mosquitoes. The authors suggest that this finding might have been due to the fact that primaquine selectively kills male gametocytes and so the gametocytes detected by PCR could have been largely females and unable to transmit infection on their own. Alternatively, primaquine might have rendered incompetent, but not eliminated, the gametocytes of either sex. This finding demonstrates the complexity of human to mosquito infectivity determinants[10] and more studies are needed to investigate these determinants further. Membrane feeding assays are not easy to standardise but the results of the study by Dicko and colleagues[9] suggest that it is not possible to only rely on gametocyte density when investigating transmission-blocking activity and that membrane feeding assays will be needed when new drugs or vaccines to block transmission are being evaluated, unless a new assay that correlates with infectiousness more directly can be developed.

Primaquine does not provide any direct benefit to a patient treated with an effective ACT, and so a high degree of safety needs to be shown if it is to be used on a large scale—eg, in a mass drug administration programme involving many healthy people without screening for G6PD deficiency.[11] The study of Dicko and colleagues[9] was not large enough to investigate safety and people who are deficient in G6PD were excluded. Now that the efficacy of a single 0·25 mg/kg dose of primaquine on infectiousness has been shown convincingly, more information is needed on the the safety of this dose when given to large populations.

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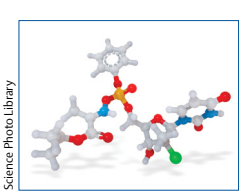
1 Abay SM. Blocking malaria transmission to Anopheles mosquitoes using artemisinin derivatives and primaquine: a systematic review and meta-analysis. *Parasit Vectors* 2013; **6:** 278.
2 White NJ. Primaquine to prevent transmission of falciparum malaria. *Lancet Infect Dis* 2013; **13:** 175–81.
3 Graves PM, Gelband H, Garner P. Primaquine or other 8-aminoquinoline for reducing Plasmodium falciparum transmission. *Cochrane Database Syst Rev* 2015; **2:** CD008152.
4 Ashley EA, Recht J, White NJ. Primaquine: the risks and the benefits. *Malar J* 2014; **13:** 418.
5 Shekalaghe SA, ter Braak R, Daou M, et al. In Tanzania, hemolysis after a single dose of primaquine coadministered with an artemisinin is not restricted to glucose-6-phosphate dehydrogenase-deficient (G6PD A-) individuals. *Antimicrob Agents Chemother* 2010; **54:** 1762–68.
6 WHO. Policy brief on single dose primaquine as a gametocytocide in *Plasmodium falciparum* malaria. Geneva: World Health Organisation, 2015.
7 Eziefula AC, Bousema T, Yeung S, et al. Single dose primaquine for clearance of *Plasmodium falciparum* gametocytes in children with uncomplicated malaria in Uganda: a randomised, controlled, double-blind, dose-ranging trial. *Lancet Infect Dis* 2014; **14:** 130–39.
8 Eziefula AC, Pett H, Grignard L, et al. Glucose-6-phosphate dehydrogenase status and risk of hemolysis in *Plasmodium falciparum*-infected African children receiving single-dose primaquine. *Antimicrob Agents Chemother* 2014; **58:** 4971–73.
9 Dicko A, Brown JM, Diawara H, et al. Primaquine to reduce transmission of *Plasmodium falciparum* malaria in Mali: a single-blind, dose-ranging, adaptive randomised phase 2 trial. *Lancet Infect Dis* 2016; published online Feb 19. http://dx.doi.org/10.1016/S1473-3099(15)00479-X.
10 Lin JT, Saunders DL, Meshnick SR. The role of submicroscopic parasitemia in malaria transmission: what is the evidence? *Trends Parasitol* 2014; **30:** 183–90.
11 Lubell Y, White L, Varadan S, et al. Ethics, economics, and the use of primaquine to reduce falciparum malaria transmission in asymptomatic populations. *PLoS Med* 2014; **11:** e1001704.

SOLAR-2: the sun also rises for cirrhotics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After decades in which treatment options for hepatitis C virus (HCV) were scarce and limited to interferon-based therapies, the advent of direct-acting antivirals has dramatically changed the landscape of antiviral treatment for HCV.

Most approved all-oral HCV antiviral regimens provide high cure rates with a very low incidence of adverse events.[1–3] However, studies have been primarily done in patients who are non-cirrhotic or treatment-naive. Although results have been extremely encouraging, they have revealed the existence of certain populations with unmet needs, such as HIV and HCV coinfected patients, patients failing direct-acting antivirals, patients harbouring resistance-associated variants, patients with HCV recurrence after liver transplantation, and patients with advanced liver disease, particularly those with decompensated cirrhosis.[4]

In *The Lancet Infectious Diseases*, Michael Manns and colleagues[5] shed more light on treatment of a subset of patients with advanced liver disease who are most in need of cure. They report the efficacy and safety of the coformulation of the NS5b-polymerase inhibitor sofosbuvir and the NS5A inhibitor ledipasvir plus ribavirin given for 12 or 24 weeks in over 300 patients

with chronic hepatitis C and advanced liver disease who had or had not undergone liver transplantation. Most patients had not responded to interferon.

In cirrhotic patients without transplantation, SVR12 rates were similar among those with Child-Turcotte-Pugh (CTP) stage B (87%, 90% CI 70–96) and stage C (85%, 66–96) in the 12-week group, whereas patients with CTP stage B showed higher SVR12 rates than those with more advanced liver disease in the 24-week group (96% [81–100] *vs* 78% [60–91]). In non-cirrhotic patients who had undergone transplantation, SVR12 rates were 93% (84–98) after 12 weeks and 100% (93–100) after 24 weeks of treatment. Similar results were reported in patients with CTP stage A and stage B cirrhosis who had liver transplants. Patient numbers in the post-transplant cohort with CTP stage C were too low to draw any conclusion: one of the two patients with HCV genotype 1 who received 12 weeks of treatment achieved SVR12, by comparison with four out of five in the 24-week group. SOLAR-2 was designed as an exploratory phase 2 clinical trial, formal comparisons between groups or treatment durations were not planned.

Serious adverse events leading to early discontinuation of treatment were reported in seven patients (2%). These data are consistent with the results obtained with other regimens.[6] Of the 17 deaths that occurred during the study period, 11 were in patients with CTP stage C who developed complications of advanced liver disease. In patients who had a liver transplant, no significant drug–drug interactions with immunosuppressants requiring dose adjustments were reported, in keeping with the favourable drug interaction profile of sofosbuvir and ledipasvir.[7]

In the context of available safe, efficacious, and convenient antiviral treatments for HCV infection, prioritisation of therapy for difficult-to-cure populations remains crucial for reducing the burden of disease. Achieving high cure rates with direct-acting antivirals in patients coinfected with HIV and HCV has pushed early access to direct-acting antivirals in this population.[8] Data from the SOLAR-2 trial, likewise, should encourage prompt treatment of cirrhotic patients, particularly those with decompensated liver disease, in whom interferon-based treatments are contraindicated. The increased risk of morbidity and mortality in cirrhotic patients justifies prioritisation when cost issues are a major obstacle.[9] HCV therapy has reached an age sufficient to encourage treatment of all carriers, irrespective of liver fibrosis stage, as is now recommended for patients with HIV. Eradication of HCV has benefits outside the liver with improvement in several extrahepatic effects, including cardiovascular events and neuropsychiatric performance.[10] Increasing the number of patients treated for HCV would result in an overall benefit for society, due to the reduction of the viraemic population, which is the main source of new infections. By decreasing HCV incidence, long-term health-care costs (hospital admissions, diagnostic procedures, and need for liver transplantation) would overcome the initial costs of HCV therapy. We must enhance ease of access to new direct-acting antivirals in developing countries, where HCV infection is generally more prevalent. Only then can we envisage eradicating HCV worldwide in the coming decades.[11]

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1 Afdhal N, Zeuzem S, Kwo P, et al. Ledipasvir and sofosbuvir for untreated HCV genotype 1 infection. *N Engl J Med* 2014; **370:** 1889–98.
2 Feld J, Kowdley K, Coakley E, et al. Treatment of HCV with ABT-450/r-ombitasvir and dasabuvir with ribavirin. *N Engl J Med* 2014; **370:** 1594–603.
3 Zeuzem S, Ghalib R, Reddy K, et al. Grazoprevir-elbasvir combination therapy for treatment-naive cirrhotic and noncirrhotic patients with chronic hepatitis C virus genotype 1, 4 or 6 Infection: a randomized trial. *Ann Intern Med* 2015; **163:** 1–13.
4 Soriano V, Labarga P, de Mendoza C, et al. New hepatitis C therapies for special patient populations. *Expert Opin Pharmacother* 2016; **17:** 217–29.
5 Manns M, Samuel D, Gane EJ, et al. Ledipasvir and sofosbuvir plus ribavirin in patients with genotype 1 or 4 hepatitis C virus infection and advanced liver disease: a multicentre, open-label, randomised, phase 2 study. *Lancet Infect Dis* 2016; published online Feb 18. http://dx.doi.org/10.1016/S1473-3099(16)00052-9.
6 Banerjee D, Reddy K. Safety and tolerability of direct-acting antiviral agents in the new era of hepatitis C therapy. *Aliment Pharmacol Ther* 2016; published online Jan 20. DOI:10.1111/apt.13514/.
7 Soriano V, Labarga P, Barreiro P, et al. Drug interactions with new hepatitis C oral drugs. *Expert Opin Drug Metab Toxicol* 2015; **11:** 333–41.
8 Shafran S. HIV coinfected have similar SVR rates as HCV monoinfected with DAAs: it's time to end segregation and integrate HIV patients into HCV trials. *Clin Infect Dis* 2015; **61:** 1127–34.
9 Ferenci P, Kozbial K, Mandorfer M, et al. HCV targeting of patients with cirrhosis. *J Hepatol* 2015; **63:** 1015–22.
10 Soriano V, Labarga P, Fernandez-Montero JV, et al. Hepatitis C cure with antiviral therapy—benefits beyond the liver. *Antivir Ther* 2015; published online Jun 25. DOI:10.3851/IMP2975.
11 World Health Organization. Glasgow declaration on hepatitis. http://www.who.int/hepatitis/glasgow-declaration-on-viral-hepatitis/en/ (accessed Feb 10, 2016).