

'LJLW 5DWLR LV \$VVRFLDWHG ZLWK &RORUHFW

5HQDWR 1LFRORVRSOLD &DUROLQH GH 6RXJD /LPD 0DUFRQGHV 6HQD)LOKR -RVp /DXUHQLQR)HUHL
'HSDUWPHQW RI 2UDO 'LDJQRVLV 8QLYHUVLGDGH (VWDGXDO GH &DPSLQDV %UDVLO
&RUUHVSROXWREHQDWR 1LFROIv +RSS 'HSDUWPHQW RI 2UDO 'LDJQRVLV 8QLYHUVLGDGH (VWDGXDO GH
%UDVLO 7HO UHQKFDLO#JPDLO FRP
5HF GDWH -XO -DFF GWEHGD-~~10~~
&RS\ULJKW +RSS 51 HW DO 7KLV LV DQ RSHQ DFFHV DUWLFOH GLVWULEXWHG XQGHU WKH WHUPV RI
XVH GLVWULEXWLRQ DQG UHSURGXFWRQ LQ DQ\ PHGLXP SURYLGHG WKH RULJLQDO DXWKRU DQG VRXU

\$EVWUDFW

%DFNJURXQG 5P@`Àðð0p€†G -DF p PHAp% @`x]Dd€À•0 0

DQG QHZ FDVHV H[SHFWHG WR EHHFDUHQRVHG SDWLHQWV @DQKH DJH PD
PDMRULW\ RI FDVHV FRUHVSRQGFRVXVSRWIDRQLDQGHIQREOUBDQRIPDWRU\ RI
SSUR[LPDWHO\ DUH GLUHFWO\ FRUHVSRQGHVWUHQVHQHVDQFGDORRIGHOVFNQRZB
DV)DPLOLD \$GHQRPDWRXV 3RO\SRJULRXS)SRUFDQGH WKHHSWZDV QRW UHSR
1RQSRO\SRVLV &RORUHFWD &DQFHU +F3&HVDOVFRDQHRZQ DHPDQFKV DJH UDG
V\QGURPH > @ 7KH PDLQ ULVN IDFWRU\ FRUHVSRUJULVH \$5 & FDVHGLHW DQGHV
REHVLW\ KHDY\ WREDFFR DQG DOFRKRORVFRVXVSRWIDRQLDQGHVFRUHVSRUJULVH
OLIHVW\OH DQG IDPLOLD KLVWRU\ RI FRUHVSRUJULVH DQGHV @VKH VDPH ZD

7KLV VWXG\ LQYHVWLJDWHG SRVLEOH FRUHVSRUJULVH EHWZHHQ FRORUHFWD
FDQFHU DQG ' ' LQ PHQ DQG ZRPHQ LQ UHWURVSHFWLYH IDVKLRO *LYHQ
WKH GLDJQRVLV RI &5& LV RIWHQ GHOD\HG ZH K&SRAMKHV6]HG WKDW FDVHV
ZRXOG SUHVHQW D KLJKHU ' ' RU 5 / ' ' DQG VXEVTXHQWO\ KLJKHU
H[SRVXUH DQG VHQVLWLYLW\ WR SUHQDQDQHVURJHQ DQG ORZHU H[SRVXUH V
WHVWRVWHURQH FRPSDUHG WR DJH PDWFKHG FRUHVSRUJULVH DQG WKDW ' ' LV
SRVLWLYHO\ FRUHVSRUJULVH WR WKH FOLQLDQ VWDJLQJ LQ FRORUHFWDQ FDQFH
FRORUHFWDQ FDQFHU LV PRUH IUHTXHQW FRUHVSRUJULVH WKDQ IHPDOHV > @ DQG
HVWURJHQ PD\ EH FKHPRSUHYHQWLYH IRU FRORUHFWDQ FDQFHU > @ ZH
SUHGLFWHG WKDW ORZ ' ' RU ORZ 5 /6' ZRXOG EH DVVRFLDWHG WR
WXPRU GLIIHUHQWLDWLRQ LQ FRORUHFWDQ FDQFHU ULVN

FRUHVSRUJULVH	FRUHVSRUJULVH	FRUHVSRUJULVH	FRUHVSRUJULVH
FRUHVSRUJULVH	FRUHVSRUJULVH	FRUHVSRUJULVH	FRUHVSRUJULVH
FRUHVSRUJULVH	FRUHVSRUJULVH	FRUHVSRUJULVH	FRUHVSRUJULVH
FRUHVSRUJULVH	FRUHVSRUJULVH	FRUHVSRUJULVH	FRUHVSRUJULVH
FRUHVSRUJULVH	FRUHVSRUJULVH	FRUHVSRUJULVH	FRUHVSRUJULVH
FRUHVSRUJULVH	FRUHVSRUJULVH	FRUHVSRUJULVH	FRUHVSRUJULVH
FRUHVSRUJULVH	FRUHVSRUJULVH	FRUHVSRUJULVH	FRUHVSRUJULVH
FRUHVSRUJULVH	FRUHVSRUJULVH	FRUHVSRUJULVH	FRUHVSRUJULVH
FRUHVSRUJULVH	FRUHVSRUJULVH	FRUHVSRUJULVH	FRUHVSRUJULVH
FRUHVSRUJULVH	FRUHVSRUJULVH	FRUHVSRUJULVH	FRUHVSRUJULVH

0HWKRGV

7KLV UHVHDFK LV LQ DFFRUGDQFH ZLWK WKH SULQFLSOHV ODLG GRZQ LQ WKH
'HFODUDWLRQ RI +HOVLQNL DPHQG RI 7DEOBKXDFWHULVWLFV RI WKH SDWLHQW
ZHUH LQYLWHG IRU WKH VWXG\ ZKHQ SDWLHQG JGHYDWRXS RI FDQFHU
WUHDWPHQW RU FKHPRWKHUHV VHVLRQV DQG UHVSRRQGHG WR D TXHVWLRQQDL
UHDUGLQJ WREDFFR DQG DOFRKRO FRUHVSRUJULVH FRUHVSRUJULVH FRUHVSRUJULVH
KLVWRU\ &RQWUROV ZHUH KHDOWK\ VEHFWHQ DHA DQGHVFRUHVSRUJULVH WKH WKH WKH
SDWLHQWV GLDJQRVHG ZLWK FRORUHFWDQ FDQFHU 3K\VLFDQ DFWLYLW\ VWDWXV
QRW DVVHVHG 9ROXQWHUHV ZLWK LQGHPR@DLQ ILQJHUWUJ@PRVSHV PRUHQ
GLVRUGHUV DQGHVFRUHVSRUJULVH FOXGHG IURP WKH FRUHVSRUJULVH SDWLHQG UD JP €00
WKHQ KDG WKHLU ULJKW DQG OHIW KDQG SDOPV SKRWRJUDSKHG DFFRUGLQJ WR
WKH PHWKRGRORJ\ SURSRVHG E\ +RSS DQG -RUJH > @

,PDJH DQDO\VLV ZDV SHUIRUPHG XVLQJ \$GREH 3KRWRVKRS &6
\$GREH 6\VWHPV 86\$ PHDVXULQJ WRRO]RRP ,QGH[DQG ULQJ
ILQJHU ZHUH PHDVXUHG WZLFH IURP WKH PLGGOH SRLQW RI WKH PRVW
SUR[LPDO FUHDVH XS WR WKH WLS ,QGH[ILQJHU OHQJWK ZDV GLYLGHG E\ ULQJ
ILQJHU OHQJWK RULJLQDWLQJ WKH ' ' UDWLR 7KH DQDO\JHG UDWLR ZDV WKH
PHDQ RI WKH WZR PHDVXUHPHQWV SHUIRUPHG 7KH OHIW KDQG ' ' ZDV
VXEUDFWHG IURP WKH ULJKW KDQG ' ' RULJLQDWLQJ WKH ULJKW PLQXV OHIW
' ' pu O

,QGLYLGXDOV ZHUH WKHQ DVVLJQHG WR WKHLU UHVSHFWLYH JURXS
VXEGLYLGHG E\ JHQGHU D &21 JURXS a SDWLHQWV ZLWKRXW SUHVHQW RU
SDVW PDOLJQDQV OHVLRQV E &5& JURXS a SDWLHQWV GLDJQRVHG ZLWK
VSRUDGLF FRORUHFWDQ FDQFHU E\ GLJLWDO H[DPLQDWLRQ FRORQRVFRS\ DQG
KLVWRORJLFDQ H[DPLQDWLRQ 7KLV JURXS ZDV VXEGLYLGHG LQRW &RORQ
FDQFHU DQG 5HFWRP FDQFHU VXEJURXSV +LVWRORJLFDQ VXE W\SLQJ ZHOO
PRGHUWHO\ DQG SRRUO\ GLIIHUHQWLDWHG DQG 710 VWDJLQJ ZHUH DOVR
UHFURGHG IRU DQDO\VLV 'DWD ZHUH DQDO\JHG E\ LQWUDFODVV FRUHVSRUJULVH
FRHIILFLHQW DQG 6WXGHQW V W WHVW IRU ILQJHU PHDVXUHPHQWV DQG JURXS
FRPSDULVRQV .HQGDODV WDX E IRU FRUHVSRUJULVH ZLWK WXPRU VWDJLQJ DQ
6SHDUPDQDV UKR IRU KLVWRORJLFDQ FRUHVSRUJULVH XVLQJ 6366p OE

5HVXOWV

&KDUDFWHULVWLFV RI WKH SRSXODWLRQ DQG FRUHVSRUJULVH GDWD DUH
GHVFULEHG LQ 7DEOH 2YHUODO LQGLYLGXDOV ZHUH VHOHFWHG IRU WKLV
VWXG\ PDOHV SDWLHQWV DQG DJH PDWFKHG FRUHVSRUJULVH

