DEPARTMENT OF PUBLIC HEALTH
&
COMMUNITY MEDICINE (DPH&CM)

Doctor of Philosophy (PhD.,) in Public Health
Programme Curriculum

CENTRAL UNIVERSITY OF KERALA, KASARAGOD

1. Central University of Kerala (CUK), Kasaragod

The Central University of Kerala, Kasaragod, came into being in 2009 under the Central Universities Act 2009 (Parliament Act No. 25 of 2009). The University is founded on the noble vision of a 'caring wisdom' and is guided by the lofty ideals of academic and social commitment, moral steadfastness and intellectual and spiritual enlightenment, as reflected in its vision statement. Located in a region characterized by linguistic and ethnic diversity and cultural richness, the University seeks to harness the local resources – human, intellectual, social, artistic and cultural – while bringing in the best that is globally available, thus maintaining a fruitful, symbiotic relationship with a region that essentially needs an educational upliftment. The University opened its academic portals in October 2009 with 17 students enrolling two PG programmes, operated from a rented building in Vidyanagar. From this humble beginning, CUK has grown into an institution offering seventeen postgraduate and research programmes with a total enrolment of 1098 odd students, in the academic year of 2017-'18. The twenty two departments, viz., Animal Science, Bio-Chemistry and Molecular Biology, Genomic Science, Plant Science, Environmental Science, Economics, Education, International Relations & Politics, Social Work, English & Comparative Literature, Hindi, Linguistics, Chemistry, Computer Science, Mathematics, Physics, Law, Malayalam, Public Health and Community Medicine, Public Administration and Policy Studies, Geology, and Yoga Studies function under eleven Schools, viz., School of Biological Sciences, School of Earth Science Systems, School of Economics, School of Education, School of Global Studies, School of Languages & Comparative Literature, School of Legal Studies, School Physical Sciences , School of Social Sciences, School of Medicine and Public health and School of Cultural Studies. As a remarkable achievement, the University at its infancy stage has completed NAAC accreditation with B++ grade.

2. Department of Public Health & Community Medicine, CUK

The Department of Public Health & Community Medicine (PH&CM) established in the year 2016 under the School of Medicine & Public Health, Central University of Kerala (CUK) is envisaged as a service oriented, academic, and research-based institution. The flagship academic programme of the Department is a two-year (4-Semesters) full-time Master of Public Health (MPH). PhD in Public Health is another programme that commenced in 2017. The Department also aspires to establishing distance education programmes in the near future.

3. Our Mission

Department of Public Health & Community Medicine is committed towards the improvement of health of communities regionally and nationally by developing professionally trained human resources for health through academics, training, research, partnerships, and related extension activities in the field of public health.

4. Our Vision

Our Department strives to excel in the field of public health through education, training, cutting edge research, innovation, thereby transforming it into a Centre of Excellence. This will contribute towards strengthening of health systems and improving public health nationally and internationally.

5. PhD Programme level Outcomes and PhD in Public Health Programme Specific Outcomes

PhD programme outcome in the Department of Public Health and Community Medicine

The Graduates of PhD Programme will develop necessary research, academic and management skills to demonstrate autonomy, critical thinking, adaptability and responsibility as a leading scholar and practitioner in public health and allied domains.

Programme Specific Outcomes-PhD in Public Health

On completion of PhD in Public Health programme at Central University of Kerala, graduates will:

i. Demonstrate a comprehensive understanding of health research methods and ethics, paradigms, tools and techniques applicable to research in public health and health systems.

ii. discover, generate, interpret and communicate newer knowledge/evidences specific to public health through research of publishable quality that satisfies peer review process.

iii. apply a significant range of advanced and specialized academic and research skills and be able to act independently in the planning, designing, and implementation of a research project of public health importance.

iv. practice a proactive and self-reflective approach and develop professional working relationships with other working professionals in the same and allied field.

v. demonstrate leadership and originality in addressing and resolving public health issues by working effectively and efficiently with others within a healthcare ecosystem.

vi. work collaboratively and in partnership with health and allied stakeholders to create, develop and exchange research knowledge to influence and benefit society and the nation at large.

6. Programme Duration and Outline

PhD programme in the Dept. of Public Health and Community Medicine, Central University of Kerala, shall be a for a minimum duration of three years, including course work and a maximum of six years. **(Refer PhD Ordinance for CUK, Kasaragod for additional details.)**

7. Course work

Every student registered for the PhD programme shall be required to undertake course work for a minimum period of one-semester (six) months in the University Department concerned.

The structure of the one-semester PhD course wok shall be as follows:

Title /Code of the course	Credit value	Continuous Evaluation	End-Semester Evaluation	Total
Course-1: MPC 71 01: Research Methodology	4	40	60	100
* Course-2: Special course related to the core area of research	6	40	60	100
Course-3: Course on the	6		100	100

specific research proposal including a review of literature				
Course-4: Research and Publication Ethics	2	As per UGC regulations letter dated December 2019 Letter no. D.O.No. F1-1/2018(Journal/CARE)		

*List of Special course related to the core area of research is given below

8. List of Special course related to the core area of research offered in the Dept. of Public Health and Community Medicine

Sl.	Course title	Course code	Credits
1	Advanced Epidemiology	MPC 71 02	6
2	Advanced Biostatistics	MPC 71 03	6
3	Project Management	MPC 71 04	6
4	Introduction to Health Systems and Policy	MPC 71 05	6
5	Principles of Health Management & Health Programme Design, Implementation and Evaluation	MPC 71 06	6
7	Mixed methods in Health Sciences	MPC 71 07	6
8	Health Economics	MPC 71 08	6
9	Health Technology and Informatics	MPC 71 09	6
10.	Geriatric Health	MPC 71 10	6
11	Nutritional Epidemiology	MPC 71 11	6
12	Non-Communicable Disease Epidemiology	MPC 71 12	6
13	Chronic Disease Epidemiology	MPC 71 13	6
14	Basic Epidemiology	MPC 71 14	6
15	Data Analytics in Health Sciences	MPC 71 15	6
16	Demography, RMNCH+A and Family Planning	MPC 71 16	6
17	Basic Biostatistics	MPC 71 17	6

9. Eligibility for Admission into PhD Programme in Dept of Public Health and Community Medicine

As per PhD Ordinance of the Central University of Kerala, Kasaragod

10. DAC Members

Sl.	Name of the expert	Capacity	Designation & Affiliation
1	Prof. (Dr.) KR Thankappan	Chairperson	Dean, School of Public Health and Community Medicine, CUK
2	Dr Jayalakshmi Rajeev	Member	HOD (In-charge), DPH&CM, CUK
3	Dr Elezebeth Mathews	Member	Asst Professor, DPH&CM, CUK
4.	Dr Sibasis Hense	Member	Asst. Professor, DPH&CM, CUK

Course Code & Title: MPC 71 01 & Research Methodology
Credits: 4

Course Objectives: At the end of the course module the participants will be able to identify an appropriate topic for research after a comprehensive literature review in general and for the PhD dissertation in particular, frame research questions, select an appropriate study design and methods of data collection, develop tools for data collection, collect data, enter data using Excel/SPSS/NVivo, analyse both numeric and textual data, and write a report on the research including an abstract and references as per APA style.

Couse Specific Outcomes:

On successful completion of the course the student shall be able to develop research proposal, conduct a systematic literature review, and effectively undertake the research of public health importance. The student will be able to manifest skills in quantitative and qualitative data analysis, bibliography/reference management and use of electronic tools such as Excel, SPSS, NVivo etc.

Teaching Methods: This course will be delivered using a variety of methods and modalities such as interactive classroom and online lectures, self-study, case studies, written assignment, class room exercises using computers/software, quiz, field visit, group work, field survey, class room presentations in groups etc.

Units and Topics	Teaching Methods								Mandatory Readings
Unit-I: Quantitative Research Methods									
	L	**FW**	**FV**	**CS**	**GW**	**SS**	**SP**	**P**	
Objectives of the course and the need for undertaking an independent research project for the PhD programme	**X**					**X**			
Literature review including various style of referencing, method of reviewing literature and how this has to be reproduced in the dissertation or a research paper with appropriate citation	**X**					**X**			Suresh, N., & Thankappan, K.R, (2019). Gender differences and barriers women face in relation to accessing type 2 diabetes care - A Systematic Review. *Indian Journal of Public Health*, *63*, 65–72. https://doi.org/10.4103/ijph.IJPH_26_18.
Choosing a research topic in general and specifically for the PhD dissertation Framing	**X**					**X**			Hall, N., & Kothari, R. (1999). Research Fundamentals: IV. Choosing a Research Design

research questions and objectives of the study									*Acad Emerg Med*, *6*(1), 67–74. https://doi.org/10.1111/j.1553-2712.1999.tb00097.x
Identification of variables, defining each variable and operationalizing them	**X**					**X**		**X**	Mini, G., Sarma, P., & Thankappan, K.,R. (2019). Cluster Randomised Controlled Trial of Behavioural Intervention Program: A Study Protocol for Control of Hypertension Among Teachers in Schools in Kerala (CHATS-K), India. *BMC Public Health*, *19*(1), 1718. https://doi.org/10.1186/s12889-019-8082-5
Various study designs including cross sectional, case control, cohort and randomized controlled trials	**X**					**X**			Riddell, M. A., Joshi, R., & Oldenburg, B et al (2016). Cluster Randomised Feasibility Trial to Improve the Control of Hypertension In Rural India (CHIRI): A Study Protocol . *BMJ Open*, *6*(10), e012404. https://doi.org/10.1136/bmjopen-2016-012404.
Different methods of data collection, Questionnaire method, interview schedules, and some physical measurements like weight, height, and waist circumference.	**X**					**X**		**X**	Patra, L., Mini, G. K., Mathews, E., & Thankappan, K.,R. (2015). Doctors' Self-Reported Physical Activity, Their Counselling Practices and Their Correlates in Urban Trivandrum, South India: Should a Full-Service Doctor Be a Physically Active Doctor? . *British Journal of Sports Medicine*, *49*(6), 413–416. https://doi.org/10.1136/bjsports-2012-091995
Organizational aspects of field survey, logistics of field survey organization, training of staff transportation etc.	**X**					**X**			Thankappan, K. R., Sivasankaran, S., Mini, G. K., Daivadanam, M., Sarma, P. S., & Khader, S. A. (2013). Impact of a Community Based Intervention Program on Awareness, Treatment and Control of Hypertension in a Rural Panchayat, Kerala, India. *Indian Heart Journal*, *65*(5), 504–509. https://doi.org/10.1016/j.ihj.2013.08.023
Estimating sample size for different study designs	**X**					**X**		**X**	Vishnu, N., Mini, G. K., & Thankappan, K. R. (2017). Complementary and Alternative Medicine

									Use by Diabetes Patients in Kerala, India. *Global Health Epidemiology and Genomics*, *15*(2), e6. https://doi.org/10.1017/gheg.2017.6
Sample selection procedure and sample frame	**X**					**X**		**X**	As above
Development of a questionnaire and interview schedule and the difference between the two, translation and back translation of the schedule/questionnaire	**X**					**X**		**X**	Sailesh, M., Pradeepkumar, A. S., Thresia, C. U., & Thankappan, K. R et al. (2006). Tobacco Use Among Medical Professionals in Kerala, India: The Need for Enhanced Tobacco Cessation and Control Efforts. *Addictive Behaviours*, *31*(12), 2313–2318.
Pilot testing of instrument/tool for the study	**X**					**X**			
Scales of measurement, reliability and validity and the difference between the two. Organization of data sheets, manual checking of data sheets, grouping them, storage and transportation,	**X**					**X**			Mathews, E., Salvo, D., Sarma, P., Thankappan, K., & Pratt, M. (2016). Adapting and Validating the Global Physical Activity Questionnaire (GPAQ) for Trivandrum, India, 2013. *Preventing Chronic Diseases*, *13*, E53.
Data entry using excel and SPSS, data cleaning	**X**					**X**		**X**	
Univariate, bivariate, and multivariate analysis	**X**					**X**		**X**	
Writing a research report with executive summary and a research article of scientific journal with an abstract.	**X**					**X**			Aziz, Z., Mathews, E., Absetz, P., & Sathish, T et al. (2018). A Group-Based Lifestyle Intervention for Diabetes Prevention in Low- And Middle-Income Country: Implementation Evaluation of the Kerala Diabetes Prevention Program. *Implementation Science*, *13*(1), 97.
Unit-II: Qualitative Research Methods									
Type of research approaches – Induction and deduction approaches, elements of research paradigm – Ontology, epistemology, axiology and ethics and research paradigm – Positivist, post-positivist and pragmatism.	**X**					**X**			Al-Saadi, H. (2014). Demystifying Ontology and Epistemology in research methods. *Research Gate*, *1*(1), 1-10. Noble, H., & Smith, J. (2014). Qualitative data

Qualitative design: Case-study, ethnography, participant's observation, and phenomenology Qualitative data collection techniques: In-depth interviews and focus group discussions. Qualitative data collection tools: In-depth interview and focus discussion guides Sampling techniques and sample size in Qualitative research.	**X**	**X**				**X**			analysis: a practical example. *Evidence-Based Nursing*, *17*(1), 2-3. Devers, K., & Frankel, R. (2000). Study design in qualitative research: Sampling and data collection strategies. Education for Health, 13(2), 263-271. Giddings, L. (2003). Rigour and trustworthiness in qualitative research. Qualitative Research Methods course, Auckland University of Technology, Auckland.
Mixed-method design: Sequential and concurrent designs and data triangulation.						**X**			
Type of qualitative data analysis approaches: Framework approach (thematic analysis), quasi-statistical (content analysis), Interpretative approach (phenomenological analysis and grounded theory) and Socio-linguistic approach (discourse analysis). Rigour and trustworthiness of qualitative research – Four techniques 1.) Credibility, transferability, dependability and confirmability.	**X** **X**			**X**		**X** **X**		**X**	Östlund, U., Kidd, L., Wengström, Y., & Rowa-Dewar, N. (2011). Combining qualitative and quantitative research within mixed method research designs: a methodological review. International Journal of Nursing Studies, 48(3), 369-383. Kitzinger, J. (1995). Qualitative research: introducing focus groups. BMJ, 311(7000), 299-302.
Demonstration of textual data analysis using Nvivo-7.5 including coding, generative patterns and developing sub-themes and sub-themes.	**X**					**X**		**X**	Caracelli, V. J., & Greene, J. C. (1993). Data analysis strategies for mixed-method evaluation designs. Educational evaluation and policy analysis, 15(2), 195-207. Clarke, V., Braun, V., & Hayfield, N. (2015). Thematic analysis. Qualitative psychology: A practical guide to research methods, 222-248. Saldaña, J. (2015). The coding manual for qualitative researchers. Sage Publications.

L- Lecture; FW- Field work; FV - Field Visit; CS - Case study; GW- Group work; SS- Self-study; SP- Seminar presentation; P-Practical

Evaluation:
As per CBCS guidelines, this course will be evaluated for 100 marks with a Continuous Evaluation (CA) component of 40 marks and End-Semester Evaluation (ESA) component of 60 marks.

Additional readings:

1. Bryman, A. (2016). *Social research methods*. Oxford university press.
2. Maxwell, J. A. (2008). Designing a qualitative study. The SAGE handbook of applied social research methods, 2, 214-253.
3. Rehman, A. A., & Alharthi, K. (2016). An introduction to research paradigms. International Journal of Educational Investigations, 3(8), 51-59.
4. Sandelowski, M. (1995). Qualitative analysis: What it is and how to begin. *Research in Nursing & Health*, *18*(4), 371-375.
5. Liamputtong, P. (2009). Qualitative data analysis: conceptual and practical considerations. Health Promotion Journal of Australia, 20(2), 133-139.
6. Higginbottom, G. M. A. (2004). Sampling issues in qualitative research. Nurse Researcher (through 2013), 12(1), 7.
7. Maxwell, J. A. (2010). Using numbers in qualitative research. Qualitative inquiry, 16(6), 475-482.
8. Minichiello, V., Aroni, R., & Hays, T. N. (2008). In-depth interviewing: Principles, techniques, analysis. Pearson Education Australia.

Course Code & Title: MPC 71 02 & Advanced Epidemiology
Credits: 6

Course Objectives:

Upon completion of this course the student should be able to:

• Understand the concept of causal inference in epidemiology, the different approaches that underpin this concept, and how to ask meaningful research questions for causal inference.
• Understand the concept of identification and how it is different from statistical estimation.
• Define the main types of bias (confounding, selection bias, measurement error), understand alternative approaches to dealing with them, and recognize situations in which those approaches are appropriate.
• Understand the concepts of effect modification and mediation, and implement general approaches for their analysis
• Apply classic epidemiologic study designs (cohort, case-control, cross-sectional) and their variants, knowing their particular strengths and limitations.

Course Specific Outcomes:

Upon completion of the course the research student will be able to apply the concepts and skills learnt in developing and conducting research of public health importance.

Teaching Methods:

Units and Topics	Teaching Methods	Mandatory Readings

	L	FW	FV	CS	GW	SS	SP	P	
Introduction to Epidemiological Inference	**X**					**X**			Morabia A. Has epidemiology become infatuated with methods? A historical perspective on the place of methods during the classical (1945-1965) phase of epidemiology. Annu Rev Public Health 2015; 36: 69-88
Measures of Disease Frequency	**X**					**X**			
Measures of Disease Association	**X**					**X**			Greenland, Sander. "Interpretation and choice of effect measures in epidemiologic analyses." American Journal of Epidemiology 125.5 (1987): 761-768. Poole, Charles. "On the origin of risk relativism." Epidemiology 21.1 (2010): 3-9.
Counterfactuals and Identifiability Assumptions									
A Definition of Causal Effect	**X**					**X**			Hernan MA, Taubman SL. Does obesity shorten life? The importance of well-defined interventions to answer causal questions. International Journal of Obesity 2008; 32: S8-S14 Messer LC, Oakes JM, Mason S. Effects of socioeconomic and racial segregation on preterm birth: a cautionary tale of structural confounding. American Journal of Epidemiology 2010; 171: 664-673. * Greenland S, Robins JM. Identifiability, exchangeability, and epidemiological confounding. Int J Epidemiol 1986;15:413-9. * Maldonado G, Greenland S. Estimating causal effects. Int J Epidemiol. 2002 Apr 1;31(2):422-9. 3 * Commentaries on Maldonado and Greenland by
Randomized Experiments	**X**					**X**		**X**	
Observational Studies	**X**					**X**			

									Dawid, Shafer, Elwert and Winship, and Kaufman and Kaufman
Confounding									
Confounding	**X**					**X**		**X**	Greenland S, Morgenstern H. Confounding in health research. Annu Rev Public Health 2001;22:189-212
Effect of Confounding Validity in Epidemiologic Studies	**X**					**X**		**X**	Hernán MA, Hernández-Díaz S, Werler MM, Mitchell AA. Causal knowledge as a prerequisite for confounding evaluation: an application to birth defects epidemiology. Am J Epidemiol 2002;155:176-84.
	X					**X**			Hernán MA, Clayton D, Keiding N. The Simpson's paradox unraveled. Int J Epidemiol 2011;40:780-5
Directed Acyclic Graphs									
Graphical representation of causal effects	**X**					**X**		**X**	Robins JM. Data, Design, and Background Knowledge in Etiologic Inference. Epidemiology 2001;12:313-320.
Causal diagrams	**X**					**X**		**X**	VanderWeele TJ, Hernán MA, Robins JM. Causal directed acyclic graphs and the direction of unmeasured confounding bias. Epidemiology 2008;19:720-8.
	X					**X**			
Selection Bias									
Selection Bias	**X**					**X**			Cole SR, Platt RW, Schisterman EF, Chu H, Westreich D, Richardson D, Poole C. Illustrating bias due to conditioning on a collider. Int J Epidemiol 2010;39:417-20 Hernandez-Diaz S, Schisterman E, Hernan MA. The birth weight "paradox" uncovered? American Journal of Epidemiology 2006; 164(11): 1115-1120.
	X	**X**				**X**			
						X			
	X			**X**		**X**		**X**	

	X					**X**			Flanders WD, Klein M. Properties of 2 counterfactual effect definitions of a point exposure. Epidemiology. 2007 Jul 1;18(4):453-60.
	X					**X**		**X**	
Measurement Bias									Dosemeci M, Wacholder S, Lubin JH. Does nondifferential misclassification of exposure always bias a true effect toward the null value? Am J Epidemiol 1990;132:746-8.
									Vanderweele T, Hernán MA. Results on differential and dependent measurement error of the exposure and the outcome using signed directed acyclic graphs. Am J Epidemiol 2012;175:1303-10
									Flegal KM, Keyl PM, Nieto FJ. Differential misclassification arising from nondifferential errors in exposure measurement. Am J Epidemiol 1991;134:1233-44.
Effect Modification	**X**	**X**				**X**			Bhavnani D, Goldstick JE, Cevallos W, Trueba G, Eisenberg JNS. Synergistic effects between rotavirus and coinfecting pathogens on diarrheal disease: Evidence from a community-based study in northwestern Ecuador. American Journal of Epidemiology 2012; 176(5): 387-395. Vanderweele TJ. Invited commentary: Assessing mechanistic interaction between coinfecting pathogens for diarrheal disease. American Journal of Epidemiology 2012; 176(5): 396-399.
Estimation and Hypothesis Testing	**X**	**X**				**X**			Poole C. Low P-values or narrow confidence intervals: which are more durable? Epidemiology

									2001;12:291-4 Rothman KJ. Curbing type I and type II errors. Eur J Epidemiol 2010;25:223-4
Randomized Trials	**X**	**X**				**X**			DeMets DL. Statistical issues in interpreting clinical trials. J Intern Med 2004;255:529-37 Mansournia MA, Higgins JP, Sterne JA, Hernán MA. Biases in randomized trials: a conversation between trialists and epidemiologists. Epidemiology. 2017 Jan 1;28(1):54-9. Kaufman JS, Kaufman S, Poole C. Causal inference from randomized trials in social epidemiology. Soc Sci Med 2003;57:2397-409.
Cohort Studies									Bao Y, Bertoia ML, Lenart EB, Stampfer MJ, Willett WC, Speizer FE, Chavarro JE. Origin, methods, and evolution of the three Nurses' Health Studies. American journal of public health. 2016 Sep;106(9):1573-81. Kolata G. Hormone studies: What went wrong? New York Times. April 22, 2003 Hernan MA, Alonso A, Logan R, Grodstein F, Michels KB, Willett W, Mason JE, Robins JM. Observational Studies Analyzed Like Randomized Experiments: An Application to Postmenopausal Hormone Therapy and Coronary Heart Disease. Epidemiology 2008; 19(6): 766-779. Ioannidis JP, Haidich AB, Pappa M, Pantazis N,

									Kokori SI, Tektonidou MG, ContopoulosIoannidis DG, Lau J. Comparison of evidence of treatment effects in randomized and nonrandomized studies. JAMA 2001; 286(7): 821-30.
Case-Control Studies									Langholz, Bryan. "Case-control studies= odds ratios: blame the retrospective model." Epidemiology 21.1 (2010): 10-12. Knol MJ, Vandenbroucke JP, Scott P, Egger M. What do case-control studies estimate? Survey of methods and assumptions in case-control research. Am J Epidemiol 2008;168:1073-81. Vandenbroucke JP, Pearce N. Case-control studies: basic concepts. Int J Epidemiol 2012;41:1480-9.
Mediation									Cole SR, Hernán MA. Fallibility in estimating direct effects. Int J Epidemiol 2002;31:163-5. Robins JM, Greenland S. Identifiability and exchangeability for direct and indirect effects. Epidemiology 1992;3:143-55. VanderWeele, Tyler J., and Whitney R. Robinson. "On causal interpretation of race in regressions adjusting for confounding and mediating variables." Epidemiology (Cambridge, Mass.) 25.4 (2014): 473.

L- Lecture; FW- Field work; FV - Field Visit; CS - Case study; GW- Group work; SS- Self-study; SP- Seminar presentation; P-Practical

Evaluation:

As per CBCS guidelines, this course will be evaluated for 100 marks with a Continuous Evaluation (CA) component of 40 marks and End-Semester Evaluation (ESA) component of 60 marks.

Additional readings:

Rothman, Kenneth J., Sander Greenland, and Timothy L. Lash. 2012. Modern Epidemiology, 3rd edition (mid-cycle revision). New York: Lippincott Williams & Wilkins. [Note: this 2012 mid-cycle revision is mostly the same as the 3rd edition from 2008]

Hernán MA, Robins JM. Causal Inference. Chapman & Hall/CRC, 2015. Available online at: http://www.hsph.harvard.edu/miguel hernan/causal-inference-book

Course Code & Title: MPC 71 03 & Advanced Biostatistics
Credits: 6

Brief description: The Course Advanced Biostatistics offered at Department of Public Health and Community Medicine, Central University of Kerala aims to equip the participants with advanced skills in quantitative data analysis.

Course Objectives:

1) To impart the essential quantitative data analysis skills to the research students
2) To enable students, understand the application of advanced data analysis methods in analysing quantitative data
3) To provide hands on training to the students in analysing health data by application of advanced statistical methods.

Course Specific Outcomes:

Upon completion of the course the research student will be able to apply the concepts and skills learnt in developing and conducting research of public health importance.

Modules	Section	Topic	Contents
1(Non-Parametric Tests)	**Non-Parametric Tests (one sample)**	Kolmogrov-Smirnov Test Sign Test Wilcoxon signed rank test	- Assumptions of the Tests - Outlining Null/alternate hypothesis - Performing the tests/computing test statistic - Hypothesis testing and interpretation
	Non-Parametric Tests (Two Sample)	Sign test for two samples Median Test Wilcoxon Signed Rank Test (two samples)	- Assumptions of the Tests - Outlining Null/alternate hypothesis - Performing the tests/computing test statistic

		Wilcoxon-Mann-Whitney U-test	- Hypothesis testing and interpretation
	Non-Parametric Tests (K-Sample)	Median test for K-samples Kruskal-Wallis K sample test Friedman's Test for RBD	- Assumptions of the Tests - Outlining Null/alternate hypothesis - Performing the tests/computing test statistic - Hypothesis testing and interpretation
2 (Regression Analysis)	**Linear Regression**	Simple linear regression Multiple linear regression	- Mathematical basis for linear regression - Assumptions and requirements of linear regression - Regression line and regression equation - Computing Regression coefficients (β_0 and β_1) - Conducting linear regression using SPSS - Interpretation of regression coefficients - Interpretation of SPSS output for linear regression (interpretation of r^2, standard errors, calculation of confidence intervals for beta coefficients)
	Logistic Regression	Binary logistic regression	- Mathematical basis for binary logistic regression (probability, odds, odds ratio, natural log, anti-log) - Sigmoid curve and its prominence in predicting a binary dependent variable. - Assumptions of Binary logistic regression - Performing Binary logistic regression using SPSS - Interpretation of the results of Binary Logistic regression (interpretation of ODDs, Calculation of probability of outcome variable etc.)

		Multi nominal logistic regression	- Mathematical basis for Multi nominal logistic regression - Assumptions of logistic regression - Performing multi nominal logistic regression using SPSS - Interpretation of the results of Multi nominal logistic regression
3(Statistical Procedures in quantitative Tool Development)	**Test(s) for internal reliability**	**Cronbach's Alpha**	- Introduction to Cronbach's alpha - Statistical basis for cronbach's alpha (including assumptions and sample size required) - Manual computation of Cronbach's alpha - Computing Cronbach's alpha using SPSS - Interpretation of Cronbach's alpha.
	Factor Analysis	**Exploratory factor analysis** **Confirmatory factor analysis**	- Introduction to factor analysis (basic uses and methods - Basic Assumptions and Procedural Guidelines - Procedure for conducting Factor Analysis - Interpretation and reporting the results of factor analysis

Books:

1) Daniel and Cross. (2013). *Biostatistics a Foundation for Analysis in Health Sciences.* 10th Edition. WILEY publications.
2) Manju Pandey. (2015). *Biostatistics: basics and advanced*. MV Learning. ISBN: 978-81-309-2753-4
3) Good, P., & Hardin, J. (2003). Common errors in statistics (and how to avoid them). John Wiely & Sons.

Weblinks:

1) https://people.exeter.ac.uk/SEGLea/multvar2/pathanal.html

2) http://www.statsoft.com/Textbook

3) https://www.researchgate.net/profile/Keith_Widaman/publication/232585482_Factor_Analysis_in_the_Development_and_Refinement_of_Clinical_Assessment_Instruments/links/00463521bc1179a08c000000/Factor-Analysis-in-the-Development-and-Refinement-of-Clinical-Assessment-Instruments.pdf

4) https://stats.idre.ucla.edu/spss/faq/what-does-cronbachs-alpha-mean/

Course Code & Title: MPC 71 04 & Project Management
Credits: 6

Course Objectives: The objective of this course is to develop competencies and skills for planning, designing, controlling and managing health projects within a dynamic healthcare ecosystem. Specifically, this course will enable students to:-

i. Understand the growing need for project and program management in a healthcare ecosystem.
ii. Define project, its characteristics, quote examples of healthcare projects, and describe project constraints.
iii. Discuss the relationship between project and program management and their contribution to health system strengthening process.
iv. Describe project management cycle and discuss key elements of project management framework, including project stakeholders, the project management knowledge areas, common tools and techniques, and project success factors.
v. Develop a project proposal addressing a public health issue.
vi. Obtain hands on experience with logical framework.

Course Specific Outcomes:

Upon completion of the course the research student will be able to apply the concepts and skills learnt in developing and conducting research of public health importance.

Teaching Methods: The delivery of this course will take place using a variety of methods and modalities. Lectures, hands on training for developing logical framework, power point presentations, group work, case study analysis, written assignment and quiz will be conducted to deliver this course.

Topic	Classroom/Field/Take Home Assignments	Suggested Reading Materials
Unit-I: Basics of Project Management: Definition and meaning of project, examples of projects in healthcare, classification of projects, characteristics/attributes of projects, differences between project and program, skills set for program and project managers, project constraints and logical	Lecture and self-study	1. Schwalbe, K., & Furlong, D. (2013). *Healthcare project management*. (Chapter-1) 2. Roy, SM (2002). *Project Planning and Management. CHAI Publication, Hyderabad (India)* – (Chapter -1) 3. Aune, J. B. (2000). Logical framework approach. *Development Methods and Approaches*, *214*.

framework approach.		
Unit-II: Project management cycle: Methodologies to project management, overview of steps in project management cycle (identification, design, appraisal, implementation, monitoring and evaluation).	Lecture and Group work	1. Project Management Methods, Methodologies, and Frameworks — A Guide for Beginners by Alexandra Cote. 2. Roy, SM (2002). *Project Planning and Management. CHAI Publication, Hyderabad (India)* – (Chapter -1)
Unit-III: Project identification and Design: **Project identification:** Concept of project identification, approaches to project identification (top down and bottom-up approaches), and situation analysis for project identification. ii. Stakeholder analysis (stakeholder's important and influence matrix), ii. Problem analysis (Problem tree) iii. Resources analysis iv. Context analysis **Project design:** Concept of project design, developing project goals and objectives, activity planning, budgeting and project sustainability.	Lecture and Group work	1. Project Cycle Handbook (2012), Terre des Hommes – Child relief. 2. Roy, SM (2002). *Project Planning and Management. CHAI Publication, Hyderabad (India)* – (Chapter -2 & 3) 3. Galer, J. B., Vriesendorp, S., & Ellis, A. (2005). Managers who lead: a handbook for improving health services.
Unit-IV: Project Appraisal: Appraisal techniques – Technical, socio-cultural, environmental, management and financial.	Lecture and Group work	1. Roy, SM (2002). *Project Planning and Management. CHAI Publication, Hyderabad (India)* – (Chapter -4)

Unit-V: Implementation Plan: Activity plan and GANTT chart, advantages and disadvantages of GANTT chart, Network analysis- PERT, CPM techniques.	Lecture and Group work	1. Roy, SM (2002). *Project Planning and Management. CHAI Publication, Hyderabad (India)* – (Chapter -5) 2. Agarwal, S., Basannar, D. R., Bhalwar, R., Bhatnagar, A., Bhatti, V. K., & Chatterjee, K. (2009). Textbook of Public Health and Community Medicine. Pune: AFMC in collaboration with WHO, India, 1205. (Chapter -3
Unit-VI: Monitoring and Evaluation: Concepts of monitoring and evaluation in public health, needs for monitoring and evaluation in public health, steps in monitoring, levels of monitoring –input, process, output and outcome, types of evaluation : concurrent, terminal, longitudinal.	Lecture and Case study analysis on project monitoring and evaluation	1. Roy, SM (2002). *Project Planning and Management. CHAI Publication, Hyderabad (India)* – (Chapter -6 & 7) 2. Crawford, P., & Bryce, P. (2003). Project monitoring and evaluation: a method for enhancing the efficiency and effectiveness of aid project implementation. *International journal of project management*, *21*(5), 363-373.
Evaluation and Feedback i. Written Examination of short/long answers type questions/Case study analysis – 20 Marks ii. Development of a complete research proposal/concept note – 20 Marks		

Additional Reading Resources

1. A Guide to the Project Management Body of Knowledge (PMBOK Guide 3rd Edition) by The Project Management Institute
2. Kerzner, H. (2013). Project management: a systems approach to planning, scheduling, and controlling. John Wiley & Sons.
3. Frame, J. D. (1999). Project management competence: Building key skills for individuals, teams, and organizations (p. 232). San Francisco, CA: Jossey-Bass.
4. Chatfield, C. S., & Johnson, T. (2013). Microsoft Project 2013 Step by Step. Pearson Education.
5. Bagherpour, M., & Erjaee, A. (2017). The Role of Project Management Office in Public Health: A New Approach for Establishment in Iran. *Iranian Journal of Public Health*, *46*(3), 433.

6. McKenzie, J. F., Neiger, B. L., & Thackeray, R. (2016). *Planning, implementing & evaluating health promotion programs: A primer*. Pearson.
7. Ramazani, J., & Jergeas, G. (2015). Project managers and the journey from good to great: The benefits of investment in project management training and education. *International Journal of Project Management*, *33*(1), 41-52.
8. Sa Couto, J. (2008). Project management can help to reduce costs and improve quality in health care services. Journal of Evaluation in Clinical Practice, 14(1), 48-52.

Course Code & Title: MPC 71 05 & Introduction to Health Systems and Policy
Credits: 6

Course objective: The objective of this course is to provide PhD students with basic understanding of a health system with respect to its evolution, levels, functions, types and building blocks. The objective is also to sensitize the students with the nitty gritty of health policy making, analyses and its implications in health services delivery and health outcome. Upon completion of the course, students will be able to:

1. Learn the WHO health system framework and its important building blocks.
2. Analyze important components of the Indian public and private healthcare systems and compare it with other emerging economies.
3. Understand the theories and concepts related to public policy.
4. Understand the political context of making policies and the role of government as policy maker
5. Compare the global and national health policies in the context of changing global health policy environment
6. Understand health policy making, analysis and actors involved in the process.
7. Identify the gaps and opportunities in health policies and systems in India.

Course Specific Outcomes:

Upon completion of the course the research student will be able to apply the concepts and skills learnt in developing and conducting research of public health importance.

Teaching Methods: This course will be delivered using a variety of methods and modalities such as classroom and online lectures, self-study, seminars, field visit, group work.

Units and Topics	Teaching Methods								Mandatory Readings
	L	FW	FV	CS	GW	SS	SP	P	
Unit-I: Introduction to Health Systems									
1.1 Definitions, evolution, functions and types of health systems. 1.2 Health systems of developing and	X					X			Gilson L (2012). Health policy and systems research: a methodology reader.

developed countries (Including Indian Health System)									WHO (2010). Monitoring the building blocks of health system: a handbook of indicators and their measurement strategies. World Health Organization. (2007). Everybody's business--strengthening health systems to improve health outcomes: WHO's framework for action.
1.3 WHO building blocks of health systems and their linkages: (i) service delivery, (ii) health workforce, (iii) health information systems, (iv) access to essential medicines, (v) financing, and (vi) leadership/governance	**X**					**X**			
1.4 Micro (Individual interactions), meso (organizational structure and community) and macro (Policy) framework of a health systems.	**X**					**X**			
Unit-II: Global Health Initiatives and Health Programmes in India									
2.1 Alma Ata Declaration, MDGs, and SDGs 2.2 Universal Health Coverage (UHC) 2.3 National Health Programmes, NHM, NUHM and ICDS. 2.4 Role of NITI Ayog, and five-year plans.	**X**					**X**			
Unit-III: Introduction to Health Policy									
3.1 Introduction to core concepts and definitions - public and private policies, policy makers and actors, policy instruments, policy transfer, power in policy 3.2 Health Policy: Definition and importance, Evidence-based policy making, Role of government as policy maker and the	**X**					**X**			Buse, K., Mays, N., Walt, G. (2005). Making Health Policy: Understanding Public Health. Open University Press. Wildavsky, A. (1979). Doing better and feeling worse: the political pathology of health policy. In the *Art and Craft of Policy Analysis* (pp. 284-308). Palgrave Macmillan, London.

political context of making health policies									
Unit-IV: Health policy making and analysis									
4.1 Policy making process: Theories – multiple-streams theory, punctuated equilibrium theory 4.2 Policy making cycle: Agenda setting, formulation of policy, adoption, implementation and evaluation. 4.3 Decision making - Linear/rational model, incrementalist model and mixed scanning model 4.4. Dichotomy between policy making and implementation: Bottom-up and top-down implementation, Street level bureaucracy 4.5 Health Policy analysis - Policy triangle framework (Walt and Gilson 1994), cost-benefit and cost-effective analysis	**X**		**X**	**X**	**X**	**X**			Buse, K., Mays, N., Walt, G. (2005). Making Health Policy: Understanding Public Health. Open University Press. Walt, G., & Gilson, L. (1994). Reforming the health sector in developing countries: the central role of policy analysis. *Health policy and planning*, *9*(4), 353-370. Walt, G., Shiffman, J., Schneider, H., Murray, S. F., Brugha, R., & Gilson, L. (2008). 'Doing'health policy analysis: methodological and conceptual reflections and challenges. *Health policy and planning*, *23*(5), 308-317.
Unit-V: Global and National Health Policies, Changing Global Health Policy Environment and Emerging Concepts									
5.1 Global Health Policies: Role of World health organization in setting norms and standards, e.g. International Health Regulations, Framework Convention on Tobacco Control (FCTC) 5.2 National health policies: Overview of health policies from developing and developed countries. 5.3 Health policies of India – National and state health policies 5.4 Global health governance to global governance for health: Role of agencies such as World Trade Organization, International	**X**		**X**		**X**	**X**			Lee, K., Kamradt-Scott, A. (2014). The multiple meanings of global health governance: a call for conceptual clarity. *Globalization and Health*, 10:28. https://www.who.int/ Adams, V., Novotny, T. E., & Leslie, H. (2008). Global health diplomacy. *Medical anthropology*, *27*(4), 315-323. WHO. (2014). Health in All Policies (HiAP) framework for country action; 2014. Gilson L. Health policy and systems research: a methodology reader. WHO; 2012. ISBN 978 92 4 150313 6.

Monitory Fund, World Bank, Donors and philanthropic organizations 5.5 Global health security and diplomacy 5.6 Health in All Policies 5.7 Health and activism 5.8 Health Policy and Systems Research									Loewenson R (2013). Activism for health. *The Lancet*, 381(9884):2157.

L- Lecture; FW- Field work; FV - Field Visit; CS - Case study; GW- Group work; SS- Self-study; SP- Seminar presentation; P-Practical

Evaluation - As per CBCS guidelines, this course will be evaluated for 100 marks with a Continuous Evaluation (CA) component of 40 marks and End-Semester Evaluation (ESA) component of 60 marks.

Additional readings:

1. Ramani, K. V., & Mavalankar, D. (2006). Health system in India: opportunities and challenges for improvements. Journal of health organization and management.
2. De, P., Dhar, A., & Bhattacharya, B. N. (2012). Efficiency of health care system in India: an inter-state analysis using DEA approach. Social Work in Public Health, 27(5), 482-506.
3. Krupp, K., & Madhivanan, P. (2009). Leveraging human capital to reduce maternal mortality in India: enhanced public health system or public-private partnership? Human Resources for Health, 7(1), 1-8.
4. Lakshminarayanan, S. (2011). Role of government in public health: Current scenario in India and future scope. Journal of Family and Community Medicine, 18(1), 26.

Course Code & Title: MPC 71 06 & Principles of Health Management & Health Programme Design, Implementation and Evaluation
Credits: 6

Course Objectives: The objectives of this course are to develop competencies and skills perform important management functions (such as planning, organizing, staffing, coordinating, organizing and directing) necessary to run a health organization engaged in public health. Its objective is also to acquire understanding of conceptualizing, designing, implementing, controlling and managing health programmes and projects in a dynamic healthcare ecosystem. Specifically, this course will enable students to:

vii. Demonstrate understanding of basic management concepts, theories, tools, and techniques of modern management practices.
viii. Understand the principles of management and its functions in context to healthcare and public health organizations.
ix. Acquire and practice leadership and managerial skills that will positively affect performance as a health manager.
x. Discuss the relationship between project and programme management and their contribution to health system strengthening process.
xi. Describe programme management cycle and discuss its important stages such as health programme conceptualization, design, implementation, monitoring and its evaluation with respect to different national health programmes in India.

Course Specific Outcomes:

Upon completion of the course the research student will be able to apply the concepts and skills learnt in developing and conducting research of public health importance.

Teaching Methods: The delivery of this course will take place using a variety of methods and modalities. Classroom lectures using power point presentations, demonstration using YouTube videos, role plays, self-study, case studies analysis, Group work, seminar presentation, etc., be utilized to deliver this course.

Units and Topics	Teaching Methods	Mandatory Readings
Unit-I: Introduction to Management and Management Principles		

	L	FW	FV	CS	GW	SS	SP	P	
- Meaning, theories, definition, levels and importance of management with a special focus on healthcare.	X					X			Bhalwar, R., & Vaidya, R. (Eds.). (2009). *Text book of public health and community medicine*. Department of Community Medicine Armed Forces Medical College. (Chapter-3: Health Policy and Healthcare System; Management Process in Healthcare).
- Some key terms used in management (aim, objectives, targets, indicators, mission and vision statements and Management by Objectives.	X					X			
- 14-Principles of Management by Henri Fayol and its application to healthcare organizations.	X					X			
- Role of a health manager and skills set of today's healthcare manage.	X					X			
Unit-II: Management functions - POSDCORB									
- Planning as a management function and types of planning in general and planning in the healthcare system - The planning process in general and planning in Indian healthcare system. - Planning process in the Indian health sector - Steps in planning a health programmes	X				X	X			Bhalwar, R., & Vaidya, R. (Eds.). (2009). *Text book of public health and community medicine*. Department of Community Medicine Armed Forces Medical College. (Chapter-3: Health Policy and Healthcare System; Management Process in Healthcare). Palmiere, D. (1972). Types of planning in the health care system. *American Journal of Public Health*, *62*(8), 1112-1115.
- Organizing health programmes in India	X				X	X			
- Staffing of human resources for health in India	X				X	X			
- Directing, coordination, reporting and budgeting	X				X	X			
Unit-III: Organizational Behaviour in Healthcare Settings									
Concept of organization, types of organization and organization structure, organization culture and climate.	X					X			Rovithis, M., Linardakis, M., Rikos, N., Merkouris, A., Patiraki, E., & Philalithis, A. (2016). Organizational culture among nurses working in the public health sector on the island of Crete-Greece. *Health Science Journal*. Warrick, D. D. (1981). Leadership styles and their consequences. Journal of Experiential Learning and
Leadership and leadership styles: Managerial grid model, Production and perish style, Improvised style, Country club style, Team style, and Middle of the road.	X			X		X		X	

Motivation and theories of motivation: Maslow's need hierarchy theory, Herzberg's two-factor theory Douglas Mc Gregor's Theory X and Y Team and team dynamics	**X**			**X**	**X**	**X**			Simulation, 3(4), 155-172. Warrick, D. D. (1981). Leadership styles and their consequences. Journal of Experiential Learning and Simulation, 3(4), 155-172. Leggat, S. G. (2007). Effective healthcare teams require effective team members: defining teamwork competencies. BMC health services research, 7(1).
Unit-IV: Health Programme and Project Management: Identification, Design, Implementation, Monitoring & Evaluation									
Concept of programme, project, programme life cycle in healthcare settings.	**X**					**X**			Roy, SM (2002). *Project Planning and Management. CHAI Publication, Hyderabad (India)* – (Chapter -6 & 7) Crawford, P., & Bryce, P. (2003). Project monitoring and evaluation: a method for enhancing the efficiency and effectiveness of aid project implementation. *International Journal of project Management*, *21*(5), 363-373. Chang, H. (2015). Evaluation framework for telemedicine using the logical framework approach and a fishbone diagram. Healthcare informatics research, 21(4), 230-238. Reynolds, H. W., & Sutherland, E. G. (2013). A systematic approach to the planning, implementation, monitoring, and evaluation of integrated health services. BMC health services research, 13(1), 168.
Project identification: Concept of project identification, approaches to project identification (top down and bottom-up approaches), and situation analysis for project identification,	**X**					**X**			
Project design: Concept of project design, logical framework, developing project goals and objectives, activity planning, budgeting and project sustainability.	**X**				**X**	**X**			
Project appraisal: Appraisal techniques – Technical, socio-cultural, environmental, management and financial.	**X**					**X**			
Implementation: Activity plan and GANTT chart, advantages and disadvantages of GANTT chart, Network analysis- PERT, CPM techniques.	**X**					**X**			
Monitoring and Evaluation: Concepts of monitoring and evaluation, needs for monitoring and evaluation, steps in monitoring, levels of monitoring –input, process, output and outcome, types of evaluation: concurrent, terminal, longitudinal.	**X**					**X**	**X**		

Unit-V: Management of National Health Programme in India									
• Reproductive, Maternal, Neonatal, Child & Adolescent Health Programme • National Nutritional Programmes • Communicable diseases related programmes • Non-communicable diseases related programmes • Health system strengthening programmes	**X**					**X**			https://www.nhp.gov.in/healthprogramme/national-health-programmes Maurya, D., & Ramesh, M. (2019). Program design, implementation and performance: the case of social health insurance in India. Health Economics, Policy and Law, 14(4), 487-508. Thomas, A., Kumar, V., Bhandari, M., Ahuja, R. C., Singh, P., Baqui, A. H., ... & for the Saksham Study Group. (2009). Neonatal health program management in a resource-constrained setting in rural Uttar Pradesh, India. The International journal of health planning and management, 24(2), 173-184. https://www.who.int/management/programme/en/

L- Lecture; FW- Field work; FV - Field Visit; CS - Case study; GW- Group work; SS- Self-study; SP- Seminar presentation; P-Practical (Role Play)

Evaluation

As per CBCS guidelines, this course will be evaluated for 100 marks with a Continuous Evaluation (CA) component of 40 marks and End-Semester Evaluation (ESA) component of 60 marks.

Additional readings

1. Powell-Jackson, T., Purohit, B., Saxena, D., Golechha, M., Fabbri, C., Ganguly, P. S., & Hanson, K. (2018). Measuring management practices in India's district public health bureaucracy. Social Science & Medicine.
2. Galer, J. B., Vriesendorp, S., & Ellis, A. (2005). Managers who lead: A Handbook for Improving Health Services.
3. A paper in open source by Ravi Duggal on Health Planning in India. Can be downloaded from: http://www.cehat.org/cehat/uploads/files/a168.pdf

4. Health Policy and Planning in India by Prof. P.K Shajahan. Can be downloaded from http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000032SW/P001728/M021621/ET/1501583220modulenumber-1-text.pdf
5. Willis-Shattuck, M., Bidwell, P., Thomas, S., Wyness, L., Blaauw, D., & Ditlopo, P. (2008). Motivation and retention of health workers in developing countries: a systematic review. *BMC health services research*, *8*(1), 247Yphantides, N., Escoboza, S., & Macchione, N. (2015). Leadership in public health: new competencies for the future. *Frontiers in public health*, *3*.
6. Robbins, S. P., & Judge, T. A. Essentials of Organizational Behavior (2008). *New Jersey: Prentice Hall. ISBN*, *10*, 0136124011
7. Sinha, P., & Sigamani, P. (2016). Key challenges of human resources for health in India. *Global Journal of Medicine and Public Health*, *5*(4).
8. LaFond, A., & Brown, L. (2003). A guide to monitoring and evaluation of capacity building interventions in the health sector in developing countries.

Course Code & Title: MPC 71 07: Mixed-Methods in Health Sciences
Credit: 6

Course Objectives: This course will provide an overview of mixed-methods research mainly in the domain of public health. It will introduce students to the epistemological/philosophical underpinnings of mixed-methods approach, and examine the ways in which quantitative and qualitative research designs interact in the context of addressing a research question. In addition, students will be able to understand the strengths and weaknesses of using mixed methods in order to address research problems and answers research questions.

Course Specific Outcomes:

Upon completion of the course the research student will be able to apply the concepts and skills learnt in developing and conducting research of public health importance.

Teaching Methods: This course will have an applied focus and delivered using a variety of methods and modalities. Such as interactive classroom and online lectures, self-study, case studies, written assignment, class room exercises using computers/software, quiz, field visit, group work, field survey, class room presentations in groups etc.

Units and Topics	Teaching Methods								Mandatory Readings
Unit-I: Introduction to mixed-methods research	**L**	**FW**	**FV**	**CS**	**GW**	**SS**	**SP**	**P**	
i. Definition and important features of mixed-methods designs and when to use a mixed them in public health; ii. Advantages and disadvantages of mixed method designs; iii. Historical development of mixed method designs; iv. Philosophical underpinnings of mixed method research and pragmatism; v. Steps in designing mixed methods study; vi. Skills needed to conduct mixed methods	**x**				**x**	**x**			Creswell JW, Klassen AC, Plano Clark VL, Smith KC. Best Practices for Mixed Methods Research in the Health Sciences. Office of Behavioral and Social Sciences Research (OBSSR) National Institutes of Health. 2011. Creswell JW. A concise introduction to mixed methods research. SAGE publications; 2014 Mar 31. (Chapter-1: Basic Features of Mixed Methods Research)

study.									Creswell JW. A concise introduction to mixed methods research. SAGE publications; 2014 Mar 31. (Chapter-2: The Development and Advancement of Mixed Methods).
Unit-II: Mixed-methods Designs	**L**	**FW**	**FV**	**CS**	**GW**	**SS**	**SP**	**P**	
Selecting the appropriate mixed method design in health research; i. Basic design: Convergent parallel designs; explanatory and exploratory sequential designs; and Convergent parallel mixed methods ii. Advanced designs: Embedded mixed method designs; transformative designs; and multi-phase designs.	**X**			**X**		**X**		**X**	Tariq S, Woodman J. Using mixed methods in health research. JRSM short reports. 2013 May 7;4(6):2042533313479197. Creswell JW. A concise introduction to mixed methods research. SAGE publications; 2014 Mar 31. Chapter 5. Basic and Advanced Mixed Methods Designs. Creswell, John W. 2008. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. Sage Publications, Inc.; 3rd edition. ISBN-10: 1412965578 Creswell JW. A concise introduction to mixed methods research. SAGE publications; 2014 Mar 31. Chapter 5. Basic and Advanced Mixed Methods Designs.
Unit-III: Integrating Quantitative and Qualitative Designs									
	L	**FW**	**FV**	**CS**	**GW**	**SS**	**SP**	**P**	
i. Sampling and data collection in mixed method research; ii. Strategies of integration in mixed-methods research;	**X**			**X**	**X**	**X**		**X**	Teddlie, Charles, and Fen Yu. "Mixed methods sampling: A typology with examples." Journal of mixed methods research 1.1 (2007): 77-100.

iii. Analyzing and interpreting data in mixed method research; iv. Quality in mixed-methods: Reliability and validity in mixed-methods research;									Onwuegbuzie JA, Johnson RB. The Validity Issue in Mixed Research. Research in the Schools. Spring 2006;13(1):48-63. Caracelli, V. J., & Greene, J. C. (1993). Data analysis strategies for mixed-method evaluation designs. Educational Evaluation and Policy Analysis, 15(2), 195- 207. Leahey, E. (2007). Convergence and confidentiality? Limits to the implementation of mixed methodology. Social Science Research, 36(1), 149-158.
Unit-III: Writing a mixed-method study for publications	**L**	**FW**	**FV**	**CS**	**GW**	**SS**	**SP**	**P**	
i. Guidelines for writing research reports in mixed method designs in public health. ii. Important consideration of writing a proposal employing mixed-methods design in public health. iii. Important journals in mixed-methods publishing studies of public health importance. iv. Mixed-methods research in scientific papers (Notable papers employing mixed-methods designs in public health)	**X**					**X**			Leech NL, Onwuegbuzie AJ, Combs JP. Writing publishable mixed research articles: Guidelines for emerging scholars in the health sciences and beyond. International Journal of Multiple Research Approaches. 2011 Apr 1;5(1):7-24. Creswell JW, Tashakkori A. Developing publishable mixed methods manuscripts. Park, E., et al. "A qualitative study of lung cancer risk perceptions and smoking beliefs among national lung screening trial participants." Brault, M., et al. "Multilevel Perspectives on Female Sterilization in Low-Income Communities in Mumbai, India."

L- Lecture; FW- Field work; FV - Field Visit; CS - Case study; GW- Group work; SS- Self-study; SP- Seminar presentation; P-Practical

Evaluation

As per CBCS guidelines, this course will be evaluated for 100 marks with a Continuous Evaluation (CA) component of 40 marks and End-Semester Evaluation (ESA) component of 60 marks.

Additional Readings

1. Bryman, A. (2016). *Social research methods*. Oxford university press.
2. Teddlie C, Yu F. Mixed Methods Sampling A Typology with Examples. J Mix Method Res. Jan 2007;1(1):77-100. DOI: 10.1177/2345678906292430
3. Moffatt S, White M, Mackintosh J, Howel D. Using quantitative and qualitative data in health services research - what happens when mixed method findings conflict? [ISRCTN61522618]. BMC Health Services Research. Mar 8 2006;6. PMID: 16524479
4. Bazeley P. Editorial: Integrating Data Analyses in Mixed Methods Research Journal of Mixed Methods Research 2009; 3; 203 DOI: 10.1177/1558689809334443.
5. Onwuegbuzie AJ, Collins KM. The Role of Sampling in Mixed Methods-Research. KZfSS Kölner Zeitschrift für Soziologie und Sozialpsychologie. 2017 Oct 1;69(2):133-56.
6. Newman I, Newman D, Newman C. Writing research articles using mixed methods: Methodological considerations to help you get published. The handbook of scholarly writing and publishing. 2011:191-208.

Course Code & Title: MPC 71 08 & Health Economics
Credits: 6

Course Objectives:

- To provide Public Health research scholars with an advanced understanding of Health economics and Health Care financing.
- To orient the research scholars to various health financing mechanisms and enable them appreciate the characteristics of each of them.
- To sensitize the students on health insurance and its role in influencing the demand and access to health care.
- To enable students' identify the role of various stakeholders (Governments, Patients, Providers and Private Players) in impacting the supply and demand of health care.
- To develop skills among the research scholars to identify research problems and conceptualize solutions in the domain of Health Economics.

Course Specific Outcomes:

Upon completion of the course the research student will be able to apply the concepts and skills learnt in developing and conducting research of public health importance.

Teaching Methods: This course will be delivered using a variety of teaching methods which include (but not limited to) classroom lectures, online classes, webinar's, assignments, field work and group work.

Units and Topics	Teaching Methods								Mandatory Readings
Unit I: Introduction to health economics									
	L	FW	FV	CS	GW	SS	SP	P	
1.1 Introduction	X								Santerre, R. E., & Neun, S. P. (2012). Health economics: Theory, insights, and industry studies. Cengage Learning.
1.1 Common terminologies used in health economics	X					X			
1.2 Demand, Supply and Market Equilibrium	X					X			
1.3 Utility and demand	X					X			

1.4 Health as an economic good	**X**					**X**			
Unit-II: Demand for health									
2.1 Demand for health capital-Grossman's model	**X**					**X**			Grossman, M. (2000). The human capital model. In Handbook of health economics (Vol. 1, pp. 347-408). Elsevier. Available at http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.455.9173&rep=rep1&type=pdf Santerre, R. E., & Neun, S. P. (2012). Health economics: Theory, insights, and industry studies. Cengage Learning. Cuyler, A., & Newhouse, J. 2000. Handbook of health economics.
2.1 Demand for medical care	**X**					**X**			
2.3 Utility maximization and demand for medical care.	**X**					**X**			
2.4 Economic and non-economic determinants of demand for medical care.	**X**					**X**			Santerre, R. E., & Neun, S. P. (2012). Health economics: Theory, insights, and industry studies. Cengage Learning.
2.5 Demand for medical care in the context of health insurance	**X**					**X**			Besley, T. (1989). The demand for health care and health insurance. Oxford Review of Economic Policy, 5(1), 21-33.
Unit III: Health care markets									
3.1 Structure, conduct and performance paradigm	**X**				**X**	**X**			Santerre, R. E., & Neun, S. P. (2012). Health economics: Theory, insights, and industry studies. Cengage Learning.
3.2 Market power and market types	**X**					**X**			
3.3 Market competition	**X**					**X**			
3.4 Medical care production & costs in Health care markets	**X**					**X**			
Unit-IV: Health Insurance									
4.1 The anatomy of health insurance	**X**								Cutler, D. M., & Zeckhauser, R. J. (2000). The anatomy of health insurance. In Handbook of health economics (Vol. 1, pp. 563-643). Elsevier.
4.2 Types of health insurance	**X**					**X**			
4.3 Theory of demand for health insurance	**X**					**X**			Nyman, J. A. (2008). Health insurance theory: the case of the missing welfare gain. The European Journal of Health Economics, 9(4), 369-380.

									Nyman, J. A. (2004). Is 'moral hazard inefficient? The policy implications of a new theory. *Health Affairs*, *23*(5)
4.4 Private health insurance industry	**X**					**X**			Robinson, J. C. (2006). The commercial health insurance industry in an era of eroding employer coverage. Health Affairs, 25(6), 1475-1486.
4.5 Provider Insurer Relationships TPAs and HMOs.	**X**								
4.6 National Health Protection Scheme (Ayushman Bharat)	**X**					**X**			Lahariya, C. (2018). 'Ayushman Bharat' program and Universal Health Coverage in India. Indian Pediatrics, 55(6), 495-506.
4.7 Issues and challenges in insurance	**X**					**X**			
Unit-V: Role of Government in Health care									
5.1 Government interventions in health care	**X**					**X**			Santerre, R. E., & Neun, S. P. (2012). Health economics: Theory, insights, and industry studies. Cengage Learning.
5.2 Government as Health Insurer	**X**				**X**	**X**			
Unit-VI: Economic Evaluation									
6.1 Introduction	**X**								Cuyler, A., & Newhouse, J. 2000. Handbook of health economics.
6.2 Cost-effectiveness analysis	**X**				**X**	**X**			Quade, E. S. (1966). Cost-effectiveness: an introduction and overview. Transportation Journal, 5-13.
6.3 Cost-utility analysis	**X**				**X**	**X**			
6.4 Cost-benefit analysis	**X**				**X**	**X**			Johannesson, M. (1995). The relationship between cost-effectiveness analysis and cost-benefit analysis. Social science & medicine, 41(4), 483-489. Bartlett, E. E. (1995). Cost-benefit analysis of patient education. Patient education and counseling, 26(1-3), 87-91.
Unit-VII: Health care financing									
7.1 Concept and Functions of Health Financing and Universal Health Coverage	**X**					**X**			Evans, D. B., Hsu, J., & Boerma, T. (2013). Universal health coverage and universal access. Available at https://www.scielosp.org/article/bwho/2013.v91n8/546-546A/
7.2 Models of health care financing	**X**					**X**			
7.3 Modes of Health Financing - Tax and revenue - Social security/social	**X**					**X**			World Health Organization. (2005). *Designing health financing systems to reduce catastrophic health expenditure* (No. WHO/EIP/HSF/PB/05.02). World Health Organization.

insurance - Private/voluntary Insurance - International (donor) Funding - Out of Pocket Expenditure (OOPE)									

L- Lecture; FW- Field work; FV - Field Visit; CS - Case study; GW- Group work; SS- Self-study; SP- Seminar presentation; P-Practical

Evaluation:

As per CBCS guidelines, this course will be evaluated for 100 marks with a Continuous Evaluation (CA) component of 40 marks and End-Semester Evaluation (ESA) component of 60 marks. CA would be conducted through Examinations, Assignments and Presentations.

Additional readings:

1. Kutzin, J. (2001). A descriptive framework for country-level analysis of health care financing arrangements. *Health policy*, *56*(3), 171-204. Available at https://apps.who.int/iris/bitstream/handle/10665/45367/WHF_1994_15%284%29_p323-328.pdf
2. Neumann, P. J. (2004). Using cost-effectiveness analysis to improve health care: opportunities and barriers. Oxford University Press. Available at http://respati.ac.id/Gberita/ebook/D-EBK-00000000000000001015-%200-19-517186-1%20-full-text.pdf
3. Glied, S. A. (2008). *Health care financing, efficiency, and equity* (No. w13881). National Bureau of economic research. Available at https://www.nber.org/papers/w13881.pdf

Course Code & Title: MPC 71 09 & Health Technology and Informatics
Credit: 6

Course Objective: The objective of this course is to develop a detailed understanding of health technology and informatics tools among the public health research scholars. The course is designed to equip students with the knowledge and application of information, communication and technology (ICT) in the field of public health. In particular, the course will enable them understand how the application of health technology, informatics and ICT tools aids in the prevention, promotion, control, treatment and management of diseases in communities. Specifically, this course will enable students to:

1. Understand the important role of ICT in potentially revolutionizing healthcare delivery, administration, education, and research.
2. Distinguish the various types of healthcare information, including knowledge, data, sources, processes and standards.
3. Analyse obstacles and success factors for implementation and integration of technologies in public health.
4. Discuss the technical and policy implications of introducing technology in public health for process efficiency and quality of care.
5. Identify the implementation and research gaps in the area of Health Technology and Informatics.

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Course Specific Outcomes:

Upon completion of the course the research student will be able to apply the concepts and skills learnt in developing and conducting research of public health importance.

Teaching Methods: The delivery of this course will take place using a variety of methods and modalities. Classroom lectures using power point presentations, demonstration using YouTube videos, self-study, case studies analysis, Group work, seminar presentation, organizational visit to understand a telemedicine centre etc., be utilized to deliver this course.

Units and Topics	Teaching Methods								Mandatory Readings
Unit-I: Overview of Health Technology and Public Health Informatics									
	L	FW	FV	CS	GW	SS	SP	P	
Definitions, scope, importance and limitations of	X					X			Athavale, A. V., & Zodpey, S. P. (2010). Public

health technology and public health informatics.									health informatics in India: the potential and the challenges. Indian journal of public health, 54(3), 131. Hovenga E, Kidd M, Cesnik B (1996). Health Informatics: An Overview. Churchill Livingstone, Australia. Jamal, A., McKenzie, K., & Clark, M. (2009). The impact of health information technology on the quality of medical and health care: a systematic review. *Health Information Management Journal*, *38*(3), 26-37. Electronic Health Record Standards-2016, Govt. of India. Available at: https://www.nhp.gov.in/ehr_standards_mtl_mtl
Concept of data, data sources, information, knowledge, insight and decision-making process.	**X**					**X**			
Health information standards and types of standards like systems, vocabulary, messaging, and security standards and EHR Standards in India (ISO, DICOM, ICD-11, and SNOMED).	**X**				**X**	**X**			
Interoperability and levels of interoperability (basic, technical and semantic interoperability).	**X**					**X**			Iroju, O., Soriyan, A., Gambo, I., & Olaleke, J. (2013). Interoperability in healthcare: benefits, challenges and resolutions. International Journal of Innovation and Applied Studies, 3(1), 262-270.
Unit-II: Building Blocks of Health Informatics									
Health data security, privacy and confidentiality	**X**					**X**			Barrows Jr, R. C., & Clayton, P. D. (1996). Privacy, confidentiality, and electronic medical records. Journal of the American Medical Informatics Association, 3(2), 139-148.
Health Registry, Types of registries (Hospital and Population based registries) and disease specific registries such as Cancer registry and diabetes registries in India.	**X**					**X**			Cancer Registry in India: Kishore Chaudhry & Usha K. Luthra. Published in MoHFW, website Govt. of India. Behera, P., & Patro, B. K. (2018). Population Based Cancer Registry of India – the Challenges and

									Opportunities. *Asian Pacific Journal of Cancer Prevention: APJCP*, *19*(10), 2885–2889.
Concept of Knowledge Management (KM), Knowledge management in Public Health, and Role of Health Informatics in KM.	**X**					**X**			Dobbins, M., DeCorby, K., Robeson, P., Husson, H., Tirilis, D., & Greco, L. (2010). A knowledge management tool for public health: health-evidence. BMC public health, 10(1), 1-16.
Unit-III: Tools of Health Technology and Informatics									
EHR and EMR, m-Health and apps, health trackers, wearables and home health devices, Tele-medicine and virtual consultation, Social media and public health, GIS and its role in disease surveillance and other public health interventions.	**X**		**X**		**X**	**X**	**X**		Mishra, S. K., Kapoor, L., & Singh, I. P. (2009). Telemedicine in India: current scenario and the future. Telemedicine and e-Health, 15(6), 568-575. Ganapathy, K., & Ravindra, A. (2009). Telemedicine in India: the Apollo story. Telemedicine and e-Health, 15(6), 576-585. Srivastava, S. K. (2016). Adoption of electronic health records: a roadmap for India. Healthcare informatics research, 22(4), 261-269. Thackeray, R., Neiger, B. L., Smith, A. K., & Van Wagenen, S. B. (2012). Adoption and use of social media among public health departments. *BMC public health*, *12*(1), 1-6. Cromley, E. K., & McLafferty, S. L. (2011). GIS and public health. Guilford Press.
Unit-IV: eHealth Policy, Organizations and Regulations									
Digital India initiative by Govt. of India, National Digital Health Blue-Print, Tele-medicine Guidelines, and Role of National e-	**X**			**X**		**X**			*Ranganathan, Sheetal (2020). Towards a Holistic Digital Health Ecosystem in India. Observer Research Foundation.*

Health Authority (NeHA) in India.									

L- Lecture; FW- Field work; FV - Field Visit; CS - Case study; GW- Group work; SS- Self-study; SP- Seminar presentation; P-Practical

Evaluation: As per CBCS guidelines, this course will be evaluated for 100 marks with a Continuous Evaluation (CA) component of 40 marks and End-Semester Evaluation (ESA) component of 60 marks.

Additional Readings

1. Singh, A. K., Kohli, M., Trell, E., Kohli, S., & Wigertz, O. (1997). Primary care informatics: Bhorugram, India: revisited. Studies in health technology and informatics, 43, 884-888.
2. Prinja, S., Downey, L. E., Gauba, V. K., & Swaminathan, S. (2018). Health technology assessment for policy making in India: current scenario and way forward.
3. Koo, S. H. (2017). Consumer differences in the United States and India on wearable trackers. Family and Consumer Sciences Research Journal, 46(1), 40-56.
4. Kalpa, S. (2012). Health IT in Indian healthcare system: A new initiative. Research Journal of Recent Sciences, 2277, 2502.
5. Sarbadhikari, S. N. (2018). Will health informatics gain its rightful place for ushering in digital India? Indian Journal of Community Medicine, 43(2), 126.
6. Croner, C. M. (2003). Public health, GIS, and the Internet. Annual Review of Public Health, 24(1), 57-82.
7. Thrall, G. I. (1999). The future of GIS in public health management and practice. Journal of Public Health Management and Practice, 5(4), 82.

Course Code & Title: MPC 71 10 & Geriatric health
Credits: 6

Course description: The course 'geriatric health' intends to introduce the students to the physical, psychological and socioeconomic problems of elderly and enable them to design public health interventions to ensure healthy ageing.

Learning Objectives:

After the completion of the course, the students will be able to

1. Understand the process of ageing and demographic transition from a public health perspective
2. Identify physical, psychological, social and economic problems of elderly population with special reference to India.
3. Assess health system preparedness to respond to the needs of increasing elderly population.
4. Illustrate palliative care and its significance in end-of-life care.
5. Design public health interventions to ensure healthy aging for all.

Course Specific Outcomes:

Upon completion of the course the research student will be able to apply the concepts and skills learnt in developing and conducting research of public health importance.

Days	Lesson	Teaching/learning method	Readings
1	Introduction to geriatric health: The process of ageing, demographic transition in developing countries	Lecture and discussion	WHO. World Report on Ageing and Health. Geneva: WHO; 2015. ISBN 978 92 4 069479 8. National Research Council. (2012). Aging in Asia: Findings from New and Emerging Data Initiatives. J.P. Smith and M. Majmundar, Eds. Panel on Policy Research and Data Needs to Meet the Challenge of Aging in Asia. Committee on Population, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press. Ory MG. Emerging Issues in Geriatric Care: Aging and Public Health Perspectives. http://www.medscape.org/viewarticle/498939

			Roshan R, Singh R, Menon GR. Workshop report on Ageing and Health. New Delhi: ICMR-Forte joint planning workshop; 2014.
2	Ageing in India: the biological, social and economic dimensions of ageing	Group discussion	Prakash I J. Ageing in India. World Health Organization; 1999. Agarwal A, Lubet A, Mitgang E, Mohanty S, and Bloom DE. Population Aging in India: Facts, Issues, and Options. PGDA Working Paper No. 132. Boston: Harvard T H Chan School of Public Health, 2016. Raju SS. Studies on Ageing in India: A Review, BKPAI Working Paper No. 2. New Delhi: United Nations Population Citation Advice: Fund (UNFPA), 2011.
3	Quality of life of elderly population: Dementia, Alzheimer's disease, parkinsonism	Group work Conducting a survey in the local area to identify physical, psychological, social and economic problems of elderly and their coping strategies.	Hootman MJ, Helmick CG, Brady TJ. A Public Health Approach to Addressing Arthritis in Older Adults: The Most Common Cause of Disability. Framing Health Matters. American Journal of Public Health. 2012;102(3):426-33. Ingle GK and Nath A: Concerns and solutions for problems in geriatric health in India. Indian Journal of Community Medicine, 2008;33(4):2014-8. Today's Research on Ageing. Noncommunicable Diseases Among Older Adults in Low- and Middle-Income Countries. Population Reference Bureau; 2012. http://www.prb.org/pdf12/TodaysResearchAging26.pdf Non-Communicable Diseases in an Ageing World. A report from the International Longevity Centre UK, HelpAge International and Alzheimer's Disease International lunch debate July 2011 www.ilcuk.org.uk Artazcoz L, Rueda S. Social inequalities in health among the elderly: a challenge for public health esearch. Journal of Epidemiology and Community Health. 2007;61(6):466-467. doi:10.1136/jech.2006.058081. Dey S, Nambiar D, Lakshmi JK, et al. Health of the Elderly in India: Challenges of Access and Affordability. In: National Research Council (US) Panel on Policy Research and Data Needs to Meet the Challenge of Aging in Asia; Smith JP, Majmundar M, editors. Aging in Asia: Findings From New and Emerging Data Initiatives. Washington (DC): National Academies Press (US); 2012.Available from: https://www.ncbi.nlm.nih.gov/books/NBK109208/
4	Quality of life of elderly population with noncommunicable diseases including cancer; and mental disorders		
5	Limited mobility and its implications on quality of life of elderly: those who are bedridden or undergone amputation or paralyzed		
6	Economic dependence and destitution of elderly		

	in India.		
7	Elderly and spirituality	Lecture and discussion	Zimmer Z , Jagger C , Chiu C, Ofstedal MB, Rojo F , Saito Y. Spirituality, religiosity, aging and health in global perspective: A review. SSM -Population Health 2016;2: 373–381.
8	Health system preparedness to respond to the needs of the increasing elderly population: medicalization of care	Lecture and discussion	WHO. Health workforce for ageing populations. Department of Ageing and Life-Course and Health Workforce Department, WHO; 2016. The Economist. Health care strategies for an aging society. The Economist Intelligence Unit Limited 2009.
9 and 10	End of life care: role of community based palliative care in India	Group discussion	Khosla D, Patel FD, Sharma SC. Palliative Care in India: Current Progress and Future Needs. Indian Journal of Palliative Care. 2012;18(3):149-154. doi:10.4103/0973-1075.105683.
11	Healthy ageing: The concept, definition and principles, human rights perspective of healthy ageing.	Lecture and group discussion	WHO. Active and Healthy Ageing Report of a Regional Consultation Thiruvananthapuram, Kerala, India. SEA-HE-195; 2007. The Swedish National Institute of Public Health Research. Healthy Ageing: a challenge for Europe; 2006.
12	Measurement, monitoring and research on healthy ageing: Gaps and challenges	Lecture and discussion	Sowa A, Tobiasz-Adamczyk B, Topór-Mądry R, Poscia A and la Milia D. Predictors of healthy ageing: public health policy targets. BMC Health Services Research 2016, 16(Suppl 5):289 DOI 10.1186/s12913-016-1520-5 Mahajan A, Ray A. The Indian elder: factors affecting geriatric care in India. GJMEDPH 2013;2(4):1-5.
13	Role of public health in ensuring healthy ageing: comparison of public health interventions for elderly around the	Brainstorming session on developing age-friendly environments: fostering	WHO. Policies and priority interventions for healthy ageing. Active ageing: good health adds life to years. WHO Regional Office for Europe; 2012. WHO. Global strategy and action plan on ageing and health (2016 - 2020): A framework for coordinated global action by the World Health Organization, Member States, and Partners across the Sustainable Development Goals.

	world.	autonomy	Stevens AJ. Burns E. A CDC Compendium of Effective Fall Interventions: What Works for Community-Dwelling Older Adults. Georgia: Centre for Disease Control; 2015.
14	Policies, laws and programmes in India to ensure social and economic security of elderly population	Assessment of the availability and utilization of the social security system for elderly in the local area.	Verma R, Khanna P. National Program of Health-Care for the Elderly in India: A Hope for Healthy Ageing. International Journal of Preventive Medicine. 2013;4(10):1103-1107. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3843295/ National Policy on Senior Citizens, 2011. Govt. of India. Abhay MB. Elderly care in India: way forward. J Gerontol Geriatr Res 2016,5:339. DOI: 10.4172/2167-7182.1000339 https://india.gov.in/people-groups/life-cycle/senior-citizens/policiesschemes
15	Summing up	Discussion	

http://www.apa.org/pi/aging/resources/guides/older.aspx
http://www.who.int/ageing/age-friendly-world/en/
https://sustainabledevelopment.un.org/sdg3
http://www.helpageindia.com
http://www.prb.org/Publications/Articles/2006/HealthCareChallengesforDevelopingCountrieswithAgingPopulations.aspx

Course Code & Title: MPC 71 11 & Nutritional Epidemiology
Credits: 6

Course objectives: Upon completion of the course, students will be able to:

1. Appreciate the relationship between nutrition, health and disease
2. Define the concept, purpose and scope of Public Health Nutrition
3. Assess nutritional status, and understand malnutrition and its determinants
4. Understand the life course nutrition approach to prevent disease and promote health
5. Describe food and nutrition security at the national, state and local levels.
6. Understand the inter-sectoral nature and implementation of nutrition and food policy
7. Apply epidemiological principles and methods in nutrition research
8. Identify relevant research gaps and design an appropriate research proposal to address the gaps.

Course Specific Outcomes:

Upon completion of the course the research student will be able to apply the concepts and skills learnt in developing and conducting research of public health importance.

Teaching Methods: This course will be delivered using a variety of methods and modalities such as classroom and online lectures, self-study, seminars, field visit and group work.

Units and Topics	Teaching Methods								Mandatory Readings
Unit I: Nutrition health and disease									
	L	**FW**	**FV**	**CS**	**GW**	**SS**	**SP**	**P**	
1.1 Definition and concepts – Food, Food composition, nutrition, macronutrients and	**X**	**X**				**X**			Vir, S, C., (2015), Public health nutrition in developing countries (Part I and II), Woodhead Publishing India Pvt, Ltd.

micronutrients, balanced diet, nutritional status and indicators, malnutrition, food security, dietary recommendations. 1.2 Definition, relevance and scope of public health nutrition in improving human health									Deaton, A., & Drèze, J. (2009). Food and nutrition in India: facts and interpretations. *Economic and political weekly*, 42-65. Fieldhouse, P. (2013). Food and nutrition: customs and culture. *Springer.*
Unit-II: Nutrition epidemiology									
2.2 Definition, utility and applications of epidemiology in nutritional sciences 2.3 Assessment of nutritional status at the population level– anthropometry, physical and bio-chemical analysis	**X**	**X**				**X**		**X**	Willett, W. (2012). *Nutritional epidemiology*. Oxford university press. Gibson, R. S. (2005). *Principles of nutritional assessment*. Oxford university press, USA.
Unit-III: Nutritional challenges in the community									
3.1 Food security –availability, accessibility, quantity and quality 3.2 Malnutrition – definition, types, burden, causes and consequences 3.3 Life course nutrition – child, adolescents, women, nutritional transition, chronic and infectious diseases) 3.4 Nutrition of Marginalized population- Tribal, Dalits, Poor Patients with TB, HIV 3.5 Globalization, lift style transition and nutrition transition	**X**	**X**				**X**		**X**	Mitchell, P. J., Cooper, C., Dawson-Hughes, B., Gordon, C. M., & Rizzoli, R. (2015). Life-course approach to nutrition. *OsteoporosisInternational*, *26*(12),2723–2742. https://doi.org/10.1007/s00198-015-3288-6 Pangaribowo, E. H., Gerber, N., & Torero, M. (2013). Food and nutrition security indicators: a review.
Unit –IV: Nutrition interventions									

4.1 Food safety and security – policies and actions 4.2 Recommended Dietary Allowances and Supplementary nutrition 4.3 Intersectoral actions – drinking water, sanitation, shelter, education, economics, policies 4.4 Overview of global and national nutritional interventions and food policies	**X**	**X**			**X**	**X**			Gwatkin, D. R., Rutstein, S., Johnson, K., Suliman, E., Wagstaff, A., & Amouzou, A. (2007). Socio-economic differences in health, nutrition, and population within developing countries: an overview. Alderman, H. (2005). Linkages between poverty reduction strategies and child nutrition: an Asian perspective. *Economic and Political Weekly*, 4837-4842. Caraher, M., & Coveney, J. (2004). Public health nutrition and food policy. *Public health nutrition*, *7*(5), 591-598. llen L, Gillespie S. What works? A review of the efficacy and effectiveness of nutrition interventions. ACC/SCN Nutrition Policy Paper no.19, ADB Nutrition and Development Series No. 5. Manila: Asian Development Bank, 2001.
Unit –V: Nutrition education									
5.1 Relevance, principles, target groups, steps of developing nutrition education programmes	**X**	**X**				**X**		**X**	McNulty, J. (2013). Challenges and issues in nutrition education. Rome: Nutrition Education and Consumer Awareness Group, Food and Agriculture Organization of the United Nations. Smith, B., & Smitasiri, S. (1997). A framework for nutrition education programmes. *FAO Food and Nutrition Paper*, 37-70. Pérez-Rodrigo, C., & Aranceta, J. (2001). School-based nutrition education: lessons learned and new perspectives. *Public Health Nutrition*, *4*(1a), 131-139.

L- Lecture; FW- Field work; FV - Field Visit; CS - Case study; GW- Group work; SS- Self-study; SP- Seminar presentation; P-Practical

Evaluation - As per CBCS guidelines, this course will be evaluated for 100 marks with a Continuous Evaluation (CA) component of 40 marks and End-Semester Evaluation (ESA) component of 60 marks.

Additional readings:

1. Grebmer, K. V., Bernstein, J., Patterson, F., Wiemers, M., Chéilleachair, R. N., & Foley, C. (2019). Global Hunger Index: The Challenge of Hunger and Climate Change. International Food Policy Research Institute, October.
2. Truswell, A. S. (2001). Levels and kinds of evidence for public-health nutrition. The Lancet, 357(9262), 1061-1062.
3. Egan, M. C. (1994). Public health nutrition: a historical perspective. Journal of the American Dietetic Association, 94(3), 298-304.
4. Worsley, A. (2002). Nutrition knowledge and food consumption: can nutrition knowledge change food behaviour?. Asia Pacific journal of clinical nutrition, 11, S579-S585.
5. Haddad, L., Kennedy, E., & Sullivan, J. (1994). Choice of indicators for food security and nutrition monitoring. Food Policy, 19(3), 329-34

Course Code & Title: MPC 71 12 Non-Communicable Disease Epidemiology
Credits: 6

Course Objectives: At the end of the course, the participants will be able to understand the major non-communicable diseases, their risk factors, major strategies for prevention, risk factor surveillance as per the World Health Organization STEPS protocol, case studies on major interventions to reduce risk factors in India and a few other developing countries and the national program for prevention and control of Cancer, Cardiovascular diseases, Diabetes and Stroke in India.

Course Specific Outcomes:

Upon completion of the course the research student will be able to apply the concepts and skills learnt in developing and conducting research of public health importance.

Teaching Methods: This course will be delivered using a variety of methods and modalities such as interactive classroom and online lectures, self-study, case studies, written assignment, class room exercises using computers, quiz, field visit, group work, field survey, class room presentations in groups etc.

Units and Topics	Teaching Methods								Mandatory Readings
Unit-I: Non-Communicable Diseases									
	L	**FW**	**FV**	**CS**	**GW**	**SS**	**SP**	**P**	
Objectives of the course	**X**								
Epidemiological Transition	**X**					**X**			Omran., A, R. The epidemiologic transition: a theory of the epidemiology of population change. 1971. *Milbank Q*. 2005;83(4):731-757.
NCD Risk factor Surveillance	**X**					**X**			Riley, L., Guthold, R., Cowan,

									M., Savin, S., Bhatti, L., Armstrong, T., & Bonita, R. (2016). The World Health Organization STEP-WISE Approach to Noncommunicable Disease Risk-Factor Surveillance: Methods, Challenges, and Opportunities. *American Journal of Public Health*, *106*(1), 74–78. https://doi.org/10.2105/AJPH.2015.302962
NCD Risk factor Surveillance STEP 1	**X**					**X**		**X**	Sarma, P. S., Sadanandan, R., & Thulaseedharan , J. V. et al (2019). Prevalence of Risk Factors of Non-Communicable Diseases in Kerala, India: Results of a Cross-Sectional Study. *BMJ Open*, *9*(11), e027880. https://doi.org/10.1136/bmjopen-2018-027880
NCD Risk factor Surveillance STEP 2 and 3	**X**					**X**		**X**	
Risk factor Modification	**X**					**X**			Puska, P., Laatikainen, T., Korpelainen, V., & Vartiainen, E. (2016). Contribution of the North Karelia Project to International Work in CVD and NCD Prevention and Health Promotion. *Global Heart*, *11*(2), 243–246. https://doi.org/10.1016/j.gheart.2

									016.04.009
Strategies of Prevention.	**X**					**X**			Rose, G. (2001). Sick Individuals and sick populations. *International Journal of Epidemiology*, *30*(3), 427–432. https://doi.org/10.1093/ije/30.3.427
Risk factors of NCDs: Tobacco, overall	**X**					**X**			WHO Tobacco: fact sheet. Geneva: World Health Organization, 2018. https://www.who.int/en/news-room/fact-sheets/detail/tobacco
Risk factors of NCDs: Tobacco, FCTC	**X**					**X**			Mohan, S., Mini, G. K., & Thankappan, K. R. (2013). High Knowledge of Framework Convention on Tobacco Control Provisions Among Local Government Representatives Does Not Translate into Effective Implementation: Findings from Kerala, India. *Public Health*, *127*(2), 178. https://doi.org/10.1016/j.puhe.2012.11.018
Risk factors of NCDs: Physical inactivity & Public Health	**X**					**X**			Mathews, E., Pratt, M., Jissa, V. T., & Thankappan, K. R. (2015). Self-reported Physical Activity and Its Correlates Among Adult Women in the Expanded Part of Thiruvananthapuram City,

									India. *Indian Journal of Public Health*, *59*(2), 136–140. https://doi.org/10.4103/0019-557X.157535
Risk factors of NCDs: Physical inactivity, methodology for measurements	**X**					**X**			Mathews, E., Salvo, D., Sarma, P., Thankappan, K., & Pratt, M. (2016). Adapting and Validating the Global Physical Activity Questionnaire (GPAQ) for Trivandrum, India, 2013. *Preventing Chronic Diseases*, *13*, E53. https://doi.org/10.5888/pcd13.150528.
Risk factors of NCDs: Unhealthy Diet	**X**					**X**			GBD 2017 Diet Collaborators. (2019). Health Effects of Dietary Risks in 195 Countries, 1990-2017: A Systematic Analysis for the Global Burden of Disease Study 2017. *Lancet*, *393*(10184), 1958. https://doi.org/10.1016/S0140-6736(19)30041-8
Risk Factors of NCDs: Alcohol use	**X**					**X**			GBD 2016 Alcohol Collaborators. (2018). Alcohol Use and Burden for 195 Countries and Territories, 1990-2016: A Systematic Analysis for the Global Burden of Disease Study 2016. *Lancet*, *392*(10152), 1015. https://doi.org/10.1016/S0140-

									6736(18)31310-2
Case studies on interventions for NCD risk reduction 1. Quit Tobacco International	**X**					**X**			Yamini , T. R., Nichter, M., Nichter, M. et al. (2015). Developing a Fully Integrated Tobacco Curriculum in Medical Colleges in India. *BMC Medical Education*, *15*, 15. https://doi.org/10.1186/s12909-015-0369-3.
Case Study 2. Dietary intervention	**X**					**X**			Daivadanam, M., Wahlstrom, R., Ravindran , T. K. S., Sarma, P. S., Sivasankaran, S., & Thankappan, K. R. (2018). Changing Household Dietary Behaviours Through Community-Based Networks: A Pragmatic Cluster Randomized Controlled Trial in Rural Kerala, India. *PloS One*, *13*(8), e0201877. https://doi.org/10.1371/journal.pone.0201877
Case Study 3. Kerala Diabetes Prevention Program	**X**					**X**			Thankappan, K. R., Sathish, T., & Tapp, R. J. (2018). A Peer-Support Lifestyle Intervention for Preventing Type 2 Diabetes in India: A Cluster-Randomized Controlled Trial of the Kerala Diabetes Prevention Program. *PLOS Medicine*, *15*(6), e1002575. https://doi.org/10.1371/journal.p

									med.1002575
Case study 4. Community Interventions for Health	**X**					**X**			Dyson, P. A., Anthony, D., Fenton, B. et al. (2015). Successful Up-Scaled Population Interventions to Reduce Risk Factors for Non-Communicable Disease in Adults: Results From the International Community Interventions for Health (CIH) Project in China, India and Mexico . *PloS One* , *10*(4), e0120941. https://doi.org/10.1371/journal.pone.0120941
National program for the prevention and control of Cancer, cardiovascular diseases, diabetes and stroke	**X**				**X**	**X**	**X**		Krishnan, A., Gupta, V., Ritvik, Nongkynrih, B., & Thakur, J. S. (2011). How to Effectively Monitor and Evaluate NCD Programmes in India . *Indian Journal of Community Medicine* , *36*, S57-62.

L- Lecture; FW- Field work; FV - Field Visit; CS - Case study; GW- Group work; SS- Self-study; SP- Seminar presentation; P-Practical

Evaluation

As per CBCS guidelines, this course will be evaluated for 100 marks with a Continuous Evaluation (CA) component of 40 marks and End-Semester Evaluation (ESA) component of 60 marks.

Additional readings

Nelson, K. E., & Williams, C. M. (Eds.). (2014). Infectious disease epidemiology: theory and practice. Jones & Bartlett Publishers.

Course Code & Title: MPC 71 13 Chronic Disease Epidemiology
Credits: 6

Course Objectives: At the end of the course, the participants will be able to understand the major non-communicable diseases, their risk factors, major strategies for prevention, risk factor surveillance as per the World Health Organization STEPS protocol, case studies on major interventions to reduce risk factors in India and a few other developing countries and the national program for prevention and control of Cancer, Cardiovascular diseases, Diabetes and Stroke in India.

Course Specific Outcomes:

Upon completion of the course the research student will be able to apply the concepts and skills learnt in developing and conducting research of public health importance.

Teaching Methods: This course will be delivered using a variety of methods and modalities such as interactive classroom and online lectures, self-study, case studies, written assignment, class room exercises using computers, quiz, field visit, group work, field survey, class room presentations in groups etc.

Units and Topics	Teaching Methods								Mandatory Readings
Unit-I: Non-Communicable Diseases									
	L	**FW**	**FV**	**CS**	**GW**	**SS**	**SP**	**P**	
Objectives of the course	**X**								
Epidemiological Transition	**X**					**X**			Omran., A, R. The epidemiologic transition: a theory of the epidemiology of population change. 1971. *Milbank Q.* 2005;83(4):731-757.
NCD Risk factor Surveillance	**X**					**X**			Riley, L., Guthold, R., Cowan, M., Savin, S., Bhatti, L., Armstrong, T., & Bonita, R. (2016). The World Health Organization STEP-WISE Approach to Noncommunicable Disease Risk-Factor Surveillance: Methods, Challenges, and

									Opportunities. *American Journal of Public Health*, *106*(1), 74–78. https://doi.org/10.2105/AJPH.2015.302962
NCD Risk factor Surveillance STEP 1	**X**					**X**		**X**	Sarma, P. S., Sadanandan, R., & Thulaseedharan , J. V. et al (2019). Prevalence of Risk Factors of Non-Communicable Diseases in Kerala, India: Results of a Cross-Sectional Study. *BMJ Open*, *9*(11), e027880. https://doi.org/10.1136/bmjopen-2018-027880
NCD Risk factor Surveillance STEP 2 and 3	**X**					**X**		**X**	
Risk factor Modification	**X**					**X**			Puska, P., Laatikainen, T., Korpelainen, V., & Vartiainen, E. (2016). Contribution of the North Karelia Project to International Work in CVD and NCD Prevention and Health Promotion. *Global Heart*, *11*(2), 243–246. https://doi.org/10.1016/j.gheart.2016.04.009
Strategies of Prevention.	**X**					**X**			Rose, G. (2001). Sick Individuals and sick populations. *International Journal of Epidemiology*, *30*(3), 427–432. https://doi.org/10.1093/ije/30.3.427
Risk factors of NCDs: Tobacco, overall	**X**					**X**			WHO Tobacco: fact sheet. Geneva: World Health Organization, 2018. https://www.who.int/en/news-room/fact-sheets/detail/tobacco
Risk factors of NCDs: Tobacco, FCTC	**X**					**X**			Mohan, S., Mini, G. K., & Thankappan, K. R. (2013). High Knowledge of Framework Convention on Tobacco Control Provisions Among Local Government Representatives Does Not Translate into Effective Implementation: Findings from Kerala, India. *Public Health*, *127*(2), 178. https://doi.org/10.1016/j.puhe.2012.11.018
Risk factors of NCDs: Physical inactivity & Public Health	**X**					**X**			Mathews, E., Pratt, M., Jissa, V. T., & Thankappan, K. R. (2015). Self-reported Physical Activity and Its Correlates Among Adult Women in the Expanded Part of Thiruvananthapuram City, India. *Indian Journal of Public Health*, *59*(2), 136–140. https://doi.org/10.4103/0019-557X.157535

Risk factors of NCDs: Physical inactivity, methodology for measurements	**X**					**X**			Mathews, E., Salvo, D., Sarma, P., Thankappan, K., & Pratt, M. (2016). Adapting and Validating the Global Physical Activity Questionnaire (GPAQ) for Trivandrum, India, 2013. *Preventing Chronic Diseases*, *13*, E53. https://doi.org/10.5888/pcd13.150528.
Risk factors of NCDs: Unhealthy Diet	**X**					**X**			GBD 2017 Diet Collaborators. (2019). Health Effects of Dietary Risks in 195 Countries, 1990-2017: A Systematic Analysis for the Global Burden of Disease Study 2017. *Lancet*, *393*(10184), 1958. https://doi.org/10.1016/S0140-6736(19)30041-8
Risk Factors of NCDs: Alcohol use	**X**					**X**			GBD 2016 Alcohol Collaborators. (2018). Alcohol Use and Burden for 195 Countries and Territories, 1990-2016: A Systematic Analysis for the Global Burden of Disease Study 2016. *Lancet*, *392*(10152), 1015. https://doi.org/10.1016/S0140-6736(18)31310-2
Case studies on interventions for NCD risk reduction 1. Quit Tobacco International	**X**					**X**			Yamini , T. R., Nichter, M., Nichter, M. et al. (2015). Developing a Fully Integrated Tobacco Curriculum in Medical Colleges in India. *BMC Medical Education*, *15*, 15. https://doi.org/10.1186/s12909-015-0369-3.
Case Study 2. Dietary intervention	**X**					**X**			Daivadanam, M., Wahlstrom, R., Ravindran , T. K. S., Sarma, P. S., Sivasankaran, S., & Thankappan, K. R. (2018). Changing Household Dietary Behaviours Through Community-Based Networks: A Pragmatic Cluster Randomized Controlled Trial in Rural Kerala, India. *PloS One*, *13*(8), e0201877. https://doi.org/10.1371/journal.pone.0201877
Case Study 3. Kerala Diabetes Prevention Program	**X**					**X**			Thankappan, K. R., Sathish, T., & Tapp, R. J. (2018). A Peer-Support Lifestyle Intervention for Preventing Type 2 Diabetes in India: A Cluster-Randomized Controlled Trial of the Kerala Diabetes Prevention Program. *PLOS Medicine*, *15*(6), e1002575. https://doi.org/10.1371/journal.pmed.1002575
Case study 4. Community Interventions for Health	**X**					**X**			Dyson, P. A., Anthony, D., Fenton, B. et al. (2015). Successful Up-Scaled Population Interventions to Reduce Risk Factors for Non-Communicable Disease in Adults: Results From the

									International Community Interventions for Health (CIH) Project in China, India and Mexico . *PloS One* , *10*(4), e0120941. https://doi.org/10.1371/journal.pone.0120941
National program for the prevention and control of Cancer, cardiovascular diseases, diabetes and stroke	**X**				**X**	**X**	**X**		Krishnan, A., Gupta, V., Ritvik, Nongkynrih, B., & Thakur, J. S. (2011). How to Effectively Monitor and Evaluate NCD Programmes in India . *Indian Journal of Community Medicine* , *36*, S57-62.

L- Lecture; FW- Field work; FV - Field Visit; CS - Case study; GW- Group work; SS- Self-study; SP- Seminar presentation; P-Practical

Evaluation

As per CBCS guidelines, this course will be evaluated for 100 marks with a Continuous Evaluation (CA) component of 40 marks and End-Semester Evaluation (ESA) component of 60 marks.

Additional readings

Nelson, K. E., & Williams, C. M. (Eds.). (2014). Infectious disease epidemiology: theory and practice. Jones & Bartlett Publishers.

Course Code & Title: MPC 71 14 & Basic Epidemiology
Credits: 6

Course Objectives

1. To enable PhD students to understand the role of epidemiology in disease prevention and health promotion.
2. To introduce PhD students to the basic epidemiological terminology, concepts, outcome measures and study designs.
3. To enable PhD students, appreciate the application of epidemiological concepts in public health practice and research.
4. To equip the PhD students with the essential skillset to critically analyze the concurrent public health challenges.

Course Specific Outcomes:

Upon completion of the course the research student will be able to apply the concepts and skills learnt in developing and conducting research of public health importance.

Teaching Methods: This course will be delivered using a variety of teaching methods which include (but not limited to) classroom lectures, online classes, webinar's, assignments, field work and group work.

Units and Topics	Teaching Methods								Mandatory Readings
Unit-I: Introduction to epidemiology and public health									
	L	**FW**	**FV**	**CS**	**GW**	**SS**	**SP**	**P**	
1.1 Definitions, History, scope, and importance of epidemiology	**X**					**X**			Gordis, L. (2014). Epidemiology. 5th Ed. Philadelphia: WB Saunders Elsevier, 116-37
1.2 Basic concepts of health and disease prevention	**X**					**X**			
1.3 Iceberg theory of Disease, Natural history of diseases	**X**					**X**			

1.4 Epidemiological transition	**X**					**X**			
1.5 Disease transmission dynamics						**X**			
Unit-II: Measuring mortality and morbidity									
2.1. Introduction to tools used in measuring disease mortality and morbidity (Rates, Ratios ad Proportion)	**X**					**X**			Gianicolo, E., Riccetti, N., Blettner, M., & Karch, A. (2020). Epidemiological Measures in the Context of the COVID-19 Pandemic. Deutsches Ärzteblatt International, 117(19), 336. Vetter, T. R., & Jesser, C. A. (2017). Fundamental epidemiology terminology and measures: it really is all in the name. *Anesthesia & Analgesia*, *125*(6), 2146-2151. Gordis, L. (2014). Epidemiology. 5th Ed. Philadelphia: WB Saunders Elsevier, 116-37
2.2. Mortality Measures	**X**				**X**			**X**	
2.3. Morbidity Measures	**X**								
2.4 Disease transmission Measures	**X**								
Unit-III: Causation and association									
3.1. Causation, association and correlation	**X**			**X**					Gianicolo, E. A., Eichler, M., Muensterer, O., Strauch, K., & Blettner, M. (2020). Methods for Evaluating Causality in Observational Studies: Part 27 of a Series on Evaluation of Scientific Publications. Deutsches Ärzteblatt International, 117(7), 101. Available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7081045/ Sauerbrei, W., & Blettner, M. (2009). Interpreting results in 2× 2 tables: part 9 of a series on evaluation of scientific publications. Deutsches Ärzteblatt International, 106(48), 795. Available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2797398/
3.2. Criteria for establishing causation	**X**							**X**	
3.3. Measures used to determine causation	**X**							**X**	
Unit-IV: Epidemiological study designs									
4.1 Introduction to epidemiological study designs	**X**							**X**	Röhrig, B., Du Prel, J. B., & Blettner, M. (2009). Study design in medical research: part 2 of a series on the evaluation of scientific publications. *Deutsches Ärzteblatt International*, *106*(11), 184.
4.2 Descriptive study designs – Ecological study, Cross-sectional study	**X**					**X**			Gordis, L. (2014). Epidemiology. 5th Ed. Philadelphia: WB Saunders Elsevier, 116-37
4.3 Descriptive study designs – Longitudinal study	**X**					**X**			Gordis, L. (2014). Epidemiology. 5th Ed. Philadelphia: WB Saunders Elsevier, 116-37
4.4 Analytical study designs – Case-control study ad Cohort	**X**					**X**			Ressing, M., Blettner, M., & Klug, S. J. (2010). Data analysis of epidemiological studies: part 11 of a series on evaluation of scientific publications. Deutsches Arzteblatt International,

study									107(11), 187.
4.5 Analytical study designs – Hybrid designs	**X**					**X**			
4.6 Experimental study designs – Randomized controlled trials	**X**					**X**			Begg, C., Cho, M., Eastwood, S., Horton, R., Moher, D., Olkin, I., ... & Stroup, D. F. (1996). Improving the quality of reporting of randomized controlled trials: the CONSORT statement. Jama, 276(8), 637-639. Kabisch, M., Ruckes, C., Seibert-Grafe, M., & Blettner, M. (2011). Randomized controlled trials: part 17 of a series on evaluation of scientific publications. *Deutsches Ärzteblatt International*, *108*(39), 663. Lange, S., Sauerland, S., Lauterberg, J., & Windeler, J. (2017). The range and scientific value of randomized trials: Part 24 of a series on evaluation of scientific publications. *Deutsches Ärzteblatt International*, *114*(38), 635.
Unit-V: Bias and cofounding in epidemiological studies									
5.1 Introduction to bias, cofounding ad effect measure modification.	**X**					**X**			Hammer, G. P., du Prel, J. B., & Blettner, M. (2009). Avoiding bias in observational studies: part 8 in a series of articles on evaluation of scientific publications. *Deutsches Ärzteblatt International*, *106*(41), 664. Smith, G. D., & Phillips, A. N. (1992). Confounding in epidemiological studies: why" independent" effects may not be all they seem. *BMJ: British Medical Journal*, *305*(6856), 757. Gordis, L. (2014). Epidemiology. 5th Ed. Philadelphia: WB Saunders Elsevier, 116-37.
5.2 Bias	**X**					**X**			
5.3 Cofounding	**X**					**X**			
5.4 Effect measure modification	**X**					**X**			
Unit-VI: Screening									
Screening of diseases and risk factors	**X**					**X**			Spix, C., & Blettner, M. (2012). Screening: part 19 of a series on evaluation of scientific publications. Deutsches Ärzteblatt International, 109(21), 385. Parikh, R., Mathai, A., Parikh, S., Sekhar, G. C., & Thomas, R. (2008). Understanding and using sensitivity, specificity and predictive values. *Indian Journal of Ophthalmology*, *56*(1), 45.

									Gordis, L. (2014). Epidemiology. 5th Ed. Philadelphia: WB Saunders Elsevier, 116-37

L- Lecture; FW- Field work; FV - Field Visit; CS - Case study; GW- Group work; SS- Self-study; SP- Seminar presentation; P-Practical

Evaluation

As per CBCS guidelines, this course will be evaluated for 100 marks with a Continuous Evaluation (CA) component of 40 marks and End-Semester Evaluation (ESA) component of 60 marks. The continuous assessment will be conducted using examinations, quiz, assignments and presentation.

Additional Readings

1. Du Prel, J. B., Röhrig, B., & Blettner, M. (2009). Critical appraisal of scientific articles: part 1 of a series on evaluation of scientific publications. *Deutsches Arzteblatt International*, *106*(7), 100. Available at https://www.aerzteblatt.de/int/archive/article/63438
2. Pearce, N. (2012). Classification of epidemiological study designs. *International journal of epidemiology*, *41*(2), 393-397. Available at https://academic.oup.com/ije/article/41/2/393/697874
3. Röhrig, B., du Prel, J. B., Wachtlin, D., Kwiecien, R., & Blettner, M. (2010). Sample size calculation in clinical trials: part 13 of a series on evaluation of scientific publications. Deutsches Ärzteblatt International, 107(31-32), 552. available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2933537/
4. Kwiecien, R., Kopp-Schneider, A., & Blettner, M. (2011). Concordance analysis: part 16 of a series on evaluation of scientific publications. Deutsches Ärzteblatt International, 108(30), 515. Available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3165924/
5. Zwiener, I., Blettner, M., & Hommel, G. (2011). Survival analysis: part 15 of a series on evaluation of scientific publications. *Deutsches Ärzteblatt International*, *108*(10), 163. Available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3071962/
6. Wellek, S., & Blettner, M. (2012). Establishing equivalence or non-inferiority in clinical trials: part 20 of a series on evaluation of scientific publications. Deutsches Ärzteblatt International, 109(41), 674. Available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3487152/
7. Wellek, S., & Blettner, M. (2012). On the proper use of the crossover design in clinical trials: part 18 of a series on evaluation of scientific publications. *Deutsches Ärzteblatt International*, *109*(15), 276. Available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3345345/

Course Code & Title: MPC 71 15 & Data Analytics in Health Sciences
Credit - 6

Course Objectives: The objective of this course is to enable research students understand the basics of both quantitative and qualitative analytics in health sciences using different techniques and tools of data analyses. The students will be also imparted with further, this module will also provide hands on training in the three important areas of

On completing this course, the students will be able to:

1. Perform analysis of numerical and textual data using R and Nvivo-12 software respectively.
2. Be sensitized with the basics of data sciences, big data, predictive analytics and regression.
3. Understand the important approaches to qualitative data analysis such as framework and thematic analysis, content analysis and socio-linguistic approaches.
4. Code, develop patterns, categories and themes from textual data collected as a result of in-depth interviews, key informants' interviews, or focus group discussion using Nvivo-12.

Course Specific Outcomes:

Upon completion of the course the research student will be able to apply the concepts and skills learnt in developing and conducting research of public health importance.

Teaching Methods: This course will be delivered using a variety of methods and modalities such as classroom and online lectures, self-study, seminar presentations, group work and hands-on training with both R and NVivo software.

Units and Topics	Teaching Methods								Mandatory Readings
Unit-I: Review of basic concepts in Epidemiology and Bio-statistics									
	L	FW	FV	CS	GW	SS	SP	P	
1.1 Review of basic concepts in epidemiology and descriptive and inferential statistics					X	X	X		Arag ´on T J. Applied Epidemiology using R. University of California, Berkeley School of Public

									Health, and the San Francisco Department of Public Health; 2013.
Unit-II: Introduction to R-software and getting data into R Studio									
2.1 Installing R and R Studio 2.2 R console and Command Prompt 2.3 Introduction to Packages in R and installation 2.4 Importing data into R 2.5 Viewing data in R 2.6 Modifying variables in a Data set - Modifying variables in a data set, merging data, sorting data, recoding and renaming of variables	X					X		X	Arag ´on T J. Applied Epidemiology using R. University of California, Berkeley School of Public Health, and the San Francisco Department of Public Health; 2013. Kamath A, Meleth A, Sathiakumar N. R Manual for Health Science Researchers. Manipal University Press; 2012.
Unit-III: Data Analysis using R									
3.1 Univariate analysis: Mean, median, frequency 3.2 Data visualization - histogram, box plot, bar diagram, scatter plot 3.3 Bivariate analysis: t-test, chi-square test, 3.4 Introduction to multivariate analysis using R – ANOVA, linear and logistic regression	X					X		X	Arag ´on T J. Applied Epidemiology using R. University of California, Berkeley School of Public Health, and the San Francisco Department of Public Health; 2013. Kamath A, Meleth A, Sathiakumar N. R Manual for Health Science Researchers. Manipal University Press; 2012.
Unit-IV: Introduction to data science and Big data in health research									
4.1 Definition and scope of data science in health science research 4.2 Introduction to big data and sources of big data in health sciences 4.3 Introduction to algorithms in big data analytics 4.4 Application of predictive and prescriptive analysis in health sector	X					X			Stanton. J (2012). Introduction to Data Science. Syracuse University. Das, S, R., & Das, S. (2016). Data science: theories, models, algorithms, and analytics. *Learning*, *143*, 145.

Unit-V: Understanding textual data and its analyses									
5.1 Concepts and sources of qualitative data in health sciences 5.2 Data formats such as texts, diagram, symbols and artifacts. 5.3 Approaches to qualitative data analyses: Quasi-statistical approach (Content analysis), Thematic and framework approaches, Interpretative approach (interpretative phenomenological analysis and grounded, theory), and Sociolinguistic approaches (discourse analysis and conversation analysis)	**X**					**X**			Lacity, M. C., & Janson, M. A. (1994). Understanding qualitative data: A framework of text analysis methods. *Journal of Management Information Systems*, *11*(2), 137-155. Ulin, P. R., Robinson, E. T., & Tolley, E. E. (2005). Qualitative methods in public health. *Med Sci Sports Exercise*, *37*(7), 1249. Noble, H., & Smith, J. (2014). Qualitative data analysis: a practical example. Evidence-based nursing, 17(1), 2-3. Braun, V., Clarke, V., & Terry, G. (2014). Thematic analysis. Qualitative Res Clinical Health Psychological, 24, 95-114
Unit-VI: Hands-on training with Nvivo-12									
6.1 Understand type(s) of data collected its unit of analysis, coding approach, types of codes, and choice of analytic method. 6.2 Set up an NVivo project and organize textual data. 6.3 Code data manually as well as using Nvivo software. 6.4 Develop patterns, identify relationships across data and generating categories, themes and sub-themes. 6.5 Present findings using graphic displays and	**X**							**X**	Saldaña, J., & Omasta, M. (2016). Qualitative research: Analyzing life. Sage Publications. Bazeley, P., & Jackson, K. (Eds.). (2013). Qualitative data analysis with NVivo. Sage Publications Limited. Wong, L. P. (2008). Data analysis in qualitative research: A brief guide to using NVivo. Malaysian family physician: the official journal of the Academy of Family Physicians of Malaysia, 3(1), 14.

visualization methods.									

L- Lecture; FW- Field work; FV - Field Visit; CS - Case study; GW- Group work; SS- Self-study; SP- Seminar presentation; P-Practical

Evaluation

As per CBCS guidelines, this course will be evaluated for 100 marks with a Continuous Evaluation (CA) component of 40 marks and End-Semester Evaluation (ESA) component of 60 marks.

Additional readings:

1. Zamawe, F. C. (2015). The implication of using NVivo software in qualitative data analysis: Evidence-based reflections. Malawi Medical Journal, 27(1), 13-15.
2. Welsh, E. (2002). Dealing with data: Using NVivo in the qualitative data analysis process. In Forum qualitative social forum: qualitative social research (Vol. 3, No. 2).
3. Richards, L. (1999). Data alive! The thinking behind NVivo. Qualitative health research, 9(3), 412-428.
4. Richards, L. (1999). Using NVivo in qualitative research. Sage.
5. Ryan, G. W., & Bernard, H. R. (2000). Techniques to identify themes in qualitative data. Handbook of Qualitative Research. 2nd ed. Thousand Oaks, CA: Sage Publications.
6. Bazeley, P. (2009). Analysing qualitative data: More than 'identifying themes'. Malaysian Journal of Qualitative Research, 2(2), 6-22.

Course Code & Title: MPC 71 16 & Demography, RMNCH+A and Family Planning
Credits: 6

Course Objectives: The objective of this course is to enable students understand demographic principles and techniques, and equip them to apply these concepts in public health. At the end of this course students will be able to:

1. Define demography and understand its scope and importance in public health.
2. Describe population composition and characteristics using demographic theories and concepts
3. Apply demographic principles to explain population dynamics (fertility, mortality and migration)
4. Identify appropriate sources of demographic data, perform basic demographic techniques and ensure comparability across populations.
5. Describe population growth and projection, implications of rapid population growth and population control measures
6. Understand the importance of Reproductive, Maternal, Newborn, Child and Adolescent Health and describe the national programmes to promote RMNCH+A.

Course Specific Outcomes:

Upon completion of the course the research student will be able to apply the concepts and skills learnt in developing and conducting research of public health importance.

Teaching Methods: This course will be delivered using a variety of methods and modalities such as classroom and online lectures, self-study, seminars, field visit and group work.

Units and Topics	Teaching Methods								Mandatory Readings
Unit-I: Introduction to demography and population sciences									
	L	**FW**	**FV**	**CS**	**GW**	**SS**	**SP**	**P**	
1.1 Definition and history of demography, principles of demographic analysis, demographic transition and stages	**X**					**X**			Siegel Jacob, S., & Swanson David, A. (2004). The Methods and Materials of Demography. *Elsevier Academic Press, California, USA*.

									Weinstein, J., & Pillai, V. K. (2015). Demography: The science of population. Rowman & Littlefield.
Unit –II: Population composition									
2.1 **Population Composition-** Age, sex, race, ethnicity, nationality, religion, caste, language, marriages -Indicators 2.1.1 Age structure, Age-sex pyramid (population pyramid), demographic transition, demographic dividend, age-dependency ratios, child dependency ratio, old-aged dependency ratio	**X**		**X**			**X**			Siegel Jacob, S., & Swanson David, A. (2004). The Methods and Materials of Demography. *Elsevier Academic Press, California, USA*. Grundy, E (2002) Demography and public health. In: Oxford Textbook of Public Health. Oxford University Press, Oxford, pp. 807-828.
Unit-III: Demographic analysis									
3.1 Fertility - Child Women Ratio, Crude Birth Rate, General Fertility Rate, General Marital Fertility Rate (GMFR), Age-Specific Fertility Rate (ASFR), Total Fertility Rate (TFR), Gross Reproductive Rate (GRR), Net Reproduction Rate (NRR). **3.2 Mortality –** Crude death rate, specific death rate, case fatality rate, proportional mortality rate and ratio, adjusted or standardized rates, life table and survival analysis using life table. **3.3 Migration -** Types of migration (temporal, internal and international), theories of internal migration (Ravenstein theory, Lee's push and pull theory, Social network theory), measuring migration (in-Migration, out-migration, net migration and gross migration), effects of migration on population growth **3.4** Determinants of fertility, mortality and migration	**X**	**X**				**X**		**X**	Grundy, E (2002) Demography and public health. In: Oxford Textbook of Public Health. Oxford University Press, Oxford, pp. 807-828. Siegel Jacob, S., & Swanson David, A. (2004). The Methods and Materials of Demography. *Elsevier Academic Press, California, USA*. Ravestein, E. (1885): The laws of migration, Journal of the Royal Statistical Society, 167-235. Hagen-Zanker, J. (2008). Why do people migrate? A review of the theoretical literature Cutler, D., Deaton, A., and Lleras-Muney, A. (2006). The determinants of mortality. *Journal of Economic Perspectives*, 20(4), 97–120. Fernandes, A., Carballo, M., Malheiros, J., and Pereira Miguel, J. (eds.) (2007). *Challenges for Health in the Age of Migration*. Conference on Health and Migration in the EU, Lisbon, Portugal,

3.5 Standardization and population comparison									27–28.
Unit-IV: Sources of demographic data									
4.1 Primary sources of demographic data collection in India -Census, Civil Registration Systems, Sample Registration Systems-SRS, and Demographic Health Surveys – National family Health Surveys (NFHS) & District Level Household Surveys Secondary sources of demographic and health data collection in India.	**X**				**X**	**X**	**X**		Siegel Jacob, S., & Swanson David, A. (2004). The Methods and Materials of Demography. *Elsevier Academic Press, California, USA*. https://censusindia.gov.in/2011-common/censusdata2011.html http://rchiips.org/nfhs/ http://crsorgi.gov.in/web/index.php/auth/login Mahapatra, P. (2010, January). An overview of the sample registration system in India. In *Prince Mahidol award conference & global health information forum* (pp. 27-30).
Unit-V: Demography in application: population growth, projection and control									
4.1 Population growth, projection and control: implications of population growth, significance of population control, evolution of contraception and family planning. **4.2 Population control and promotion of health in India** - National Population Policy of India, National Family Welfare Programme, Reproductive, Maternal, Newborn, Child and Adolescent Health (RMNCH+A)	**X**		**X**		**X**	**X**			Raulet, H. M. (1970). Family planning and population control in developing countries. *Demography*, *7*(2), 211-234. Alexandratos, N. (2005). Countries with rapid population growth and resource constraints: issues of food, agriculture and development. *Population and Development Review*, 31, 237– 258.
Unit-VI: Reproductive, Maternal, Newborn, Child and Adolescent Health									
6.1 Introduction to the RMNCH+A services – historical context, evolution, coverage and innovations **6.2 Components of service delivery under RMNCH+A** – Programmes by the Government of India	**X**		**X**		**X**	**X**			Taneja, G., Sridhar, V. S. R., Mohanty, J. S., Joshi, A., Bhushan, P., Jain, M., ... & Gera, R. (2019). India's RMNCH+ A Strategy: approach, learnings and limitations. *BMJ global health*, *4*(3), e001162. Chokshi, M., Patil, B., Khanna, R., Neogi, S. B., Sharma, J., Paul, V.

									K., & Zodpey, S. (2016). Health systems in India. *Journal of Perinatology*, *36*(3), S9-S12.

L- Lecture; FW- Field work; FV - Field Visit; CS - Case study; GW- Group work; SS- Self-study; SP- Seminar presentation; P-Practical

Evaluation: As per CBCS guidelines, this course will be evaluated for 100 marks with a Continuous Evaluation (CA) component of 40 marks and End-Semester Evaluation (ESA) component of 60 marks.

Additional Readings

1. Bhende, A., & Kanitkar, T. (1982). Principles of Population. Studies. Himalaya Publishing House, Bombay.
2. Weeks, J. R. (2020). Population: An introduction to concepts and issues. Cengage Learning.
3. P Singh, S. N. (1989). Population Transition in India (Vol. 1). BR Publishing Corporation.
4. James, K. S. (2011). India's demographic change: opportunities and challenges. Science, 333(6042), 576-580.
5. Pathak, K. B., & Ram, F. (1992). Techniques of demographic analysis. Himalaya Publishing House.

Course Code & Title: MPC 71 17 & Basic Biostatistics
Credits:6

Course Objectives:

- To provide an introduction to the common concepts of Biostatistics applied in public health.
- To introduce the PhD students to univariate, bivariate and multivariate statistical procedures
- To provide hands on experience to PhD students in cleaning, preparing and analyzing statistical data
- To develop the competencies among the students to make statistical inferences
- To enable the PhD students use SPSS package to
    - Enter, clean and prepare statistical data for analysis
    - Conduct selected univariate, bivariate and multi-variate statistical procedures

Course Specific Outcomes:

Upon completion of the course the research student will be able to apply the concepts and skills learnt in developing and conducting research of public health importance.

Teaching Methods: This course will be delivered using a variety of teaching methods which include (but not limited to) classroom lectures, online classes, webinar's, assignments, field work and group work. Additionally, practical training of SPSS will be provided for relevant modules.

Units and Topics	Teaching Methods								Mandatory Readings
Unit-I: Introduction to biostatistics ad its application in public health									
	L	FW	FV	CS	GW	SS	SP	P	
1.1 Scope and application of biostatistics in public health	**X**								Ahlbom, A. (1993). Biostatistics for epidemiologists. CRC Press.
1.2 Probability theory	**X**								

1.3 Commonly used distributions in biostatistics - normal distribution - binomial distribution - passion distribution	**X**								Greasley, P. (2007). *Quantitative data analysis using SPSS: an introduction for health & social science*. McGraw-Hill Education (UK).
1.4 Variable, variable types and its prominence in statistical analysis.	**X**							**X**	
Unit-II: Statistical inference ad hypothesis testing									
2.1 Statistical inference	**X**								Ahlbom, A. (1993). Biostatistics for epidemiologists. CRC Press.
2.2 p-value & statistical significance	**X**							**X**	Du Prel, J. B., Hommel, G., Röhrig, B., & Blettner, M. (2009). Confidence interval or p-value? Part 4 of a series on evaluation of scientific publications. *Deutsches Ärzteblatt International*, *106*(19), 335.
2.3. Confidence interval and confidence level	**X**							**X**	
2.4 Hypothesis testing	**X**								
Unit-III: Univariate statistics									
3.1 Measures of central tendency	**X**							**X**	Gertsman, B. B. (2015). Basic Biostatistics: Statistics for public health practice. Burlington, MA. Glasser, G. J. (1962). Variance formulas for the mean difference and coefficient of concentration. *Journal of the American Statistical Association*, *57*(299), 648-654.
3.1 Measures of dispersion	**X**							**X**	
3.3 Prevalence and incidence measures	**X**								Ahlbom, A. (1993). Biostatistics for epidemiologists. CRC Press.
3.4 Non-parametric tests for single sample	**X**								Gertsman, B. B. (2015). Basic Biostatistics: Statistics for public health practice. Burlington, MA.
Unit-IV: Bivariate statistics									
4.1 Measures ad methods commonly used in bivariate analysis	**X**								
4.3 t- test	**X**							**X**	Kim, T. K. (2015). T test as a parametric statistic. *Korean journal of anesthesiology*, *68*(6), 540.
4.4 Correlation analysis	**X**							**X**	Greasley, P. (2007). *Quantitative data analysis using SPSS: an introduction for health & social science*. McGraw-Hill Education (UK).
4.5 Chi-squared tests and Fischer's exact test	**X**				**X**			**X**	Gertsman, B. B. (2015). Basic Biostatistics: Statistics for public health practice. Burlington, MA.
4.6 Non-parametric tests for two sample	**X**							**X**	

UNIT-V: Multivariate statistics									
5.1 Introduction to multivariate statistical approaches	**X**								Gertsman, B. B. (2015). Basic Biostatistics: Statistics for public health practice. Burlington, MA. Schneider, A., Hommel, G., & Blettner, M. (2010). Linear regression analysis: part 14 of a series on evaluation of scientific publications. *Deutsches Ärzteblatt International*, *107*(44), 776.
5.2 Analysis of Variance (ANOVA)	**X**								
5.3 Linear regression analysis	**X**					**X**		**X**	
5.4 Logistic regression	**X**					**X**		**X**	
5.5 Non-parametric tests for three/more sample	**X**							**X**	Gertsman, B. B. (2015). Basic Biostatistics: Statistics for public health practice. Burlington, MA
Unit-VI: Sample size estimation									
6.1 Basic principles of sample size calculation	**X**								Devane, D., Begley, C. M., & Clarke, M. (2004). How many do I need? Basic principles of sample size estimation. *Journal of Advanced Nursing*, *47*(3), 297-302.
6.2 Sample size estimation in public health research	**X**								Charan, J., & Biswas, T. (2013). How to calculate sample size for different study designs in medical research? *Indian journal of psychological medicine*, *35*(2), 121. Röhrig, B., du Prel, J. B., Wachtlin, D., Kwiecien, R., & Blettner, M. (2010). Sample size calculation in clinical trials: part 13 of a series on evaluation of scientific publications. Deutsches Ärzteblatt International, 107(31-32). Hajian-Tilaki, Karimollah. "Sample size estimation in epidemiologic studies." *Caspian journal of internal medicine* 2, no. 4 (2011): 289.
6.3 Internet tools for sample size calculation (overview of OpenEpi)	X					X		X	Website: https://www.openepi.com/Menu/OE_Menu.htm
Unit-VII: Data preparation, data cleaning and data presentation									
7.1 Data preparation and data cleaning	X							X	

7.2 Presenting statistical data using tables and figures	X								Spriestersbach, A., Röhrig, B., Du Prel, J. B., Gerhold-Ay, A., & Blettner, M. (2009). Descriptive statistics: The specification of statistical measures and their presentation in tables and graphs. Part 7 of a series on evaluation of scientific publications. Deutsches Ärzteblatt International, 106(36), 578.

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Evaluation: As per CBCS guidelines, this course will be evaluated for 100 marks with a Continuous Evaluation (CA) component of 40 marks and End-Semester Evaluation (ESA) component of 60 marks. CA would be conducted through Examinations, Assignments and Presentations.

Additional Readings

1) Landau, S. (2004). *A handbook of statistical analyses using SPSS*. CRC.
2) Blanca, M. J., Alarcón, R., Arnau, J., Bono, R., & Bendayan, R. (2017). Non-normal data: Is ANOVA still a valid option? Psicothema, 29(4), 552-557.
3) Barton, B., & Peat, J. (2014). Medical statistics: A guide to SPSS, data analysis and critical appraisal. John Wiley & Sons.
4) Starkweather, J., & Moske, A. K. (2011). Multinomial logistic regression. *Consulted page at September 10th: http://www. unt. edu/rss/class/Jon/Benchmarks/MLR_JDS_Aug2011. pdf*, *29*, 2825-2830.
5) Glasser, M. (1964). Linear regression analysis with missing observations among the independent variables. *Journal of the American Statistical Association*, *59*(307), 834-844.
6) Chao, Y. C. E., Zhao, Y., Kupper, L. L., & Nylander-French, L. A. (2008). Quantifying the relative importance of predictors in multiple linear regression analyses for public health studies. Journal of occupational and environmental hygiene, 5(8), 519-529.
7) Victor, A., Elsäßer, A., Hommel, G., & Blettner, M. (2010). Judging a plethora of p-values: how to contend with the problem of multiple testing-part 10 of a series on evaluation of scientific publications. Deutsches Arzteblatt International, 107(4).