

7KH VHYHULW\ RI FRQVWLSDWLRQ ZDXHTGDSW SILHHYGL FEXDWHGG RQF WKEH & 6RU WK
 UDQJH a DW LQFUHPHQWV RI QR PLVSMSPRU FRP SURPKMHG OCHFDLQJH RI FR
 SDUDPHWHUV ZHUH PRQLWRUH RQ D GSHLQZEBMLVSHRUFHQZWHJH VRKH SOXIRVHQWRHL
 ERZHO PRYHPHQWV GLILFXOW\ LQ HYDSDWLRQW I SHUOLVHQ RI HLLQPR SOXWDE V H
 HYDFXDWLRQ DEGRPLQDO SDLQ WLP HXQU WKQH WCHY DWRG\ \$KGL WLR QD OOD [DWLY
 HQHPDV DQG GLJLWDO DVVLVWDQFH IDEOMLYDWLWMP SWFKDW ERZKHCH PRNPHQWU F
 GXUDWLRQ RI FRQVWLSDWLRQ 7DEOH DV \$KHFWRWD OHVFRSUL ZPWQVE WDL QKH EF
 DGGLQJ WKH VFRUHV RI WKHVH LQGLVFRQWDO ESHRUDR HDQGU V ZFRNDV D HWUZRKN
 SURGXFWLYLW\ WKH :3\$, IRU FKURQLFDQDQVLS DWLRQ :3\$, && > @ ZDV

&KURQLF FRQVWLSDWLRQ SDWLHQWV Q

	6FRUH Q	
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)UHTXHQF\ RI ERZHO PRYHPHQWV	7LPH PLQXWHV LQ ODYDWRU\ SHU DWWHPSW
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WLP HV SHU GD\ V	
WLP HV SHU ZHHN	±
2QFH SHU ZHHN	±
/HVW WKDQ RQFH SHU ZHHN	±
/HVW WKDQ RQFH SHU PRQWK	!
'LILFXOW\ SDLQIXO HYDFXDWLRQ HIIRUW	\$VVLVWDQFH W\SH RI DVVLVWDQFH
1HYHU	:LWKRXW DVVLVWDQFH
5DUHO\	6WLPXODWLYH OD [DWLYHV
6RPHWLP HV	'LJLWDO DVVLVWDQFH RU HQHPD
8VXDOO\	
\$OZD\ V	

&RPSOHWHQHVV IHOLQJ LQFRPSOHWH HYDFXDWLRQWLEOH XQVFFHV VIXO DWWHPSWV IRU HYDFXDWLRQ

1HYHU	
5DUHO\	±
6RPHWLP HV	±
8VXDOO\	±
\$OZD\ V	!
3DLQ DEGRPLQDO SDLQ	+LVWRU\ GXUDWLRQ RI FRQVWLSDWLRQ \HDUV
1HYHU	
5DUHO\	±
6RPHWLP HV	±
8VXDOO\	±
\$OZD\ V	!

7KH FKDQJHV LQ WKH &66 VFRUH IURP EDVHOLQH WR ZHHNV DUH VKRZQ LQ
 7DEOH 7KH SDWLHQWV H[SHULHQFH VWDWLWLFDOO\ VLJQLILFDQW
 LPSURYHPHQWV ZKHQ FRPSDUHG ZLWK EDVHOLQH LQ WKH PHDQ GHJUHH RI
 GLILFXOW\ S FRPSOHWHQHVV S DOH SDLQ S WLPH
 S DQG WRWDO VFRUH S)UHTXHQF\ DVV LVWDQFH DQG
 IDLOXUH UDWHV DOVR LPSURYHG EXW GLG QRW UHDEK VWDWLWLFDOO\ VLJQLILF
 :LWK UHVSHFW WR WKH FRQVWLSDWLRQ S W\SHV WKH WRWDO VFRUHV RI WKH 2' D
 0L[HG JURXSV VKRZH G VLJQLILFDQW G HFUHDVHV IURP S DQG
 s DW EDVHOLQH WR s DQG s DIWHU ZHHNV
 UHVSHFWLYHO\ S DQG UHVSHFWLYHO\ ZKHUH DV WKH QXPEHU RI
 SDWLHQWV ZLWK 67& ZDV WRR VPDOO WR GUDZ D FRQFOXVLRQ
 1RQH RI WKH SDWLHQWV ZKR ZHUW LPSOR\HG DW WKH WLPH RI
 WKH VXUYH\ UHSRUWHG ZRUN WLPH PLVVHG GXH WR && 7KH 3\$, &&
 UHVXOWV LQGLFDWHG QR VLJQLILFDQW FKDQJHV LQ DEVHQWHHLVP SUHVHQWHH
 DQG WKH FRPELQDWLRQ RI WKH WZR 2' EVJFWLYH LPSURYHPHQWV ZDV
 VWDWLWLFDOO\ VLJQLILFDQW S & REVRN FORHERY KLPSDLUPHQW RI QRQ
 ZRUN DFWLYLWLHV ZLWK DOOHYLDWLRQ RI LPSDLUPHQW UHDFKLQJ D PHDQ
 PDJQLWXGH RI s 7DEOH 7DEOH 3DWLHQW GHPRJUDSKLQV

&RQVWLSDWLRQ 6FRULQJ 6\ VWHP	%DVHOLQH Q	\$IWHU ZHHNV Q	S 9DOXH
7RWDO	"	"	
)UHTXHQF\	"	"	
'LIILFXOW\	"	"	
&RPSOHWHQHVV	"	"	
3DLQ	"	"	
7LPH	"	"	
\$VVLVWDQFH	"	"	
)DLOXUH	"	"	
+LVWRU\	"	"	

7DEOH &KDQJHV LQ &RQVWLSDWLRQ 6FRULQJ 6\ VWHP 4XHVWLRQQDLUH 6FRUH

,PSDLUPHQW GXH WR FRQVWLSDWLRQ	Q	0HDQ " 6'	S YDOXH
:RUN DFWLYLW\			
\$EVHQWHHLVP RI ZRUN WLPH			
%DVHOLQH			S
\$IWHU ZHHNV ZLWK OXELSURVWRQH &KDQJH IURP EDVHOLQH			
3UHVHQWHHLVP LPSDLUPHQW			
%DVHOLQH		"	S
\$IWHU ZHHNV ZLWK OXELSURVWRQH &KDQJH IURP EDVHOLQH		"	
2YHUDOO SURGXFWLYLW\ ORVV		"	
%DVHOLQH		"	S
\$IWHU ZHHNV ZLWK OXELSURVWRQH &KDQJH IURP EDVHOLQH		"	

1RQ ZRUN DFWLYLW\ LPSDLUPHQW			
%DVHOLQH \$IWHU ZHHNV ZLWK OXELSURVWRQH &KDQJH IURP EDVHOLQH		" " "	S

7DEOH HVXOWV RI WKH :RUN 3URGXFWLYLW\ DQG \$FWLYLW\ ,PSDLUPHQW 4XHVWLRQ

\$OWKRXXJK WKHUH ZHUH QR VHULRXV DGRHVLVJHQIGUFDQJOTXDWHGWHYRIQDVLHGXLPSOLJ
WKH VWXG\ SDWLHQWV H[SHULHQFHG DRUOHDFWLYRQH DGEVHUVH HHHHWW
7DEOH 7KH\ ZHUH DEOH WR WROH ZHUHMHFWKORVHG HG XULHOFJW WKHZLWKXG/KHOL
H[FHSWLRQ RI RQH DIRUHPHQWLRQH G \$XV\FDQJ DQG FRQWUJSDUVRWWRQH :ZDV &R W
GLVFRQWLQXHG 7KH PRVW FRPPRQ WULPSVPHHQWHORZHG VLGJH HHHHFWW ZHPSHU
QDXVHD DQG GLDUUKHD OXELSURVWRQH ZKLFK PD\ EH UHODWHG
OHVV SURQRXQFHG IHHOLQJ RI LQFRPSO
DEGRPLQDO SDLQ DQG UHGXFWRQ LQ W
SUHYDOHQFH RI FRQVWLSDWLRQ LQFUHDV
! \HDUV > @ 8S WR RI RXU VWXG\ SD
DQG PRVW RI WKHP ZHUH DOUHDG\ UHWL
REVHUYHG RQ WKH QRQ ZRUN DFWLYLW\ L
LQ WHUPV RI H[WHQGLQJ KHDOWK\ OLIH H[

3DUDPHWHU	Q
\$W OHDVW RQH DGYHUVH HYHQW	
\$GYHUVH HYHQW	
1DXVHD	
'LDUUKHD	
\$EGRPLQDO SDLQ	
&KHW SDLQ	
'\VSHSVLD	
'\VSQHD	
)ODWXOHQFH	
9RPLWLQJ	

/XELSURVWRQH VHOHFWLYHO\ VWLPXODW
FHOOV RI WKH HSLWKHOLXP ZKLFK OHDG
LQWHVWLQDO OXPHQ \$V D UHVXOW IOXL
OXPHQ LQLWLDWHV D EROXV HHHFW WKD
WUDQVLW DQG DOOHYLDWHV V\PSWRPV
DFWLRQ RI OXELSURVWRQH LV OLPLWHG V
WKLW GUXJ LV UDSLGO\ PHWDEROLJHG
ELRDYDLODELWLW\ > @ ,W KDV EHHQ GHP
HHHFWLYH DQG VDIH LQ WKH WUHDWPHQW
> @

*DVWURLQWHVWLQDO DGYHUVH HYHQWV

7DEOH XPPDU\ RI DGYHUVH HYHQWV

'LVFXVVLQRQ

7KH UHVXOWV RI WKH &66 LQGLFDWHG WKDW SDWLHQW UHSRUWHG
LPSURYHPHQWV DIWHU WUHDWPHQW ZLWK OXELSURVWRQH ZHUH FOLQLFDOO\ DG
VWDWLWVWLFDOO\ VLJQLILFDQW 3DWLHQWV WDNLQJ OXELSURVWRQH DOVR H[SHU
VLJQLILFDQW LPSURYHPHQWV LQ KHDOWK UHODWHG TXDOLW\ RI OLIH

&XUHQWO\ WUHH W\SHV RI FRQVWLSDWLRQ DUH GLIIHUHQWLDWHG 67& 2'
DQG D FRPELQDWLRQ RI WKH WZR > @ 6\PSWRPV RI 2' VWUDLQLQJ KDUG
DQG OXPS\ VWRROV RU LQFRPSOHWH HYDFXDWRQ DUH PRUH IUHTXHQW DQG
ERWKHUVRPH WKDQ WKH LQIUHTXHQF\ RI ERZHO PRYHPHQWV > @ 6XFK
SDWLHQWV DUH RIWHQ XQDEOH WR KDYH VSRQWDQHRXV HYDFXDWRQV DQG
JHQHUDOO\ H[SHULHQFH EHHWHU UHVXOWV ZLWK HQHPDV VXSSRVLWRULHV DG
GLJLWDLWRQ WKDQ ZLWK OD[DWLYHV > @ 3UHYLRXV VWXGLHV LQYROYLQJ
OXELSURVWRQH HQUROOHG SDWLHQWV ZLWK && GHILQH DV IHZHU WKDQ
VSRQWDQHRXV ERZHO PRYHPHQWV SHU ZHHN DQG WKH SULPDU\ HILFDF\
HQGSRLQWV ZHUH WKH QXPEHU RI ERZHO PRYHPHQWV VSRQWDQHRXV ERZHO
PRYHPHQWV ZLWKLQ K RI LQLWLDWLQJ WKHDS\ RU VWRRO FRQLVWHQF\ > @
,Q FRWUDVW RXU SDWLHQWV PRVWO\ H[SHULHQFHG 2' UDWKHU WKDQ 67&
7KHUHIRUH RXU &66 UHVXOWV DUH LQWHUHVWLQJ WKH GLILFXOW\ FRPSOHWHQ
SDLQ DQG WLPH SDUDPHWHUV DOO LPSURYHG VLJQLILFDQWO\ \HW WKH
LPSURYHPHQW RI IUHTXHQF\ ZDV QRW VLJQLILFDQW 2YHUDOO RXU GDWD
VXJJHVW WKDW OXELSURVWRQH PD\ EH D XVHIXO DJHQW LQ WKH PDQDJHPHQW RI
SDWLHQWV ZLWK 2' DV ZHOOR DV 67&

SRSXODWLRQ DJLQJ UDSLGO\ EHRPLQJ RQD VVWUWHBPSVSC HQRPHQR'Q+RXJKWRQ /
OXELSURVWRQH PD\ ILQG ZLGHU FOLQLFDQ DSSOL\DFWLRQDQERZHO PLWRUGHUYKLE
VWXG\ LV OLPLWHG E\ LWV VPDOO VDPSONH VLIH DQG ODFN RI FRQWURO JURXS
)XUWKHU UHILQHPPHQW RI VWXG\ GHVLJQ DQG DGGLWLRQDO FDVHV LQ WKH IXWXU
ZLOO EH QHHGHG WR FRQILUP RXU FRQFOXVLRQV

5HIHUUHQFHV

/HPE& &DPLOOHUL 0 &KURQLF FRQVWLSDWLRQ 1 (QJO - 0HG
,UYLQH (-)HUUDJL 6 3DUH 3 7KRPSVRQ :* 5DQFH / +HDOWK
UHODWHG TXDOLW\ RI OLIH LQ IXQFWLRQDO *, GLVRUGHUV IRFXV RQ FRQVWLSDWLRQ
DQG UHVRXUFH XWLOLJDWLRQ \$P - *DVWURHQWHURO
-RKDQVRQUDOVWHLQ - &KURQLF FRQVWLSDWLRQ D VXUYH\ RI WKH
SDWLHQW SHUVSHFWLYH \$OLPHQW 3KDUPDFRO 7KHU
-RKDQVRQRUWRQ ' *HHQH - 8HQR 5 0XOWLFHQWHU ZHHN
GRXEOH EOLQG UDQGRPLJHG SODFHER FRQWUROOHG WULDO RI OXELSURVWRQH D
ORFDOO\ DFWLQJ W\SH FKORULGH FKDQQHO DFWLYDWRU LQ SDWLHQWV ZLWK FKURQLF
FRQVWLSDWLRQ \$P - *DVWURHQWHURO
)XNXGR+RQJR 0 .DQNR + 7DNDQR 0 8HQR 5 /XELSURVWRQH
LQFUHDVHV VSRQDQHRXV ERZHO PRYHPPHQW IUHTXHQF\ DQG TXDOLW\ RI OLIH LQ
SDWLHQWV ZLWK FKURQLF LGLRSDWKLF FRQVWLSDWLRQ &OLQ *DVWURHQWHURO +HSDW
>(SXE DKHDG RI SULQW@
\$JDFKQ&KHQ 7 3IHLIHU - 5HLVVPDQ 3 :H[QHU 6' \$
FRQVWLSDWLRQ VFRULQJ V\WHP WR VLPSOLI\ HYDOXDWLRQ DQG PDQDJHPPHQW RI
FRQVWLSDWHG SDWLHQWV 'LV &RORQ 5HFWXP
6XQ 6; 'LERQDYHQWXUD 0 3XUD\LGDWKLO): :DJQHU -6 'DEERXV 2 HW
DO ,PSDFW RI FKURQLF FRQVWLSDWLRQ RQ KHDOWK UHODWHG TXDOLW\ RI OLIH
ZRUN SURGXFWLYLW\ DQG KHDOWKFDUH UHVRXUFH XVH DQ DQDO\VLV RI WKH
1DWLRQDO +HDOWK DQG :HOQHVV 6XUYH\ 'LJ 'LV 6FL