gender differences in genetic risk profiles for cardiovascular disease. *PLoS One*. 2008; 3: 3615. doi: 10.1371/journal.pone.0003615

19. Bromfield S, Muntner P. High blood pressure: The leading global burden of disease risk factor and the need for worldwide prevention programs. *Current hypertension reports*. 2013; 15(3): 134-136. doi: 10.1007/s11906-013-0340-9

20. Azantsa Kingue GB, Yangoua Mafo CH, Ngondi JL, Oben Enyong J. The effect of body weight on the incidence and prevalence of hypertension in Yaoundé. *Journal of Diabetes and Endocrinology*. 2010; 1(1): 6-12.

21. FID (Fédération internationale de Diabète). Diabetes Atlas. 6th ed. 2013. 19-24.

22. Oehrli M. Activité physique chez l'enfant atteint de diabète de type 1. Département de pédiatrie [In: French]. Hôpitaux Universitaires de Genève. 2004; 48.

23. Adler NE, Newman K. Socioeconomic disparities in health: Pathways and policies. *Health Aff (Millwood)*. 2002; 21(2): 60-76. doi: 10.1377/hlthaff.21.2.60

24. Lee Z, Cheung A, Cape D, Zinman B. Impact of diabetes on coronary artery disease in women and men: A meta-analysis of prospective studies. *Diabetes care*. 2001; 23(7): 962-968.

25. Vanuzzo D, Pilotto L, Mirolo R, Pirelli S. Cardiovascular risk and cardiometabolic risk: An epidemiological evaluation. *G Ital Cardiol (Rome)*. 2008; 9: 6-17.

26. World Health Organisation (WHO). Tobacco control: strengthening national efforts. 2003.

27. CamBoD (Cameroon Burden of Diabete Projet). Baseline survey report. Executive summary. https://www.who.int/ncds/surveillance/steps/STEPS_Cameroon.pdf. 2004. 33.

28. Blacher J, Czernichow S, Iaria P. Traitement non pharmacologique de l'hypertension artérielle. *EMC-Cardiologie Angéiologie*. 2005; 2: 136-151.

29. Gani P, Priya KJ, Paramasivam S. Prevalence of hypertension in an urban area: A community-based survey in Trichy, Tamilnadu, India. *Int J Community Med Public Health*. 2016; 3(8): 2325-2329. doi: 10.18203/2394-6040.ijcmph20162592

30. Morrison LM. Reduction of mortality rate in coronary atherosclerosis by a low cholesterol-low fat diet. *Am Heart J*. 1951; 42: 538-545. doi: 10.1016/0002-8703(51)90150-0

31. Pannier B, Raison J. HTA et composition corporelle-Place du surpoids et du syndrome métabolique nutrition et facteurs de risque [In: French]. 2005; 3.

32. Ouologuem N. *Place de l'HTA dans la pathologie cardiovasculaire dans le District de Bamako* [master's thesis]. Bamako, Mali: Universite de Bamako; 2002.

33. Fouda AA, Lemogoum D, Manga JO, et al. Epidemiology of obesity in the work milieu, Douala, Cameroon [In: French]. *Rev*

Med Brux. 2012; 33: 131-137.

34. Chobanian AV. Isolated systolic hypertension in the elderly. *N Engl J Med*. 2007; 357: 789-796. doi: 10.1056/NEJMcp071137

35. James PA, Oparil S, Carter BL, et al. 2014 Evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8). *JAMA*. 2014; 311: 507-520. doi: 10.1001/jama.2013.284427

36. Franklin SS, Larson MG, Khan SA, et al. Does the relation of blood pressure to coronary heart disease risk change with aging: The framingham heart study. *Circulation*. 2001; 103: 1245-1249. doi: 10.1161/01.CIR.103.9.1245

37. PNNS (Programme national nutrition santé) Activité physique et santé. Arguments scientifiques, pistes pratiques [In French]. www.mangerbouger.fr/pro/IMG/pdf/SynthesePNNS-AP.pdf. 2005. Accessed on February 02, 2014.

38. Helmrich S, Ragland R, Leung W, Paffenbarger S. Physical activity and reduced occurrence of non-insulin-dependent diabetes mellitus. *N Engl J Med*. 1991; 325(3): 147-152. doi: 10.1056/NEJM199107183250302

39. Maire B, Delpeuch F. Les effets de la mondialisation du mode d'alimentation occidental [In French]. 2006; 11: 131-147.

40. World Health Organisation (WHO). Fighting non-communicable diseases: Africa's new silent killers. 2008.

41. Laufs U, Wassmann S, Czech T, et al. Physical inactivity increases oxidative stress, endothelial dysfunction and artherosclerosis. *Arterioscler Thromb Vasc Biol*. 2005; 25: 809-814. doi: 10.1161/01.ATV.0000158311.24443.af

42. Krishnan S, Rosenberg L, Palmer JR. Physical activity and television watching in relation to risk of type 2 diabetes: The black women's health study. *Am J Epidemiol*. 2009; 169(4): 428-434. doi: 10.1093/aje/kwn344

43. Mushtaq M, Najam N. Depression, anxiety, stress, and demographic determinants of hypertension disease. *Pak J Med Sci*. 2014; 30(6): 1293-1298. doi: 10.12669/pjms.306.5433

44. Naseem S, Khattak UK, Ghazanfar H, Irfan A. Prevalence of non-communicable diseases and their risk factors at a semi-urban community, Pakistan. *Pan Afr Med J*. 2016; 23: 151. doi: 10.11604/pamj.2016.23.151.8974

45. Ntentie FR, Mboindi MO, Dama G, et al. A silent killer in the far North Region of Cameroon: Increasing prevalence of hypertension among population living in Kaele. *BioRxiv*. 2016. doi: doi: 10.1101/472357

46. Cleeman JI. Executive summary of the third report on the National cholesterol education program (NCEP) expert panel on detection, evaluation and treatment of high blood cholesterol in adults (Adult treatment panel III). *JAMA*. 2001; 285(19): 2486-2497.

47. Zhang Z, Hayward MD. Gender, the marital life course, and cardiovascular disease in late midlife. *Journal of Marriage and Family*. 2006; 68: 639-657. doi: 10.1111/j.1741-3737.2006.00280.x

48. Gardner J, Oswald A. How is mortality affected by money, marriage, and stress? *J Health Econ*. 2004; 23: 1181-1207. doi: 10.1016/j.jhealeco.2004.03.002

49. Murphy M, Grundy E, Kalogirou S. The increase in marital status differences in mortality up to the oldest age in seven European countries, 1990-99. *Popul Stud (Camb)*. 2007; 61: 287-298. doi: 10.1080/00324720701524466

50. Manzoli L, Villari P, Pirone M, Boccia A. Marital status and mortality in the elderly: A systematic review and meta-analysis. *Soc Sci Med*. 2007; 64: 77-94. doi: 10.1016/j.socscimed.2006.08.031

51. Waite LJ, Lehrer EL. The benefits from marriage and religion in the United States: A comparative analysis. *Popul Dev Rev*. 2003; 29: 255-276. doi: 10.1111/j.1728-4457.2003.00255.x

52. Kiecolt-Glaser JK, Newton TL. Marriage and health: His and hers. *Psychol Bull*. 2001; 127: 472-503. doi: 10.1037/0033-2909.127.4.472

53. Hamer M, Molloy GJ, Stamatakis E. Psychological distress as a risk factor for cardiovascular events: Pathophysiological and behavioral mechanisms. *J Am Coll Cardiol*. 2008; 52(25): 2156-2162. doi: 10.1016/j.jacc.2008.08.057

54. Virdis A, Giannarelli C, Neves MF, Taddei S, Ghiadani L. Cigarette smoking and hypertension. *Curr Pharm Des*. 2010; 16(23): 2518-2525.

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Brief Report

U.S. Veteran Population Projections, 2015 through 2040: Implications for Health Planning and Monitoring Population Health Outcomes

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ABSTRACT

Introduction
A population's structure and how it may change over time could affect the interpretation and use of health service utilization rates. This informative report describes how data for Veteran population composition age group and sex could have important implications for the comparison of rates as health planners consider the long-term resources necessary to support rehabilitation, health and wellness, and Veteran reintegration.

Methods
U.S. Veteran population projections were examined. Secondary data were used to examine the population structure of Veteran and U.S. adult populations from 2015 to 2040. Population pyramids were constructed.

Results
The projected Veteran population for 2040 is lower than that in 2015. During the same period, the U.S. adult population is projected to increase. Close inspection of the population pyramids for 2015 to 2040 showed that between these years, not only would the proportion of female Veterans increase over time but, also, there will be more Veterans in the older age groups.

Conclusions
As Veterans Health Administration (VHA) modernizes health system operations, health outcomes and health service utilization rates over time will be an important component for monitoring progress and refining health planning activities. The report, also, proposes a "standard reference population" for the comparison Veteran population rates from 2018 to 2030.

Keywords
Ecological design; Secondary data; Cohort-component method; Population pyramid; Standardization of population health information; Health planning; Managerial epidemiology.

INTRODUCTION

As the Veterans Health Administration (VHA) takes steps to modernize health system operations,[1] the rates of health outcomes and health service utilization over time will be an important component for monitoring progress and refining health planning activities. Monitoring clinical preventive services, such as screening for mental health conditions and substance abuse or vision disorders among Veterans using the VHA system[1,2] may require the calculation and monitoring of rates within the system and across time periods. Along with other administrative data, these rates may be useful in health system planning.

Comparing health outcome and health service utilization rates within a health care system across populations or time periods are an essential component of health system planning, monitoring, and health program evaluation. Yet, the comparison of crude rates across time or populations without adjustment, at least for age, is less than ideal and could lead to faulty conclusions from the health system data on which resource allocation decisions are based.[3] The structure of a population and how it may change over time could affect the interpretation and use of health service utilization rates.

The health of a population cannot be measured directly, so inferences are made by using other measures. Information

about a population's health can be derived from measures such as[4]:

- Health-related characteristics or risk factors—measures of deprivation, living conditions, employment, housing, etc.
- Mortality—death in a population
- Morbidity—illness in a population
- Health service use data—diagnoses, interventions and procedures, and health outcomes in a population

Crude rates are usually reported for these measures, but using these rates to measure mortality across time and populations while overlooking possible changes in the structure of the underlying population could lead to misleading recommendations.[4,5]

In recognition of the importance of understanding the U.S. Veteran population structure for VHA health planning, this review explores U.S. Veteran population projection data from 2015 to 2040. We also compare U.S. adult population projections for the same period with emphasis on the structure of the populations. We discuss the implications of Veteran population structure on health planning and monitoring population health outcomes.

METHODS

Using an ecological design, secondary data were used to examine the Veteran and adult population structures from 2015 to 2040. This examination relied on publicly-available population projections from the U.S. Department of Veterans affairs (VA) and the U.S. Bureau of the Census.[6,7] The data were downloaded from public-facing websites and organized by age group and sex for 2015, 2020, 2030, and 2040.

Specifically, the Veteran population data were derived from the Veteran Population Projection Model[8]: The Veteran Population Projection Model 2016 (VetPop2016) provides the latest official Veteran population projections. VetPop2016 is an actuarial projection model developed by VA Office of predictive analytics and actuary (PAA) for Veteran population projections from Fiscal Year (FY) 2015 to FY2045. Using the best available Veteran data by the end of FY2015, VetPop2016 provides Veteran counts based on key demographic characteristics such as age group in years (17 to 19-years {or <20years}; 20 to 24-years; etc.), sex, period of service, and race/ethnicity at various geographic levels for the next 30 years. Similarly, the adult population [non-Veteran] data were from the Census Bureau's data table entitled, "Population projections for the United States from 2015 to 2060 (in millions)."

The population projections from both agencies relied on the cohort-component method.[8,9] This method for population projection and estimation has the advantage of maintaining knowledge of the underlying age distribution in the population over time. The methods used by the VA is essentially identical to the equation used by the Census Bureau for their population projections.[9]

The percentage of males and females for each age group in the Veteran and US adult population were calculated based on the datasets. Population pyramids were constructed for the data (in millions) from each year for the Veterans and the corresponding data for the adult population. The differences in these population pyramids were observed. Population pyramids illustrate how a population may transform itself over time; this transformation, with emphasis on changes in age of a population, may impact the experience of illness and disease in the same population with implications for health planning.[10,11]

Table 1. *U.S.Veteran Population Structures (%) for 2015, 2020, 2030,2040*

	2015 (N=18,823,869)		2020 (N=18,823,869)		2030 (N=15,466,321)		2040 (N=12,925,893)	
Age Groups (yrs)	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
<20	0.04	0.17	0.03	0.11	0.04	0.10	0.05	0.09
20-24	1.18	3.13	1.16	2.82	1.39	2.51	1.73	2.47
25-29	3.23	7.40	3.01	6.71	3.33	5.77	4.18	5.73
30-34	4.21	10.05	4.45	8.89	4.13	7.11	5.12	6.95
35-39	4.15	9.86	5.02	10.25	4.81	7.97	5.45	7.30
40-44	4.73	9.14	4.98	9.87	6.27	9.22	5.90	7.68
45-49	6.56	10.67	5.53	8.97	7.04	10.30	6.70	8.27
50-54	7.79	11.91	7.33	10.16	6.57	9.45	8.15	9.12
55-59	9.02	12.04	8.45	11.10	6.78	8.24	8.55	9.74
60-64	9.35	9.03	9.59	11.07	8.54	9.02	7.61	8.68
65-69	14.95	5.21	9.68	8.16	9.44	9.53	7.53	7.35
70-74	11.12	3.34	14.81	4.55	10.14	9.08	9.00	7.68
75-79	7.82	2.36	10.46	2.78	9.25	6.19	9.15	7.49
80-84	7.49	2.11	6.64	1.81	11.95	3.02	8.59	6.34
85+	8.37	3.59	8.86	2.76	10.30	2.50	12.30	5.10
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Data Sources: [6]

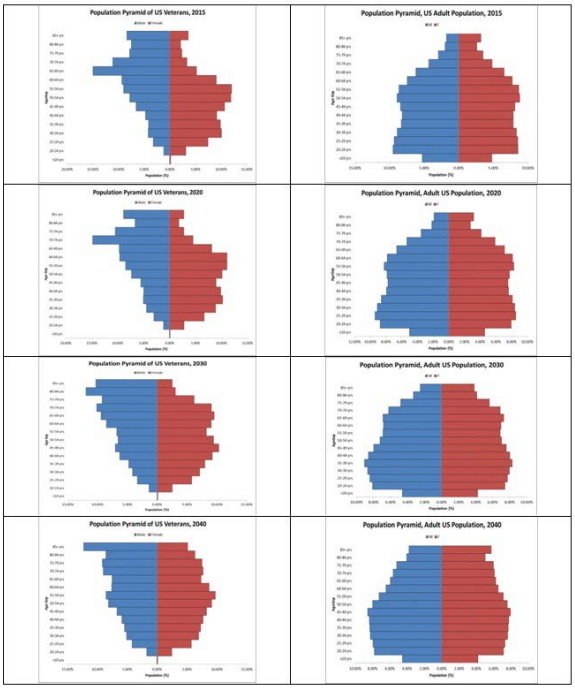
RESULTS

In Table 1, we examined the projected Veteran population structure from 2015 to 2040 according to age group and sex. The U.S. adult population was also examined in the same manner (not shown). In the table, the population projections are presented for a 25-year period assuming that no armed conflict will change the structure of the projections.

The population pyramids constructed using the projected population data are effective graphical representations of these data patterns. Over time, the US Adult population is projected to increase while the US Veteran population is projected to decrease. The underlying data from Table 1 for the projected Veteran population structures for the indicated periods along with companion data for the adult population for the same periods were used to create the population pyramids.

In Figure 1, the Veteran and adult population projections for the 25-year period are placed side-by-side. In each pyramid, the data representing the projections for males by age group (17 years and above) are on the left-side of the pyramid (blue); that for females are on the right-side (red). We note that each Veteran population structure from 2015 to 2040 differs from that of the adult population for the same period. This may be related to the military experiences of the US Veteran population were different from the experiences of the US adult population who were not on active duty along with the fact that more men enlist in US military service compared to the number of women who enlist.

Figure 1. *U.S. Veteran and Adult Projected Population Pyramids, 2015 through 2040*



Data Sources: [6,7]

DISCUSSION

We examined the population projection data from 2015 to 2040 to obtain a better idea of what the U.S. Veteran population may look like in the next 25-years. We observed that the Veteran population is projected to decrease from 21 million in 2015 to 13 million by 2040 (Table 1). During this period, the U.S. adult population is projected to increase from 321 million to 380 million. Study of the population pyramids for Veterans showed that between 2015 and 2040, not only would the proportion of female Veterans increase over time but also that there will be a greater representation of Veterans in the older age groups (Figure 1).

Implications for Health Planning in VHA

Increasing access to health care, preventing unnecessary duplication of services, and enhancing the acceptability of care are examples of objectives used in health planning to improve a population's health.[3] Consideration of population health needs based, in part, on population structure is important for health planning efforts that seek to improve population health. Additionally, military service may impact the health needs of a population and may need to be considered in health planning efforts.

The density and sex distribution data of the Veteran population structure for the 25-year period (Table 1) might suggest possible health conditions that health system administrators, health planners, and managerial epidemiologists could study in greater detail for Veterans using the VHA system.[3] For health planning purposes, the population pyramid could be examined, generally, by age group and the health needs of Veterans in each age grouping can be considered in terms of acute health care and rehabilitation, health and wellness, community health, and Veteran reintegration.[12] Models of health care and rehabilitation stemming from the effects of military service for Veteransin each population group could drive health planning efforts. Similarly, the influences of military service could shape health and wellness plans, community health, and Veteran reintegration activities with the local community according to Veterans at each age group.

Implications for Monitoring Long-Term Population Health Outcomes

Since projections showed that the Veteran population age will increase over time, it will be important to monitor the rates of important health outcomes over time to determine long-term success toward meeting health planning goals to improve Veteran population health. There are well-known disadvantages to comparing crude health outcome rates over time without adjustment.[13-15] Ahmad et al[16] provided a justification for using a "standard reference population" to compare rates in populations over time; the selection of such a population is arbitrary but agreement on what will be the "standard reference population" is essential for long-term, population rate comparisons.[16] Comparing health outcome rates in a population over time using a "standard reference population" is necessary for making health system decision-making based on population-based data;

effectively interpreted data are needed to monitor and improve the utilization of public medical services for the benefit of the Veteran population.[17]

Selecting the Veteran population projections for 2030 might be a useful "standard reference population" for comparing population health outcome rates pertaining to the Veteran population where direct standardization is used from the year 2018 until 2030. The advantage of this approach is that the VA has invested resources in these population projections[8] so the VHA can utilize this work in important, long-term monitoring of Veteran population health outcome rates. It is likely that the VA will update their population projections in coming years. As 2030 approaches and Veteran population projections become available for 2050 or 2060, for example, future VHA leaders can decide to update the Veteran "standard reference population" for comparing population health outcomes beyond 2030 that can rely on the VA population projections at that future time.

LIMITATIONS

We relied on the population projection data from the VA; their description of the population projections models includes recognition of the strengths and limitations of the approach.[8] The same might, also, be said of the population projections from the Census Bureau. These are just projections and we cannot know how the behavior of the individuals in the population will impact the population projections. This uncertainty is a part of the population data presented in this report.

CONCLUSION

Comparing health outcome and health service utilization rates within a health care system across populations or time periods are an essential component of health system planning, monitoring, and health program evaluation. Crude rates are usually reported for these outcome measures. However, using unadjusted crude rates for comparison over time in a population could lead to faulty conclusions in public sector reports.

Close inspection of population pyramids for the projected years showed that between 2015 and 2040, not only could the proportion of female Veterans increase over time but, also, more Veterans will be represented in the older age groups. The population composition based on age group and sex could have important implications for the comparison of population health outcome rates as health planners consider the long-term resources necessary to support acute health care and rehabilitation, health and wellness, community health, and Veteran reintegration into the community. Where Veteran population health outcome rates are intended to be monitored over a long period of time, it might make sense to use the Veteran population projections for 2030 as a "standard reference population" for the direct standardization of rates.

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AUTHOR CONTRIBUTIONS

Dr. Gregory Fant conceptualized and designed the project, acquired the data, analyzed and interpreted the data, drafted the article and revised it, provided final approval for the version to be submitted for publication, and is accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. This brief report is an expansion of a scientific poster presented at professional conference of the Association of Military Surgeons of the United States (AMSUS or The Society of Federal Health Professionals) in Washington, DC, November 2018. Earlier in the year, the author used the similar methods to examine population projections in a particular state in India for another public health purpose.

DISCLAIMER

The views expressed in this Brief Report are those of the author and do not represent the official position of the U.S. Government.

DISCLOSURE

The author reports no conflicts of interest in this work or financial disclosures to report.

REFERENCES

1. U.S. Department of Veterans Affairs. FY 2018-2024 strategic plan. https://www.va.gov/oei/docs/va2018-2024strategicplan.pdf. Published February 12, 2018. Accessed May 20, 2019.

2. U.S. Department of Veterans Affairs, Veterans Health Administration. Restoring trust in Veterans health care-Annual report 2016. https://www.va.gov/HEALTH/docs/VHA_AR16.pdf. Accessed May 20, 2019.

3. Fos PJ, Fine DJ, Zuniga MA. *Managerial Epidemiology for Health Care Organizations*. 3rd ed. San Francisco, CA, USA: Jossey-Bass; 2018.

4. Guest C, Ricciardi W, Kawachi I, Lang I. *Oxford Handbook of Public Health Practice*. 3rd ed. Oxford, England, UK: Oxford University Press; 2013.

5. Bonita R, Beaglehole R, Kjellstrom T. *Basic Epidemiology*. 2nd ed. Geneva, Switzerland: World Health Organization; 2006.

6. U.S. Department of Veterans Affairs, VA National Center for Veterans Analysis and Statistics.Table: Table 6L_VetPop2016_National. Web site. https://www.va.gov/vetdata/. 2018. Updated May 7, 2019. Accessed May 20, 2019.

7. U.S. Bureau of the Census, Population Projections. Table:

Population projections for the United States from 2015 to 2060 (in millions). Web site. https://www.census.gov/data/tables/2014/demo/popproj/2014-summary-tables.html. 2018. Revised May 9, 2017. Accessed May 20, 2019.

8. Ahn PJ. Veteran population project model 2016-executive summary and overview. Washington, DC: 2017.

9. Hollmann FW, Mulder TJ, Kallan JE. Methodology and assumptions for population projections of the United States: 1999 to 2100. *Population Division Paper Working Papers*. 2000-01. https://www.census.gov/library/working-papers/2000/demo/POP-twps0038.html. Accessed May 20, 2019.

10. Oleske DM. *Epidemiology and the Delivery of Health Care Services*. 2nd ed. New York, USA: Kluwer Academic Publishers; 2001.

11. Oleske DM. *Epidemiology and the Delivery of Health Care Services*. 3rd ed. New York, USA: Springer; 2010.

12. Rowe J, Berkman L, Fried L, et al. Preparing for better health and health care for an aging population. Discussion Paper. https://nam.edu/wp-content/uploads/2016/09/Preparing-for-Better-Health-and-Health-Care-for-an-Aging-Population.pdf. Published September 19, 2016.

13. Bhopal RS. *Concepts of Epidemiology*. 3rd ed. Oxford, England, UK: Oxford University Press; 2016.

14. Wiener JM, Tilly J. Population ageing in the United States of America: Implications for public programmes. *Int J Epidemiol*. 2002; 31(4): 776-781. doi: 10.1093/ije/31.4.776

15. Wolinsky FD. Age, Period, and Cohort Analyses of Health-Related Behavior In: Dean K, ed. *Population Health Research*. London, UK: SAGE Publications; 1993.

16. Ahmad O, Boschi-Pinto C, Lopez AD, et al. Age standardization of rates: A new WHO standard. 2001.

17. McGrail K, Jones K, Akbari A, et al. A position statement on population data science: The science of data about people. *International Journal of Population Data Science*. 2018; 3: 4. doi: 10.23889/ijpds.v3i1.415

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Lifestyle Pattern and Bone Mineral Density: A Preliminary Study

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ABSTRACT

Objective
The aim of the study was to find an association of lifestyle pattern with bone mineral density among adults of Delhi.

Methodology
Cross-sectional data was collected among 153 participants both males and females with age ranging from 20-60 years. The bone mineral density was assessed using heel ultrasonic test. Each participant was studied for dietary pattern including vegetarian and non-vegetarian food, milk intake and physical activity. Stature and body weight were measured for each participant and body mass index (BMI) was computed. The respondents were classified in different nutritional status categories based on the BMI and different bone mineral density categories based on their bone quality index and T-score.

Results
The risk of osteoporosis and osteopenia was found to be significantly different among respondents belonging to different categories of nutritional status, fat percentage, dietary intake and physical activity.

Conclusion
Bone Quality Index (BQI) indicated an association with dietary trends, nutritional status, milk intake and physical activity (with only milk intake and physical activity being significant). There is need to sensitize the population towards taking an adequate care and to prevent themselves from loss of bone mineral and associated risks.

Keywords
Bone quality index; Nutritional status; Dietary trends; Physical activity; Fat percent; Body mass index (BMI); BQI.

INTRODUCTION

There is a worldwide increasing prevalence of osteoporosis which occurs in both men and women with advancing age, especially.[1,2] Various lifestyle aspects including dietary patterns, physical activity, and leisure time life activities influence on bone health among adults and elderly.[3] The change in bone contents and mass is controlled by several aspects involving genetic factors, peak bone mass (PBM), balanced nutrition, physical activity, and lifestyle risk factors such as beverage intakes, smoking, etc.[4] Osteoporotic fractures are a significant cause of morbidity and mortality, increased dependency in old age, both in developing and developed countries. Osteoporosis is one of the major public health concerns among adults including both males and females. Osteoporosis is responsible for two million broken bones and $19 billion in related costs every year.[5] Historically, calcium and vitamin D are the primary nutrients considered for osteoporosis prevention. It is very important to have the knowledge of bone health and its future impact as the amount of bone mass accrued from childhood to early adulthood and bone structure adaptation are the most important predictors of osteoporosis risk later in life.[6] Besides this, dietary components and physical activity are the two important modifiable factors that have a strong influence on bone accumulation, maintenance, and loss during the evolving life cycle of bone.[7] Since the dietary intake of a given nutrient is always related to the intake of other nutrients potentially affecting bone health, to disentangle the role of an individual nutritional item from that of the general dietary pattern is not easy. Accordingly, to

better understand the effect of nutrition on bone mineral density (BMD), it seems more logical to focus on the relationship between the general dietary pattern and changes of BMD. Low body mass index (BMI) is a well-documented risk factor for low bone density and future fracture. The risk is most marked for lean individuals with a BMI of <20 kg/m^2. Above 20 kg/m^2 incremental increases in weight have little protective effect; leanness appears to be a risk factor rather than obesity protective. The association of fracture risk with leanness is largely dependent on BMD. For hip fracture, a modest risk persists after adjustment for BMD.[8] Several mechanisms have been proposed to explain the protective effect of obesity on bone mass. Physical activity prevents bone loss. Berard and co-workers found a significant protective effect of physical activity on BMD.[9] Diet has a significant effect on bone and muscle health. Bone health is affected by many factors such as genetic, nutrition especially dietary protein intake, environment and lifestyle. Nutrition is one of the vital modifiable factors in the maintenance and development of bone and prevention of osteoporosis. It is likely that other environmental and lifestyle factors, particularly exercise, may modulate this effect. Positive relationships of BMD with dairy product intake and with physical activity have been reported.[10-13] This study aimed to examine the relationship between dietary factors, physical activity, nutritional status and bone health.

METHODOLOGY

A cross-sectional study was conducted in Delhi population among 153 participants, both males and females, ranging in age from 20-60 years. The present study consist a part of on-going larger study therefore the sample size is small. Anthropometric data including stature and body weight was measured using standard techniques. The BMI was computed. The bone density was taken on each respondent using heel ultrasonic test. Quantitative ultrasound (QUS) of calcaneal bone was considered as a low-cost technique and a fast examination with absence of ionizing radiation for assessment of bone quality.[14] Bone densitometer (Sonost-3000) using ultrasonic waves was used to measure the speed of sound (SOS) in the heel. All subjects had QUS measurements of their right calcaneus using densitometer with transmission imaging. The instrument measures BUA and SOS in a circular area of lowest attenuation in the posterior tuberosity of the calcaneus. This method was used as a non-invasive technique and so the measurement is safe and is suitable for primary screening of healthy population especially for children and pregnant women. The measurement is also suitable due to its high correlativity with dual-energy x-ray absorptiometry (DEXA). Various standardized indices were used like BMI and Bone Quality index (BQI). The BMI was categorizedas per World Health Organization (WHO) standards.[15] The WHO has proposed a set of criteria to define osteoporosis in terms of a BMD measurement. The BMD value of an individual patient is expressed in terms of the number of standard deviations from the mean of healthy young adults i.e., T-score. Osteoporosis has been defined by a T-score ≤-2.5, as osteopenia -1> T-score >-2.5 and as normal T-score ≥-1.[16] A structured proforma was used for collecting demographic as well as information regarding lifestyle parameters. Informed consent was taken from each participant prior to the start of the study and ethical clearance was also obtained from the concerned Ethical clearance committee for conducting the study. A criterion of including apparently healthy individual has been followed to recruit the participants for the present study.

Statistical analysis

For analysis, the respondents were categorized in three groups based on their BQI values namely normal bone health, osteopenia and osteoporosis. Statistical analysis was performed using SPSS version 17.0. The data was checked for normal distribution. Fisher exact test (two sided) Chi square test were used.

RESULTS

Most of the male (56%) and female (63.1%) respondents belong to 20-40 years age group followed by 41-50 years and 51-60 years (Table 1).

Table 1. *Age and Gender Wise Distribution of Respondents*

Age Groups (years)	Males N (%)	Females N (%)	Total N (%)
20-40 years	28(56)	65(63.1)	93(60.8)
41-50 years	18(36)	26(25.2)	44(28.8)
51-60 years	4(8)	12(11.7)	16(10.5)
Total	50(100)	103(100)	153(100)

N–Number of respondents

Table 2 displays the distribution of respondents, males and females, as per BQI (T-score). Among males 24% were found to have osteoporosis and 4% were found to be suffering with osteopenia. However, among females more than half of the respondents (53.4%) were found to be suffering with osteoporosis and 3.9% were found to have osteopenia. Significant gender differences (χ^2=12.16, p<0.01) for BQI were reported.

Table 2. *Distribution of Respondents According to BQI (T-score)*

Respondents		Osteopenia	Osteoporosis	Normal	Total	Chi square Value
Males	N	2	12	36	50	χ^2=12.16** df=2
	%	4.0%	24.0%	72.0%	100%	
Females	N	4	55	44	103	
	%	3.9%	53.4%	42.7%	100%	
Total	N	6	67	80	153	
	%	3.9%	43.8%	52.3%	100%	

***p<0.01, BQI-Bone quality index, N-Number of respondents, df-Degrees of freedom*

Table 3 indicates that majority of respondents taking a vegetarian or non-vegetarian diet were comparable based on BQI. In the present study, our findings showed that those who consumed either vegetarians or non-vegetarian food are at equal risk of being osteopenic/osteoporotic. A higher percentage of respondents consuming vegetarian food (53.5%) were reported to be normal as compared to those consuming non-vegetarian diet

(51.2%). The chi square value (χ^2=0.45) was found to be non-significant.

Table 3. *Association of Dietary Components with BQI*

Respondents Category		Vegetarian	Non-vegetarian	Chi square Value
Osteopenia	N	2	4	χ^2=0.45 NS df=2
	%	2.8%	4.9%	
Osteoporosis	N	31	36	
	%	43.7%	43.9%	
Normal	N	38	42	
	%	53.5%	51.2%	

BQI–Bone quality index, NS-Non-significant, N–Number of respondents, df–degrees of freedom

Table 4 displays the association of milk intake with BQI. It was found that 5% of the participants taking milk were categorized as osteopenia according to BQI and 37.5% were osteoporotic and 57.5% were under the normal BQI category. Among the participants who were not taking milk, 66.7% of them were classified as osteoporotic and 33.3 % were under the normal BQI category. Significant milk intake differences (χ^2=9.57, p<0.01) were reported.

Table 4. *Association of Milk Intake with BQI*

Respondents Category		Yes	No	Chi square Value
Osteopenia	N	6	0	χ^2=9.57** df=2
	%	5.0%	0.0%	
Osteoporosis	N	45	22	
	%	37.5%	66.7%	
Normal	N	69	11	
	%	57.5%	33.3%	

*** p<0.01, BQI–Bone quality index, NS-Non-significant, N–Number of respondents, df–degrees of freedom*

Table 5 displays that most of the respondents who consumed milk on daily (58.8%) or weekly (56.2%) or occasionally (46.4%) basis had normal bone quality index. However, some of those taking milk were reported to be suffering with either

Table 5. *Association of Milk Intake Frequency with BQI*

Respondents Category		Daily	Weekly	Occasionally	Fisher's Exact Test
Osteopenia	N	1	0	4	2.881 p=0.019
	%	2	0	7.2	
Osteoporosis	N	20	7	26	
	%	39.2	43.8	46.4	
Normal	N	30	9	26	
	%	58.8	56.2	46.4	
Total	N	5	53	65	
	%	4.1	43.1	52.8	

BQI-Bone quality index, N-Number of respondents, df-Degrees of freedom

osteopenia or osteoporosis. Fisher exact test reported significant association (F=2.881, p=0.019) among respondents with respect to frequency of milk intake and their BQI.

Table 6 displays an association of nutritional status with BQI. It was found that 2.6% of the respondents in the underweight BMI category were categorized as osteoporotic according to BQI and 2.0% were atthe normal BQI category. Atthe normal BMI category, 24.8% of the respondents were classified osteoporotic according to BQI, 1.3% respondents were osteopenia and 24.2% were under the normal BQI category. Among respondents who are overweight/obese according to BMI, it was found that 16.3 % were classified osteoporotic, 2.6% were osteopenia, and 26.1% were under BQI normal category. The association between BQI and nutritional status according to BMI was found to be non-significant (χ^2 =7.66).

Table 6. *Association of Nutritional Status with BQI*

Respondents Category		Under-weight	Normal Weight	Overweight/ Obese	Fisher's Exact Test
Osteopenia	N	0	2	4	χ^2=7.66 NS df=4
	%	0.0%	1.3 %	2.6 %	
Osteoporosis	N	4	38	25	
	%	2.6 %	24.8%	16.3%	
Normal	N	3	37	40	
	%	1.9%	24.2%	26.1%	

NS-non-significant, N–Number of respondents, df–degrees of freedom

Table 7 displays the association of bone health and physical activity. It was observed that among those respondents who performed any type of physical activity, 29.4% belonged to osteoporosis category and 70.6% to the normal category. Whereas, 47.9% respondents without any physical activity practices were found to belong to the osteoporosis category, 5.0% were osteopenic and 47.1% had no osteopenia and osteoporosis.. Significant differences (χ^2=6.58*, p<0.05) were obtained between respondents on the basis of physical activity.

Table 7. *Association of Physical Activity with BQI*

Respondents Category		With Physical Activityweight	Without Physical Activity	Chi square Value
Osteopenia	N	0	6	χ^2=6.58* df=2
	%	0.0%	5.0%	
Osteoporosis	N	10	57	
	%	29.4%	47.9%	
Normal	N	24	56	
	%	% 70.6	47.1%	

**p<0.05, BQI–bone quality index, N–number of respondents, df-degrees of freedom*

DISCUSSION

As compared to males, females were reported to be osteopenia/osteoporosis. More than half of the female respondents under study were found to be suffering with osteoporosis/osteopenia.

Significant gender differences were reported. Earlier studies have reported that bone loss occurs with progression of age in both genders, but the rate of loss is much greater in women.[17]

Majority of respondent taking a vegetarian or non-vegetarian diet were comparable based on BQI. Dietary protein intake may be important in determining bone mass and fracture risk.[18] However, in the present study, it was reported that those who consumed either vegetarian or non vegetarian food are at equal risk of being osteopenia/osteoporotic. A higher percentage of respondent consuming vegetarian food were reported to be normal as compared to those consuming a non-vegetarian diet but this was not statistically different. It has been suggested that protein derived from vegetable sources may be more beneficial for the skeleton than animal protein.[8]

Milk is considered as one of the most complete foods enriched with needed amounts of minerals such as calcium and essential vitamins for formation of healthy bone. Most of the respondents who consumed milk on daily or weekly or occasional basis had normal BQI. Some of those taking milk were reported to have osteopenia or osteoporosis. This could be due to reasons that these participants were not consuming the adequate quantity of milk. Similar positive relationships between dairy product intake and BMD have been reported earlier.[10,11] It is uncertain which nutrient or combination of nutrients is responsible for changes in bone mass when dairy products are consumed because protein, calcium, phosphorus and vitamin D are known to be associated with bone health.[10] Also the role of exposure to sun cannot be ruled out. It was reported in previous studies that calcium has a positive effect on bone mass formation among people all ages.[19] This is due to the high levels of calcium in milk, as reported previously.[20] The respondents in our study in particular should increase their consumption of milk or calcium-rich foods to promote bone health and prevent osteoporosis during aging.

It is widely known that a high body weight or high BMI is related to a high bone mass but this is not the case in our data. An association of nutritional status (based on BMI) with BQI was reported in our present study but this was not statistically significant. Majority of those respondents who were overweight/obese were found to be suffering with osteoporosis or osteopenia. There are prior reports indicating that obesity significantly decreased the risk of osteoporosis but did not decrease the risk for osteopenia.[3] In addition, the supportive results of Guney et al,[21] showed that a lower BMI was associated with a low BMD and fractures.[21] Other studies also found associations between body weight and BMD.[22,23] Bone mineralization and resistance, result in stress that compresses the skeleton, and since body weight places the most constant mechanical stress on bones, the correlation between BMD and body weight is understandable.[24,25]

Physical activity plays an integral part in stimulating bone formation and helps in regulating bone size, shape, and strength.[26] In the present study, it was observed that among those respondents who performed any type of physical activity reported less occurrence of osteopenia/osteoporosis as compared to those who were not involved with any type of physical activity. Physical activity has been shown to contribute to bone mass in earlier studies.[12,13,27] Individuals with low physical activity were susceptible to bone loss or osteoporotic fracture and an increased physical activity results in an increase in BMD and a concomitant decrease in BMI.[28,29] Earlier studies showed significant continuing increase in bone mass in exercising premenopausal young women compared to non-exercising controls.[30,31]

Our data suggested that BMI and physical activity, along with other risk factors such as milk intake and dietary pattern are associated with bone health. The association of milk intake and physical activity were found to be significant, however the association of BMI and other dietary patterns are reported to be non significant which could be due to the small sample size. As the diet and lifestyle can be modified, demonstrating the effects of nutrition on bone health can provide an approach for osteoporosis prevention. Keeping in mind the incidence of osteopenia/osteoporosis in apparently healthy people as reported in the present study, it is important to sensitize the population towards taking an adequate care and to prevent themselves from bone mineral loss and associated risks. Proactive strategies need to be devised to reduce the risk and to lead a quality life.

CONCLUSION

An association of bone quality index and lifestyle trends including dietary pattern and physical activity were reported. Bone quality index or stiffness index indicated a significant association with milk intake and physical activity. Non-significant association are reported for dietary trends and nutritional status based on BMI. There is need to sensitize the population towards taking an adequate care and to prevent themselves from loss of bone mineral and associated risks.

STUDY STRENGTH

With globalisation and changing lifestyle, there is a paradigm shift in the dietary patterns of people across all cultures. In addition to this, people have sedentary lifestyle as many are migrating to the metropolitan cities for their livelihood. This sedentary lifestyle alongwith change in the dietary pattern makes it important to carry out such type of study. There are very few population based studies conducted on such a crucial aspect of health.

LIMITATIONS

The present study consist a part of on-going larger study therefore the sample size is small. As reflected in the sample distribution in Table 1, there was lesser number of male respondents due to their work schedule. Conversely, it is noteworthy that majority of the female respondents were homemakers/housewives which is better reflected in their larger representation.

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CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

REFERENCES

1. Melton LJ 3rd. Epidemiology worldwide. *Endocrinol Metab Clin North Am*. 2003; 32: 1-13.

2. Bonura F. Prevention, screening, and management of osteoporosis: An overview of the current strategies. *Postgrad Med*. 2009; 121(4): 5-17. doi: 10.3810/pgm.2009.07.2021

3. World Health Organization (WHO) Scientific Group on the prevention and management of osteoporosis. Prevention and management of osteoporosis: Report of a WHO Scientific Group. https://apps.who.int/iris/handle/10665/42841. 2000; 1-3. Accessed January 21, 2019.

4. Korkmaz N, Tutoğlu A, Korkmaz I, Boyacı A. The relationships among vitamin D level, balance, muscle strength, and quality of life in postmenopausal patients with osteoporosis. *J Phys Ther Sci*. 2014; 26: 1521-1526. doi: 10.1589/jpts.26.1521

5. Sahni S, Mangano KM, McLean RR, Hannah MT, Kiel DP. Dietary approaches for bone health: Lessons from the Framingham Osteoporosis Study. *Curr Osteoporos Rep*. 2015; 13(4): 245-255. doi: 10.1007/s11914-015-0272-1

6. Kontulainen SA, Kawalilak CE, Johnston JD, Bailey DA. Prevention of osteoporosis and bone fragility: A pediatric concern. *Am J Lifestyle Med*. 2013; 7: 405-417. doi: 10.1177/1559827613487664

7. New SA. Exercise, bone and nutrition. *Proc Nutr Soc*. 2001; 60: 265-274.

8. Frassetto LA, Todd KM, Morris RC, Sebastian A. Worldwide incidence of hip fracture in elderly women: Relation to consumption of animal and vegetable foods. *J Gerontol A Biol Sci Med Sci*. 2000; 55: M585-M592. doi: 10.1093/gerona/55.10.m585

9. Berard A, Bravo G, Gauthier P. Meta-analysis of the effectiveness of physical activity for the prevention of bone loss in postmenopausal women. *Osteoporosis Int*. 1997; 7: 331-337.

10. Merrilees MJ, Smart EJ, Gilchrist NL, et al. Effects of dairy food supplements on bone mineral density in teenage girls. *Eur J Nutr*. 2000; 39(6): 256-262. doi: 10.1007/s003940070

11. Beaudoin CM, Blum JW. Calcium knowledge, dietary calcium intake, and bone mineral content and density in young women. *N Am J Psychol*. 2005; 7(2): 265-277. doi: 10.1093/jn/136.5.1281

12. Bedford JL, Barr SI. The relationship between 24-hr urinary cortisol and bone in healthy young women. *Int J Behav Med*. 2010; 17(3): 207-215. doi: 10.1007/s12529-009-9064-2

13. Breban S, Chappard C, Jaffre C, et al. Positive influence of long-lasting and intensive weight-bearing physical activity on hip structure of young adults. *J Clin Densitom*. 2011; 14(2): 129-137. doi: 10.1016/j.jocd.2011.02.001

14. Raum K, Grimal Q, Varga P, Barkmann R, Glüer CC, Laugier P. Ultrasound to assess bone quality. *Curr Osteoporos Rep*. 2014; 12(2): 154-162. doi: 10.1007/s11914-014-0205-4

15. World Health Organization (WHO). The world health report 2002-Reducing risks, promoting healthy life. Web site. www.who.int/whr/2002/en/. 2002. Accessed January 21, 2019.

16. World Health Organization (WHO). Fracture Risk Assessment Tool (The FRAX tool). Web site. http://www.shef.ac.uk/FRAX. 2010. Accessed January 21, 2019.

17. Nilas L, Christiansen C. Bone mass and its relationship to age and the menopause. *J Clin Endocrinol Metab*. 1987; 65: 697-702. doi: 10.1210/jcem-65-4-697

18. Ginty F. Dietary protein and bone health. *Proc Nutr Soc*. 2003; 62: 867-876. doi: 10.1079/PNS2003307

19. Cashman KD. Review: Milk minerals (including trace elements) and bone health. *Int Dairy J*. 2006; 16: 1389-1398. doi: 10.1016/j.idairyj.2006.06.017

20. Institute of Medicine. *Institute of Medicine: Dietary Reference Intakes: Calcium, Magnesium, Phosphorus Vitamin D, and Fluoride*. Washington, DC, USA: National Academy Press; 1997.

21. Guney E, Kisakol G, Ozgen G, Yilmaz C, Yilmaz R, Kabalak T. Effect of weight loss on bone metabolism: Comparison of vertical banded gastroplasty and medical intervention. *Obes Surg*. 2003; 13: 383-388. doi: 10.1381/096089203765887705

22. Wang MC, Bachrach LK, Van Loan M, et al. The relative contributions of lean tissue mass and fat mass to bone density in young women. *Bone*. 2005; 37: 474-481. doi: 10.1016/j.bone.2005.04.038

23. El Hage R, Jacob C, Moussa E, et al. Influence of the weight status on bone mineral content and bone mineral density in a group of Lebanese adolescent girls. *Joint Bone Spine*. 2009; 76: 680-684. doi: 10.1016/j.jbspin.2009.10.004

24. Hall SJ. *Biomecanica Basica*. 4th ed. Rio de Janeiro, Brazil: Guanabara Koogan; 2000.

25. Koca I, Boyaci A, Tutoglu A, Boyaci N, Ozkur A. The relationship between quadriceps thickness, radiological staging, and clinical parameters in knee osteoarthritis. *J Phys Ther Sci*. 2014; 26: 931-936. doi: 10.1589/jpts.26.931

26. Karlsson MK, Hasserius R, Obrant KJ. Bone mineral density in athletes during and after career: A comparison between loaded and unloaded skeletal regions. *Calcif Tissue Int*.1996; 59: 245-248. doi: 10.1007/s002239900

27. Suominen H. Physical activity and health: Musculoskeletal issues. *Adv Physiother*. 2007; 9(2): 65-75. doi: 10.1080/14038190701374718

28. Andreoli A, Bazzocchi A, Celi M, et al. Relationship between body composition, body mass index and bone mineral density in a large population of normal, osteopenic and osteoporotic women. *Radiol Med*. 2011; 116: 1115-1123. doi: 10.1007/s11547-011-0689-2

29. Han JT, Lee SY. A comparison of vital capacity between normal weight and underweight women in their 20s in South Korea. *J Phys Ther Sci*. 2012; 24: 379-381. doi: 10.1589/jpts.24.379

30. Ginty F, Rennie KL, Mills L, Stear S, Jones S, Prentice A. Positive, site-specific associations between bone mineral status, fitness, and time spent at high-impact activities in 16- to 18-year-old boys. *Bone*. 2005; 36: 101-110. doi: 10.1016/j.bone.2004.10.001

31. Kamide N, Shiba Y, Koide K. The timed up and go test is related to quantitative ultrasound parameters of bone strength in Japanese community dwelling elderly women. *J Phys Ther Sci*. 2009; 21: 373-378. doi: 10.1589/jpts.21.373