









































## LIST OF ABBREVIATIONS

A1c	glycosylated hemoglobin
ALT	alanine aminotransferase
AST	aspartate aminotransferase
AUROC	area under the receiver operating characteristic curve
BMI	body mass index
CI	confidence interval
GGT	gamma glutamyltransferase
HBcAb	hepatitis B core antibody
HBsAg	hepatitis B surface antigen
HBV	hepatitis B virus
HCC	hepatocellular carcinoma
HCV	hepatitis C virus
HOMA-IR	homeostasis model assessment of insulin resistance
HR	hazard ratio
MELD	Model for End-Stage Liver Disease
MR	magnetic resonance
NAFLD	nonalcoholic fatty liver disease
NASH	nonalcoholic steatohepatitis
NHANES	National Health and Nutrition Examination Survey
OGTT	oral glucose tolerance test
OR	odds ratio
RNA	ribonucleic acid
SAF	standard analysis file
SMR	standardized mortality ratio
SRTR	Scientific Registry of Transplant Recipients

## CONVERSIONS

Conversions for A1c and glucose values are provided in *Diabetes in America Appendix 1 Conversions*.

## ACKNOWLEDGMENTS/ FUNDING

The authors thank Danita Byrd-Clark for assistance with programming of Scientific Registry of Transplant Recipient data and Bryan Sayer for assistance with programming of National Health and Nutrition Examination Survey data.

## DUALITY OF INTEREST

Drs. Ruhl, Clark, and Everhart reported no conflicts of interest.

## REFERENCES

- Seshasai SR, Kaptoge S, Thompson A, Di Angelantonio E, Gao P, Sarwar N, Whincup PH, Mukamal KJ, Gillum RF, Holme I, Njolstad I, Fletcher A, Nilsson P, Lewington S, Collins R, Gudnason V, Thompson SG, Sattar N, Selvin E, Hu FB, Danesh J; Emerging Risk Factors Collaboration: Diabetes mellitus, fasting glucose, and risk of cause-specific death. *N Engl J Med* 364:829–841, 2011
- Campbell PT, Newton CC, Patel AV, Jacobs EJ, Gapstur SM: Diabetes and cause-specific mortality in a prospective cohort of one million U.S. adults. *Diabetes Care* 35:1835–1844, 2012
- National Health and Nutrition Examination Survey (NHANES) [article online], 2016. Available from <http://www.cdc.gov/nchs/nhanes.htm>. Accessed 3 August 2015
- Hernaez R, Lazo M, Bonekamp S, Kamel I, Brancati FL, Guallar E, Clark JM: Diagnostic accuracy and reliability of ultrasonography for the detection of fatty liver: a meta-analysis. *Hepatology* 54:1082–1090, 2011
- About SRTR Standard Analysis Files (SAFs) [article online]. Available from <https://www.srtr.org/requesting-srtr-data/about-srtr-standard-analysis-files>. Accessed 2 March 2017
- Rahman R, Hammoud GM, Almashhrawi AA, Ahmed KT, Ibdah JA: Primary hepatocellular carcinoma and metabolic syndrome: an update. *World J Gastrointest Oncol* 5:186–194, 2013
- Chalasan N, Younossi Z, Lavine JE, Diehl AM, Brunt EM, Cusi K, Charlton M, Sanyal AJ; American Association for the Study of Liver Diseases; American College of Gastroenterology; American Gastroenterological Association: The diagnosis and management of non-alcoholic fatty liver disease: Practice guideline by the American Association for the Study of Liver Diseases, American College of Gastroenterology, and the American Gastroenterological Association. *Am J Gastroenterol* 107:811–826, 2012
- National Center for Health Statistics: *Plan and Operation of the Third National Health and Nutrition Examination Survey, 1988–94. Series 1: Programs and Collection Procedures, No. 32*. Hyattsville, MD: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, 1994
- Cobbold JF, Patel D, Taylor-Robinson SD: Assessment of inflammation and fibrosis in non-alcoholic fatty liver disease by imaging-based techniques. *J Gastroenterol Hepatol* 27:1281–1292, 2012
- Bedogni G, Bellentani S, Miglioli L, Masutti F, Passalacqua M, Castiglione A, Tiribelli C: The Fatty Liver Index: a simple and accurate predictor of hepatic steatosis in the general population. *BMC Gastroenterol* 6:33, 2006
- Zelber-Sagi S, Webb M, Assy N, Blendis L, Yeshua H, Leshno M, Ratzui V, Halpern Z, Oren R, Santo E: Comparison of fatty liver index with noninvasive methods for steatosis detection and quantification. *World J Gastroenterol* 19:57–64, 2013
- Koehler EM, Schouten JN, Hansen BE, Hofman A, Stricker BH, Janssen HL: External validation of the fatty liver index



43. de Marco R, Locatelli F, Zoppini G, Verlato G, Bonora E, Muggeo M: Cause-specific mortality in type 2 diabetes. The Verona Diabetes Study. *Diabetes Care* 22:756–761, 1999
44. Moss SE, Klein R, Klein BE: Cause-specific mortality in a population-based study of diabetes. *Am J Public Health* 81:1158–1162, 1991
45. Adams LA, Lymp JF, St Sauver J, Sanderson SO, Lindor KD, Feldstein A, Angulo P: The natural history of nonalcoholic fatty liver disease: a population-based cohort study. *Gastroenterology* 129:113–121, 2005
46. Kim WR, Brown RS, Jr., Terrault NA, El-Serag H: Burden of liver disease in the United States: summary of a workshop. *Hepatology* 36:227–242, 2002
47. Kim WR: The burden of hepatitis C in the United States. *Hepatology* 36(5 Suppl 1): S30–S34, 2002
48. Kim WR, Terrault NA, Pedersen RA, Therneau TM, Edwards E, Hindman AA, Brosgart CL: Trends in waiting list registration for liver transplantation for viral hepatitis in the United States. *Gastroenterology* 137:1680–1686, 2009
49. White DL, Ratziu V, El-Serag HB: Hepatitis C infection and risk of diabetes: a systematic review and meta-analysis. *J Hepatol* 49:831–844, 2008
50. Everhart J: A confluence of epidemics: does hepatitis C cause type 2 diabetes? *Hepatology* 33:762–763, 2001
51. Mehta SH, Brancati FL, Sulkowski MS, Strathdee SA, Szklo M, Thomas DL: Prevalence of type 2 diabetes mellitus among persons with hepatitis C virus infection in the United States. *Ann Intern Med* 133:592–599, 2000
52. Mehta SH, Brancati FL, Strathdee SA, Pankow JS, Netski D, Coresh J, Szklo M, Thomas DL: Hepatitis C virus infection and incident type 2 diabetes. *Hepatology* 38:50–56, 2003
53. Wang CS, Wang ST, Yao WJ, Chang TT, Chou P: Hepatitis C virus infection and the development of type 2 diabetes in a community-based longitudinal study. *Am J Epidemiol* 166:196–203, 2007
54. Montenegro L, De Michina A, Misciagna G, Guerra V, Di Leo A: Virus C hepatitis and type 2 diabetes: a cohort study in southern Italy. *Am J Gastroenterol* 108:1108–1111, 2013
55. Ruhl CE, Menke A, Cowie CC, Everhart JE: Relationship of hepatitis C virus infection with diabetes in the U.S. population. *Hepatology* 60:1139–1149, 2014
56. Yoneda M, Saito S, Ikeda T, Fujita K, Mawatari H, Kirikoshi H, Inamori M, Nozaki Y, Akiyama T, Takahashi H, Abe Y, Kubota K, Iwasaki T, Terauchi Y, Togo S, Nakajima A: Hepatitis C virus directly associates with insulin resistance independent of the visceral fat area in nonobese and nondiabetic patients. *J Viral Hepat* 14:600–607, 2007
57. Stepanova M, Lam B, Younossi Y, Srishord MK, Younossi ZM: Association of hepatitis C with insulin resistance and type 2 diabetes in US general population: the impact of the epidemic of obesity. *J Viral Hepat* 19:341–345, 2012
58. Miyajima I, Kawaguchi T, Fukami A, Nagao Y, Adachi H, Sasaki S, Imaizumi T, Sata M: Chronic HCV infection was associated with severe insulin resistance and mild atherosclerosis: a population-based study in an HCV hyperendemic area. *J Gastroenterol* 48:93–100, 2013
59. Eslam M, Kawaguchi T, Del Campo JA, Sata M, Khattab MA, Romero-Gomez M: Use of HOMA-IR in hepatitis C. *J Viral Hepat* 18:675–684, 2011
60. Conjeevaram HS, Wahed AS, Afdhal N, Howell CD, Everhart JE, Hoofnagle JH; Virahep-C Study Group: Changes in insulin sensitivity and body weight during and after peginterferon and ribavirin therapy for hepatitis C. *Gastroenterology* 140:469–477, 2011
61. Kawaguchi T, Ide T, Taniguchi E, Hirano E, Itou M, Sumie S, Nagao Y, Yanagimoto C, Hanada S, Koga H, Sata M: Clearance of HCV improves insulin resistance, beta-cell function, and hepatic expression of insulin receptor substrate 1 and 2. *Am J Gastroenterol* 102:570–576, 2007
62. Kawaguchi Y, Mizuta T, Oza N, Takahashi H, Ario K, Yoshimura T, Eguchi Y, Ozaki I, Hisatomi A, Fujimoto K: Eradication of hepatitis C virus by interferon improves whole-body insulin resistance and hyperinsulinaemia in patients with chronic hepatitis C. *Liver Int* 29:871–877, 2009
63. Romero-Gomez M, Del Mar Viloria M, Andrade RJ, Salmeron J, Diago M, Fernandez-Rodriguez CM, Corpas R, Cruz M, Grande L, Vazquez L, Munoz-De-Rueda P, Lopez-Serrano P, Gila A, Gutierrez ML, Perez C, Ruiz-Extremera A, Suarez E, Castillo J: Insulin resistance impairs sustained response rate to peginterferon plus ribavirin in chronic hepatitis C patients. *Gastroenterology* 128:636–641, 2005
64. Lam KD, Bacchetti P, Abbasi F, Ayala CE, Loeb SM, Shah V, Wen MJ, Reaven GM, Maher JJ, Khalili M: Comparison of surrogate and direct measurement of insulin resistance in chronic hepatitis C virus infection: impact of obesity and ethnicity. *Hepatology* 52:38–46, 2010
65. Brandman D, Bacchetti P, Ayala CE, Maher JJ, Khalili M: Impact of insulin resistance on HCV treatment response and impact of HCV treatment on insulin sensitivity using direct measurements of insulin action. *Diabetes Care* 35:1090–1094, 2012
66. Arase Y, Suzuki F, Suzuki Y, Akuta N, Kobayashi M, Kawamura Y, Yatsuji H, Sezaki H, Hosaka T, Hirakawa M, Ikeda K, Kumada H: Sustained virological response reduces incidence of onset of type 2 diabetes in chronic hepatitis C. *Hepatology* 49:739–744, 2009
67. Simo R, Lecube A, Genesca J, Esteban JI, Hernandez C: Sustained virological response correlates with reduction in the incidence of glucose abnormalities in patients with chronic hepatitis C virus infection. *Diabetes Care* 29:2462–2466, 2006
68. Maeno T, Okumura A, Ishikawa T, Kato K, Sakakibara F, Sato K, Ayada M, Hotta N, Tagaya T, Fukuzawa Y, Kakumu S: Mechanisms of increased insulin resistance in non-cirrhotic patients with chronic hepatitis C virus infection. *J Gastroenterol Hepatol* 18:1358–1363, 2003
69. Papatheodoridis GV, Chrysanthos N, Savvas S, Sevastianos V, Kafiri G, Petraki K, Manesis EK: Diabetes mellitus in chronic hepatitis B and C: prevalence and potential association with the extent of liver fibrosis. *J Viral Hepat* 13:303–310, 2006
70. Mason AL, Lau JY, Hoang N, Qian K, Alexander GJ, Xu L, Guo L, Jacob S, Regenstein FG, Zimmerman R, Everhart JE, Wasserfall C, Maclaren NK, Perrillo RP: Association of diabetes mellitus and chronic hepatitis C virus infection. *Hepatology* 29:328–333, 1999
71. Imazeki F, Yokosuka O, Fukai K, Kanda T, Kojima H, Saisho H: Prevalence of diabetes mellitus and insulin resistance in patients with chronic hepatitis C: comparison with hepatitis B virus-infected and hepatitis C virus-cleared patients. *Liver Int* 28:355–362, 2008
72. Caronia S, Taylor K, Pagliaro L, Carr C, Palazzo U, Petrik J, O’Rahilly S, Shore S, Tom BD, Alexander GJ: Further evidence for an association between non-insulin-dependent diabetes mellitus and chronic hepatitis C virus infection. *Hepatology* 30:1059–1063, 1999
73. Bloodworth JM, Jr.: Diabetes mellitus and cirrhosis of the liver. *Arch Intern Med* 108:695–701, 1961

74. Holstein A, Hinze S, Thiessen E, Plaschke A, Egberts EH: Clinical implications of hepatogenous diabetes in liver cirrhosis. *J Gastroenterol Hepatol* 17:677–681, 2002
75. Braganca AC, Alvares-da-Silva MR: Prevalence of diabetes mellitus and impaired glucose tolerance in patients with decompensated cirrhosis being evaluated for liver transplantation: the utility of oral glucose tolerance test. *Arq Gastroenterol* 47:22–27, 2010
76. Garcia-Compean D, Jaquez-Quintana JO, Lavalle-Gonzalez FJ, Reyes-Cabello E, Gonzalez-Gonzalez JA, Munoz-Espinosa LE, Vazquez-Elizondo G, Villarreal-Perez JZ, Maldonado-Garza HJ: The prevalence and clinical characteristics of glucose metabolism disorders in patients with liver cirrhosis. A prospective study. *Ann Hepatol* 11:240–248, 2012
77. Muller MJ, Pirlich M, Balks HJ, Selberg O: Glucose intolerance in liver cirrhosis: role of hepatic and non-hepatic influences. *Eur J Clin Chem Clin Biochem* 32:749–758, 1994
78. Tietge UJ, Selberg O, Kreter A, Bahr MJ, Pirlich M, Burchert W, Muller MJ, Manns MP, Boker KH: Alterations in glucose metabolism associated with liver cirrhosis persist in the clinically stable long-term course after liver transplantation. *Liver Transpl* 10:1030–1040, 2004
79. Gundling F, Schepp W, Schumm-Draeger PM: Hepatogenous diabetes in cirrhosis: academic sport or a neglected disease? *Exp Clin Endocrinol Diabetes* 120:469–471, 2012
80. Gentile S, Loguercio C, Marmo R, Carbone L, Del Vecchio Blanco C: Incidence of altered glucose tolerance in liver cirrhosis. *Diabetes Res Clin Pract* 22:37–44, 1993
81. Nishida T, Tsuji S, Tsujii M, Arimitsu S, Haruna Y, Imano E, Suzuki M, Kanda T, Kawano S, Hiramatsu N, Hayashi N, Hori M: Oral glucose tolerance test predicts prognosis of patients with liver cirrhosis. *Am J Gastroenterol* 101:70–75, 2006
82. Chen T, Jia H, Li J, Chen X, Zhou H, Tian H: New onset diabetes mellitus after liver transplantation and hepatitis C virus infection: meta-analysis of clinical studies. *Transpl Int* 22:408–415, 2009
83. Kuo HT, Sampaio MS, Ye X, Reddy P, Martin P, Bunnapradist S: Risk factors for new-onset diabetes mellitus in adult liver transplant recipients, an analysis of the Organ Procurement and Transplant Network/United Network for Organ Sharing database. *Transplantation* 89:1134–1140, 2010
84. Delgado-Borrego A, Liu YS, Jordan SH, Agrawal S, Zhang H, Christofi M, Casson D, Cosimi AB, Chung RT: Prospective study of liver transplant recipients with HCV infection: evidence for a causal relationship between HCV and insulin resistance. *Liver Transpl* 14:193–201, 2008
85. Delgado-Borrego A, Casson D, Schoenfeld D, Somsouk M, Terella A, Jordan SH, Bhan A, Baid S, Cosimi AB, Pascual M, Chung RT: Hepatitis C virus is independently associated with increased insulin resistance after liver transplantation. *Transplantation* 77:703–710, 2004
86. Parolin MB, Zaina FE, Araujo MV, Kupka E, Coelho JC: Prevalence of new-onset diabetes mellitus in Brazilian liver transplant recipients: association with HCV infection. *Transplant Proc* 36:2776–2777, 2004
87. Moon JI, Barbeito R, Faradj RN, Gaynor JJ, Tzakis AG: Negative impact of new-onset diabetes mellitus on patient and graft survival after liver transplantation: long-term follow up. *Transplantation* 82:1625–1628, 2006
88. Saliba F, Lakehal M, Pageaux GP, Roche B, Vanlemmens C, Duvoux C, Dumortier J, Salame E, Calmus Y, Maugendre D; Diapason Study Group: Risk factors for new-onset diabetes mellitus following liver transplantation and impact of hepatitis C infection: an observational multicenter study. *Liver Transpl* 13:136–144, 2007
89. Schmilovitz-Weiss H, Mor E, Sulkes J, Bar-Nathan N, Shaharabani E, Melzer E, Tur-Kaspa R, Ben-Ari Z: Association of post-liver transplantation diabetes mellitus with hepatitis C virus infection. *Transplant Proc* 35:667–668, 2003
90. Khalili M, Lim JW, Bass N, Ascher NL, Roberts JP, Terrault NA: New onset diabetes mellitus after liver transplantation: the critical role of hepatitis C infection. *Liver Transpl* 10:349–355, 2004
91. Kishi Y, Sugawara Y, Tamura S, Kaneko J, Matsui Y, Makuuchi M: New-onset diabetes mellitus after living donor liver transplantation: possible association with hepatitis C. *Transplant Proc* 38:2989–2992, 2006
92. Baid S, Cosimi AB, Farrell ML, Schoenfeld DA, Feng S, Chung RT, Tolkoff-Rubin N, Pascual M: Posttransplant diabetes mellitus in liver transplant recipients: risk factors, temporal relationship with hepatitis C virus allograft hepatitis, and impact on mortality. *Transplantation* 72:1066–1072, 2001
93. Bigam DL, Pennington JJ, Carpentier A, Wanless IR, Hemming AW, Croxford R, Greig PD, Lilly LB, Heathcote JE, Levy GA, Cattral MS: Hepatitis C-related cirrhosis: a predictor of diabetes after liver transplantation. *Hepatology* 32:87–90, 2000
94. Perseghin G, Mazzaferro V, Sereni LP, Regalia E, Benedini S, Bazzigaluppi E, Pulvirenti A, Leao AA, Calori G, Romito R, Baratti D, Luzi L: Contribution of reduced insulin sensitivity and secretion to the pathogenesis of hepatogenous diabetes: effect of liver transplantation. *Hepatology* 31:694–703, 2000
95. Everhart JE, Khare M, Hill M, Maurer KR: Prevalence and ethnic differences in gallbladder disease in the United States. *Gastroenterology* 117:632–639, 1999
96. Everhart JE: Digestive Diseases and Diabetes. In *Diabetes in America*. 2nd ed. Harris MI, Cowie CC, Stern MP, Boyko EJ, Reiber GE, Bennett PH, Eds. Bethesda, MD, National Institutes of Health, NIH Pub No. 95-1468, 1995, p. 457–483
97. Ruhl CE, Everhart JE: Association of diabetes, serum insulin, and C-peptide with gallbladder disease. *Hepatology* 31:299–303, 2000
98. Hanis CL, Hewett-Emmett D, Kubrusly LF, Maklad MN, Douglas TC, Mueller WH, Barton SA, Yoshimaru H, Kubrusly DB, Gonzalez R, Schull WJ: An ultrasound survey of gallbladder disease among Mexican Americans in Starr County, Texas: frequencies and risk factors. *Ethn Dis* 3:32–43, 1993
99. Everhart JE, Yeh F, Lee ET, Hill MC, Fabsitz R, Howard BV, Welty TK: Prevalence of gallbladder disease in American Indian populations: findings from the Strong Heart Study. *Hepatology* 35:1507–1512, 2002
100. Sampliner RE, Bennett PH, Comess LJ, Rose FA, Burch TA: Gallbladder disease in Pima Indians. Demonstration of high prevalence and early onset by cholecystography. *N Engl J Med* 283:1358–1364, 1970
101. Attili AF, Capocaccia R, Carulli N, Festi D, Roda E, Barbara L, Capocaccia L, Menotti A, Okolicsanyi L, Ricci G, Lalloni L, Mariotti S, Sama C, Scafato E: Factors associated with gallstone disease in the MICOL experience. Multicenter Italian Study on Epidemiology of Cholelithiasis. *Hepatology* 26:809–818, 1997
102. De Santis A, Attili AF, Ginanni Corradini S, Scafato E, Cantagalli A, De Luca C, Pinto G, Lisi D, Capocaccia L: Gallstones and diabetes: a case-control study in a free-living population sample. *Hepatology* 25:787–790, 1997
103. Kono S, Shinchi K, Ikeda N, Yanai F, Imanishi K: Prevalence of gallstone disease in relation to smoking, alcohol use, obesity, and glucose tolerance: a study of self-defense officials in Japan. *Am J Epidemiol* 136:787–794, 1992

104. Kono S, Shinchi K, Todoroki I, Honjo S, Sakurai Y, Wakabayashi K, Imanishi K, Nishikawa H, Ogawa S, Katsurada M: Gallstone disease among Japanese men in relation to obesity, glucose intolerance, exercise, alcohol use, and smoking. *Scand J Gastroenterol* 30:372–376, 1995
105. Sasazuki S, Kono S, Todoroki I, Honjo S, Sakurai Y, Wakabayashi K, Nishiwaki M, Hamada H, Nishikawa H, Koga H, Ogawa S, Nakagawa K: Impaired glucose tolerance, diabetes mellitus, and gallstone disease: an extended study of male self-defense officials in Japan. *Eur J Epidemiol* 15:245–251, 1999
106. Chen CH, Huang MH, Yang JC, Nien CK, Etheredge GD, Yang CC, Yeh YH, Wu HS, Chou DA, Yueh SK: Prevalence and risk factors of gallstone disease in an adult population of Taiwan: an epidemiological survey. *J Gastroenterol Hepatol* 21:1737–1743, 2006
107. Liu CM, Tung TH, Chou P, Chen VT, Hsu CT, Chien WS, Lin YT, Lu HF, Shih HC, Liu JH: Clinical correlation of gallstone disease in a Chinese population in Taiwan: experience at Cheng Hsin General Hospital. *World J Gastroenterol* 12:1281–1286, 2006
108. Lu SN, Chang WY, Wang LY, Hsieh MY, Chuang WL, Chen SC, Su WP, Tai TY, Wu MM, Chen CJ: Risk factors for gallstones among Chinese in Taiwan. A community sonographic survey. *J Clin Gastroenterol* 12:542–546, 1990
109. Misciagna G, Leoci G, Guerra V, Chiloiro M, Elba S, Petrucci J, Mossa A, Noviello MR, Coviello A, Minutolo MC, Mangini V, Messa C, Cavallini A, De Michele G, Giorgio I: Epidemiology of cholelithiasis in southern Italy. Part II: Risk factors. *Eur J Gastroenterol Hepatol* 8:585–593, 1996
110. Festi D, Dormi A, Capodicasa S, Staniscia T, Attili AF, Loria P, Pazzi P, Mazzella G, Sama C, Roda E, Colecchia A: Incidence of gallstone disease in Italy: results from a multicenter, population-based Italian study (the MICOL project). *World J Gastroenterol* 14:5282–5289, 2008
111. Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report. *Circulation* 106:3143–3421, 2002
112. Diehl AK: Cholelithiasis and the insulin resistance syndrome. *Hepatology* 31:528–530, 2000
113. Grundy SM: Cholesterol gallstones: a fellow traveler with metabolic syndrome? *Am J Clin Nutr* 80:1–2, 2004
114. Matthews DR, Hosker JP, Rudenski AS, Naylor BA, Treacher DF, Turner RC: Homeostasis model assessment: insulin resistance and beta-cell function from fasting plasma glucose and insulin concentrations in man. *Diabetologia* 28:412–419, 1985
115. Hanson RL, Pratley RE, Bogardus C, Narayan KM, Roumain JM, Imperatore G, Fagot-Campagna A, Pettitt DJ, Bennett PH, Knowler WC: Evaluation of simple indices of insulin sensitivity and insulin secretion for use in epidemiologic studies. *Am J Epidemiol* 151:190–198, 2000
116. Nervi F, Miquel JF, Alvarez M, Ferreccio C, Garcia-Zattera MJ, Gonzalez R, Perez-Ayuso RM, Rigotti A, Villarreal L: Gallbladder disease is associated with insulin resistance in a high risk Hispanic population. *J Hepatol* 45:299–305, 2006
117. Chang Y, Sung E, Ryu S, Park YW, Jang YM, Park M: Insulin resistance is associated with gallstones even in non-obese, non-diabetic Korean men. *J Korean Med Sci* 23:644–650, 2008
118. Misciagna G, Guerra V, Di Leo A, Correale M, Trevisan M: Insulin and gall stones: a population case control study in southern Italy. *Gut* 47:144–147, 2000
119. Diehl AK, Schwesinger WH, Holleman DR, Jr., Chapman JB, Kurtin WE: Gallstone characteristics in Mexican Americans and non-Hispanic whites. *Dig Dis Sci* 39:2223–2228, 1994
120. Trotman BW, Soloway RD: Pigment vs cholesterol cholelithiasis: clinical and epidemiological aspects. *Am J Dig Dis* 20:735–740, 1975
121. Diehl AK, Schwesinger WH, Holleman DR, Jr., Chapman JB, Kurtin WE: Clinical correlates of gallstone composition: distinguishing pigment from cholesterol stones. *Am J Gastroenterol* 90:967–972, 1995
122. Weikert C, Weikert S, Schulze MB, Pischon T, Fritsche A, Bergmann MM, Willich SN, Boeing H: Presence of gallstones or kidney stones and risk of type 2 diabetes. *Am J Epidemiol* 171:447–454, 2010