We develop a Tannakian framework for group-theoretic analogs of displays, originally introduced by Bueltel and Pappas, and further studied by Lau. We use this framework to generalize the purely group-theoretic definition of Rapoport-Zink spaces given by Bueltel and Pappas, and to show that this definition coincides with the classical one in the case of unramified EL-type local Shimura data. (Received September 17, 2019)